PRE-FINAL REMEDIAL DESIGN REPORT

DRAFT

BUFFALO COLOR CORPORATION
AREA "D" SITE

Buffalo, New York **Site No. 9-15-012**

VOLUME II - APPENDICES G AND H

SUBMITTED TO

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS
WASTE REMEDIATION

SUBMITTED BY

AlliedSignal

PREPARED BY

PARSONS ENGINEERING SCIENCE, INC.
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Buffalo, New York

PARSONS

OCTOBER 1995

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REMEDIAL DESIGN REPORT
FINAL DESIGN SUBMITTAL
VOLUME 1

BUFFALO COLOR CORPORATION
AREA "D" SITE
100 LEE STREET
BUFFALO, NEW YORK
NYSDEC SITE NO. 9-15-012

Submitted to:

THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

Submitted by:

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FEBRUARY 1996

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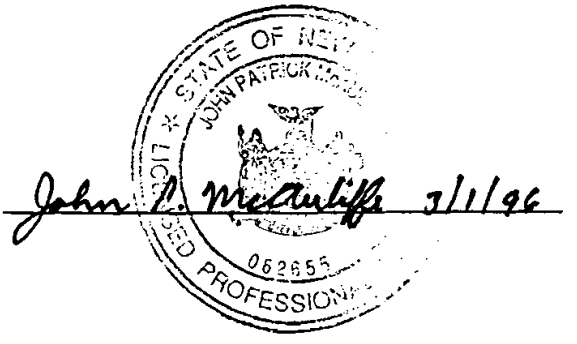
REMEDIAL DESIGN REPORT

BUFFALO COLOR CORPORATION,
AREA "D" SITE
100 LEE STREET
BUFFALO, ERIE COUNTY, NEW YORK
(NYSDEC SITE NO. 9-15-012)

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



John P. McAuliffe 3/1/96

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LIST OF ABBREVIATIONS AND ACRONYMS

ACRONYM	DESCRIPTION
AlliedSignal	AlliedSignal Inc.
API	American Petroleum Institute
ARARs	applicable or relevant and appropriate requirements
ASTM	American Society for Testing and Materials
BCC	Buffalo Color Corporation
BRIC	Buffalo River Improvement Corporation
BSA	Buffalo Sewer Authority
CFR	Code of Federal Regulations
cm/sec	centimeters per second
°F	degrees Fahrenheit
DNAPL	dense non-aqueous phase liquids
ECP	Electrical Control Panel
EPA	U.S. Environmental Protection Agency
FML	flexible membrane liner
ft^3	cubic feet
ft^3/sec	cubic feet per second
ft-msl	feet above mean sea level
GAC	granular activated carbon
GCL	geosynthetic clay liner
gpm	gallons per minute
gpm/ft^2	gallons per minute per square feet
HDPE	high-density polyethylene
H-O-A	Hand/Off/Auto
lb/ft^3	pounds per cubic feet
lbs/acre	pounds per acre
LNAPL	light non-aqueous phase liquid

LIST OF ABBREVIATIONS AND ACRONYMS

(Continued)

ACRONYM	DESCRIPTION
µg/kg	micrograms per kilogram
mg/l	milligrams per liter
MSL	Mean Sea Level
NAPL	non-aqueous phase liquid
NWWA	National Water Well Association
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
P&ID	process and instrumentation diagram
PAHs	polynuclear aromatic hydrocarbons
PIWP	Predesign Investigation Work Plan
POTW	publicly owned treatment works
ppm	parts per million
QAPP	Quality Assurance Project Plan
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SAP	Sampling and Analyses Plan
SCGs	Standards, Criteria, and Guidelines
SPDES	State Pollutant Discharge Elimination System
SVOCs	semivolatile organic compounds
TAGM	Technical and Administrative Guidance Memorandum
TBCs	To Be Considered
TDS	total dissolved solids
TOGS	Technical and Operations Guidance Series
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
VOCs	volatile organic compounds

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BUFFALO COLOR
TECHNICAL SPECIFICATIONS

FINAL DESIGN SUBMITTAL

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SECTION 01001

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 Use of Site

The Contractor shall limit his use of the premises to the work indicated.

A. Keep existing driveways and entrances serving the premises clear and available at all times. Do not use for parking or storage of materials.

1.02 Housekeeping

See Section 01620.

1.03 Vehicles

A. No vehicles are to be parked on site without the Owner's permission.

Lock automotive type vehicles and other mechanized or motorized construction equipment, when parked and unattended. Do not leave vehicles or equipment unattended with motor running or ignition key in place.

B. Vehicle repairs are not to be done without permission of the Owner.

C. Trucks delivering materials for the Project are required to:

1. Comply with security procedures at all entrance/exit gates and sign in and out.
2. Follow material delivery route approved by the Owner.

D. Load trucks arriving at and leaving the site with materials in a manner which shall prevent dropping materials or debris on the streets. Utilize tarps as dust covers. The trucks shall be subject to periodic inspection by the Owner. Adjoining roadways shall be kept clean and free of debris.

E. Remove spills of materials in public and private areas immediately, and comply with Federal and State requirements for reporting, clean-up, etc. Spill reports must be completed and the spill must be reported to the Owner immediately.

F. Contractor to provide employee parking onsite, not on or adjacent to public roadways.

1.04 Access Roads

Access roads shall be maintained for use by the Contractor and the Owner for the duration of the contract. The contractor shall repair any ruts and/or weak spots in the roads created by the construction traffic. Proper drainage shall be maintained on all access roads. Gravel or crushed stone for use in road construction or repair shall be approved by the Engineer prior to use. Owner will not unreasonably impede Contractor's access.

1.05 Dust Control

A. Control the generation of dust at all times. Accomplish dust control by water sprinkling or by other methods approved by the Owner. The use of petroleum products for dust control shall not be permitted. More detailed requirements are included in the Health and Safety Plan prepared by the Engineer as part of the Remedial Action Work Plan.

B. The operating permit for the site requires the Owner to control dust. Any penalties levied by the regulatory agency against the Owner for non-compliance by the Contractor's activities (or its subcontractor) shall be borne by the contractor by deduction from payment applications.

1.06 Signs

The Contractor shall post the work zone with signs reading "Warning, Hazardous Work Area, Do Not Enter Unless Authorized". Warning signs shall be posted at a minimum of every 500 feet along the perimeter fencing.

1.07 Subcontractors and Employees

A. The Contractor is responsible for the acts and omissions of its employees and subcontractors in connection with the performance of the work.

B. No visitors are allowed on-site without prior approval of the Owner.

C. The Contractor's personnel and its subcontractor's personnel shall sign in and out daily with the Owner's security at the site.

1.08 Permits

The Contractor shall obtain and pay for all permits required to perform the work.

1.09 Project Photographs

A. The Contractor shall not take any photographs of the project site or work conducted at the site.

B. The Engineer will take photographs to document the work. The Contractor may request the Engineer to take photographs of specific portions of the work, however, the Engineer shall retain all negatives and copies of the photographs.

C. The Contractor shall be permitted to view project photographs in the Engineer's field trailer. Requests for photographic reproductions shall be given to the Engineer for approval by the Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

--END OF SECTION 01001--

SECTION 01010

SUMMARY OF THE WORK

PART 1 - GENERAL

1.01 Identification

The work shall be performed at the Buffalo Color Area "D" Site, City of Buffalo, Erie County, New York.

1.02 Contract Documents

Requirements of the work are contained in the Contract Documents, and include cross-references herein to published information, which is not necessarily bound therewith. The Contract Documents have been prepared under the terms of the Order on Consent between AlliedSignal and the NYSDEC. Two copies of the Order on Consent will be provided to the selected contractor.

A. Included in the general contract are demolition, well abandonments, site grading, excavation, soil/sediment removal, groundwater treatment, plant construction, landfill cover construction, general construction, well installation, electrical, mechanical, and all other operations and work required to complete the remedial construction according to the intent of the Contract Documents.

1.03 Site Background

A. Site Location. Buffalo Color Corporation's (BCC) Area "D" is an inactive hazardous waste site accessed through 100 Lee Street in the City of Buffalo, Erie County, New York (see Figure 1.1). The site consists of an 19-acre peninsula surrounded on three sides by the Buffalo River and on the fourth side by a railroad yard and BCC's dye manufacturing facility.

Three waste management units were operated in Area "D"; iron sludge ponds, a metal sludge weathering area and an incinerator area (see Figure 1.2). Two of the areas, the iron sludge ponds (Site Code 9-15-012A) and the metal sludge weathering area (Site Code 9-15-012B) are currently listed as Class 2 sites in the Registry of Inactive Hazardous Waste Disposal Site by the New York State Department of Environmental Conservation (NYSDEC) The site and immediate surrounding area are zoned for heavy industry. The nearest residential area is approximately 1,200 feet northwest of the site. The topography of the Area "D" site, and the surrounding area, is relatively flat. Surface run-off at the site is entirely to the Buffalo River.

B. Site Use. Area "D" was used from 1905 to 1974 as a chemical manufacturing, handling, and disposal site. From 1905 to 1920, acids, chemicals, and dye intermediates were produced by Contact Process Company and by National Aniline Chemical Company. Phosgene gas was produced during 1917 to 1918 by National Aniline and Edgewood Arsenal. Allied Chemical and Dye Corporation manufactured petroleum-based detergents, dye intermediates, picric acid; and other chemicals at Area "D" during 1920 to 1974. All chemical manufacturing operations ceased in 1974 and chemical waste handling ceased in 1976 at Area "D".

In 1977, the property was sold to BCC and manufacturing has remained idle since that time. All structures on the site were demolished to grade by Buffalo Color in 1984.

C. Area of Concern. The portions of the Area "D" which are of concern include:

1. The "Weathering Area" located at the tip of the peninsula which was utilized for the storage of metal oxide sludges for weathering before shipment to metal recyclers (1916-1976);

2. The "Iron Oxide Sludge Lagoons" which were used for storage of iron oxide sludge from the manufacturer of dyes and intermediates (1916-1976);

3. Tank farm areas used for the bulk storage of petroleum products and process chemicals; and

4. The area on the eastern side of the peninsula formerly occupied by open burning pits (1922-1954) and later by an incinerator (1954-1972) was used for burning of organic wastes generated during dye manufacturing processes.

These areas of concern cover most of the Area "D" site. The analytical results of the samples collected during the Remedial Investigation (RI) have demonstrated contamination at Area "D" to be both widespread and variable with respect to its character and concentration. Contamination was found in the soil and/or groundwater at virtually every location of the site investigated. Therefore, Area "D" is considered as a whole for remediation.

Contaminants known to be present on site are summarized Table 01010-1. Polynuclear aromatic hydrocarbons (PAHs), metals, arsenic, and chlorinated benzene were detected in samples from the fill layer. Samples of sediments adjacent to the site had detectable concentrations of PAHs, arsenic, and several metals. Contamination of the shallow groundwater was found to include volatile organics, chlorinated benzene, iron, and other metals. In addition, an oily sheen was observed in the soils at a number of locations and a light non-aqueous phase liquid (LNAPL) was found in the groundwater in the area of former Tank Park 910 and the former incineration area.

1.04 Summary of Work

A. General

The work consists of furnishing all labor, materials, supervision, equipment, and services necessary to complete the scope of work detailed in the Specifications and Contract Drawings. The work includes, but is not limited to, the following:

1. conformance to the requirements of the health and safety plan;

2. clearing and grubbing the site of debris and brush;

3. demolition of existing foundations, piping, and other structures as necessary for remedial construction;

4. removing and regrading of sediment from the river and wastefill along the shoreline;

5. stabilization and habitat enhancement of the site's shoreline along the Buffalo River;

6. installation of a perimeter bentonite slurry cutoff wall;

7. recontouring of the site;

8. installation of a membrane cover system over the recontoured site;

9. installation of groundwater recovery wells and conveyance piping;

10. construction of an onsite groundwater treatment facility for the removal of metals and organic compounds from recovered groundwater;
11. construction of supporting access roads, and drainage systems;
12. restoration of Owner's facilities damaged during remedial construction;
13. the removal of snow and ice as needed during construction; and
14. construction quality control testing.

-- END OF SECTION 01010 --

TABLE 01010-1

BUFFALO COLOR CORPORATION AREA "D" SITE SUMMARY
ON SITE CONTAMINANTS

Type of Analysis	Analyte	Range
a. Organics/Surface Soils (0-2') mg/kg		
	Nitrobenzene	0.21 - 580
	Benzoic Acid	2.8
	Naphthalene	470
	2-Chloronaphthalene	66
	Phenanthrene	4.6 - 270
	Fluoranthene	4.8 - 330
	Pyrene	3.9 - 310
	Benzo(a)anthracene	1.9 - 180
	Chrysene	2.1 - 180
	Benzo(b)flouranthene	3.1 - 150
	Benzo(k)fluoranthene	140
	Benzo(a)pyrene	1.7 - 140
	Indeno(1,2,3-cd)pyrene	0.76 - 77
	Benzo(g,h,i)perylene	0.78 - 63
	ROX(mg/kg)	11 - 2,780
b. Inorganics/Surface Soils (0-2') mg/kg		
	Arsenic	4.5 - 77.2
	Cadmium	0.82 - 24.8
	Chromium	44.2 - 1,990
	Copper	36.2 - 3,580
	Iron	15,200 - 537,000
	Lead	8.9 - 27,300
	Mercury	0.07 - 6.2
c. Organics/Subsurface Soils mg/kg		
	1,4-Dichlorobenzene	1.7 - 13
	1,2-Dichlorobenzene	0.91 - 110
	Nitrobenzene	0.21 - 1,100
	1,2,4-Trichlorobenzene	1.2 -150
	Naphthalene	1.9 - 8.2
	2-Chloronaphthalene	0.55 - 140
	Fluoranthene	0.19 - 14
	Pyrene	0.14 - 13
	Benzo(a)anthracene	1.1 - 6.7
	Chrysene	0.35 - 8.2
	Benzo(b)flouranthene	1.6 - 9.7
	Benzo(a)pyrene	11 - 360
	ROX (mg/kg)	11 - 360

TABLE 01010-1
(CONTINUED)

BUFFALO COLOR CORPORATION AREA "D" SITE SUMMARY
ON SITE CONTAMINANTS

Type of Analysis	Analyte	Range
d. Inorganics/Subsurface Soils mg/kg		
	Arsenic	4 - 2,680
	Cadmium	0.7 - 7
	Chromium	5.7 - 440
	Copper	6 - 14,500
	Iron	1,750 - 360,000
	Lead	8.4 - 83,200
	Mercury	0.19 - 14
e. Organics/Subsurface Soils µg/l		
	2-Chlorophenol	0.8 - 1,800
	1,4-Dichlorobenzene	1 - 4,900
	1,2-Dichlorobenzene	2 - 21,000
	1,2,4-Trichlorobenzene	8 - 1,200
	Naphthalene	0.03 -14,900
	4-Chloroaniline	8 - 11,000
	2,4-Dinitrotoluene (2)	2,000
	2,6-Dinitrotoluene	1,500 - 1,700
	Benzidine	90 - 360
	1-Napthylamine	6 - 42,000
	Aniline (3)	5 - 660
	Benzene	0.1 - 28,000
	Toluene	0.09 - 4,700
	Chlorobenzene	0.6 - 48,000
	Ethylbenzene	0.2 - 43,000
	Xylene (Total)	1 - 1,700
f. Inorganics/Groundwater µg/l		
	Arsenic	5.7 - 1,820
	Cadmium	5 - 127
	Chromium	13 - 2,140
	Copper	15 - 78,700
	Iron	3,940 - 405,000
	Lead	5 - 3,030
	Mercury	0.29 - 50

SECTION 01025

MEASUREMENT AND PAYMENT

PART I - GENERAL

1.01 Description

A. This section covers the methods and procedures which the OWNER will use to measure the Contractor's work and to provide payment for the work performed. This general outline of measurement and payment will not in any way limit the responsibility of the Contractor for making a thorough investigation of the Contract Documents to determine the scope of work included in each bid task.

B. Payments will be made to the Contractor in accordance with the specified method of measurement and the unit or lump sum prices stipulated in the accepted bid. This method of payment will constitute complete compensation for all work required by the Contract Documents as well as all costs of accepting the general risks, liabilities, and obligations, expressed or implied. No other payment will be made. Payment under all tasks will include, but not necessarily be limited to, compensation for furnishing all supervision, labor, equipment, overhead, profit, material, and services; and for performing all other related work required.

C. No payment shall be made for work performed by the Contractor to replace defective work, work which is not shown in the Contract Documents, work outside the limits of the contract, and additional work necessary due to actions of the Contractor, unless ordered by the Engineer in writing.

D. The Contractor will be required to submit a detailed bid breakdown which identifies the individual cost of each item described below.

1.02 Incidental Items

A. Except for the items designated hereunder for measurement and payment, the costs of items necessary to complete the work as specified are considered incidental to the items specified for measurement and payment. The costs of incidental items shall be included in the prices of items specified for measurement and payment.

1.03 Quantities

A. The estimated quantities indicated in the Bid Schedule are the quantities estimated for the evaluation of bids. The actual quantities of items to be paid for on a unit price basis may vary significantly form the quantities indicated in the Bid Schedule.

1.04 Related Provisions Specified Elsewhere

A. Payment to Contractor: Refer to General Conditions and Contract Agreement.

B. Changes in Contract Price: General Conditions.

PART 2 - MEASUREMENT

2.01 Total Job Basis

A. Measurement of all lump sum items will be on a total job basis.

2.02 Volume Basis

A. Where items are specified to be measured on a volume basis, the volume will be determined on an in-place basis (prior to excavation for excavation or after placement and compaction for imported fill) between the existing ground surface and final grade lines shown on the drawings unless a lesser quantity was placed or excavated and such a lesser quantity is within specified tolerances. If no tolerance is specified, the tolerance shall be interpreted to be 0.00 foot.

B. The Contractor should note that excavation will be measured on a volume basis and that overexcavation will not be measured for payment. Overexcavation is excavation beyond the specified limits.

2.03 Area Basis

A. Where items are specified to be measured on an area basis, the area will be the actual surface area within specified limits. If a specified width of an item is indicated, the area will be determined by the actual length along the centerline multiplied by the specified width.

2.04 Length Basis

A. Where items are specified to be measured on a length basis, the length will be the actual length along the centerline measured with specified limits.

2.05 Unit Basis

A. Where items are to be measured on a unit basis, measurement will be of each particular unit as specified with the description of the unit.

PART 3 - BID ITEMS

A. Item 1 - Temporary Field Office and Facilities

1. Work Included. The work includes all materials, equipment, and labor for providing, installing, and maintaining temporary field offices and facilities, temporary utilities, temporary access roads, temporary security, staging areas, collection and disposal of miscellaneous sanitary wastes, and snow removal as needed.

2. Measurement. Monthly pro-rated for the duration of the project.

3. Payment. Payment shall be made on a monthly basis provided the work is on schedule. If work is behind schedule payment shall be based upon the percentage of work completed.

B. Item 2 - Health and Safety and Decontamination

1. Work Included: Provide Contractor's Health and Safety Plan, health and safety related monitoring, analysis, clothing, equipment, required personnel, medical surveillance program including physical examination, and all project records and

documents. Construct and operate required and necessary decontamination facilities, manage decontaminant wastes, and remove facilities after construction as per Section 02131, Decontamination Pad and Equipment.

2. Measurement: Monthly pro-rated for the duration of the project.

3. Payment. Payment shall be made on a monthly basis provided the work is on schedule. If work is behind schedule payment shall be based upon the percentage of work completed.

C. Item 3 - Mobilize/Demobilize

1. Work Included: Furnish all materials, equipment and labor for all other work specified in the Contract Documents that is not included in paragraphs E through VV, inclusive, but not limited to posting all forms of financial guarantees, performance and payment bonds, permits, work plans, preliminary testing of materials, and mobilizing/demobilizing construction crews and equipment.

2. Measurement: Lump Sum.

3. Payment: Payment shall be made on a progress basis, based upon the percentage of work completed and an approved schedule of values. No payment shall be made until:

   a. The Contractor has physically occupied the site.

   b. Temporary utilities and lighting are connected and operational.

   c. Staging areas are established.

   d. Decontamination pad has been constructed and is operational.

   e. Sufficient equipment is available to start clearing and excavation work.

D. Item 4 - Erosion control

1. Work Included: Provide, install, and maintain erosion and runoff control, and remove all temporary measures following the establishment of permanent measures as specified in Section 01564, Erosion Control and the Storm Water Management and Erosion Control Plan dated November 1995.

2. Measurement: Lump Sum.

3. Payment: The payment shall be made on a progress basis, based upon the percentage of work completed and an approved schedule of values.

E. Item 5 - Clearing and Grubbing

1. Work Included: Clear the work zone of all trees and brush, grub all stumps, roots, and matted roots and miscellaneous debris and dispose of material in accordance with the Contract Documents. The work also includes any incidental clearing and grubbing as required to facilitate construction activities and the crushing and burial of empty drums found on the site.

2. Measurement: Lump sum.

3. Payment: The payment shall be on a progress basis, based up on the percentage of work completed and an approved schedule of values.

F. Item 6 - Reinforced Concrete Demolition

1. Work Included: Demolition and onsite disposal of concrete foundations and other concrete structures as necessary to achieve the design grades as specified in Section 02050, Demolition. Non-concrete items requiring demolition are included in other payment items.

2. Measurement: The quantity will be based upon the actual cubic yards of concrete demolished as measured in the field.

3. Payment: The payment shall be unit price per cubic yard of concrete demolished.

G. Item 7 - Abandon Wells

1. Work Included: Abandon existing monitoring wells.

2. Measurement: The quantity will be based upon the actual number of wells abandoned.

3. Payment: Payment shall be unit price bid per well abandoned.

H. Item 8 - Pipeline Plugging

1. Work Included: The removal and capping of an existing 10" water service (removed section to be valved off prior to removal) and the tapping and installation of a valve and cap on an existing live 24" water service. The approximate locations are shown on the Contract Drawings.

2. Measurement: Lump sum.

3. Payment: Payment shall be made on a progress basis, based upon the percentage of work completed and an approved schedule of values.

I. Item 9 - Excavate, Spread, Dry, and Compact Wastefill

1. Work Included: Excavation, transporting, spreading, drying, backfilling, and compacting onsite soils in the wastefill area above the water level in the river at the time of excavation in accordance with the Contract Documents.

2. Measurement: The Contractor shall perform a subgrade topographic survey of the wastefill excavation area after excavation and relocation of the wastewater fill. The Contractor shall then compare the subgrade topographic survey with the original undisturbed topographic survey shown on Drawing G-2, Existing Site Plan, to determine the volume of wastefill.

3. Payment: Payment shall be made on a volume basis of the unit price per bid per cubic yard for this item.

J. Item 10 - River Dredging, Spreading, Drying and Compaction

1. Work Included: Dredging, transportation, spreading, drying, backfilling, and compacting onsite sediments and wastefill from the Buffalo River below the water level at the time of dredging in accordance with Section 02081, Sediment Removal.

2. Measurement: The Contractor shall perform bathymetric soundings of the river bottom prior to and after sediment removal. The Contractor shall then compare the bathymetric soundings to determine the volume of sediment removed.

3. Project: Payment shall be on a volume basis at the unit price bid per cubic yard for this item.

K. Item 11 - Cutoff Wall

1. Work Included: Installation of a cutoff wall in accordance with Section 02296, Cutoff Wall. Included is the disposal of excavation spoils and slurry onsite.

2. Measurement: Lump sum.

3. Payment: Payment shall be made on a progress basis, based upon the percentage of work completed and an approved schedule of values.

L. Item 12 - Cap Construction

1. Work Included: Install the geotextiles, geonet, geomembrane, fill layer, topsoil layer, seeding and mulching, and incidental testing of materials for review and approval.

2. Measurement: Lump sum.

3. Payment: Payment shall be made on a progress basis, based upon the percentage of work completed and an approved schedule of values.

M. Item 13 - Natural Erosion Control Fabric

1. Work Included: Furnish and install natural erosion control fabric on steep slopes in accordance with the Section 02990, Finish Grading, Topsoil and Seeding.

2. Measurement: The quantity will be measured based upon the actual number of square yards placed.

3. Payment: Payment shall be unit price per square yard of natural erosion control fabric.

N. Item 14 - Perimeter Underdrain System, Ditches and Culverts

1. Work Included: All drainage structures including the perimeter underdrain system, ditches and culverts. Included is all excavation, bedding, piping, backfill, outfall structures, and geotextiles.

2. Measurement: Lump sum.

3. Payment: Payment shall be made on a progress basis, based upon the percentage of work completed and an approved schedule of values.

O. Item 15 - Maintenance Roadway and Parking Areas

1. Work Included: Prepare the road subbase, furnish and install reinforcement geotextile, and aggregate paving in accordance with Section 02501, Gravel Maintenance and Access Road.

2. Measurement: Lump sum.

3. Payment: Payment shall be made on a progress basis, based upon the percentage of work completed and an approved schedule of values.

P. Item 16 - Rip Rap

1. Work Included: Furnish and place rip-rap in accordance with Section 02275, Rip-Rap.

2. Measurement: Lump sum up to the quantity stated in the bid schedule. Quantities in excess of that stated in the lump sum quantity will be measured based upon the weight of rip-rap placed.

3. Payment: Payment made based on an approved schedule of values for the lump sum quantity then unit price per ton of additional rip-rap placed.

Q. Item 17 - Riverbank Restoration/Wetland Creation

1. Work Included: Furnish and place substrate soil and plantings in accordance with Section 02910, Riverbank Restoration/Wetland Creation.

2. Measurement: Lump sum.

3. Payment: Payment shall be made on a progress basis, based upon the percentage of work completed and an approved schedule of values.

R. Item 18 - Groundwater Monitoring and Extraction Wells

1. Work Included: Furnish and install new groundwater monitoring and extraction wells, develop wells, and dispose of cuttings and development waters in accordance with Sections 02671, Groundwater Monitoring Wells and 02672, Extraction Wells. Included are the concrete valves and hatches.

2. Measurement: Lump sum.

3. Payment: Payment shall be made on a progress basis, based upon the percentage of work completed and an approved schedule of values.

S. Item 19 - Electrical Service and Systems

1. Work Included: Furnish and install all permanent electrical service and systems as per Division 16, Electrical. Work includes all necessary poles, insulators, transformers, meter panel and meter, wiring, conduits, pull boxes, excavation for underground installations, generator, motor control centers, grounding grid, lighting and all other items necessary to complete the work.

2. Measurement: Lump sum.

3. Payment: Payment shall be on a progress basis, based upon the percentage of the work completed for this item and an approved schedule of values.

T. Item 20 - Groundwater Treatment Building

1. Work Included: Furnish and construct the treatment building including securing construction permits, stamped pre-engineered building drawings, excavation and preparation of foundation areas, construction of foundation and floors, erection of the building framing, installation of wall panels, masonry, miscellaneous metals, railings,

roofing, insulation, firestopping, sealants, doors and frames, windows, hardware, overhead door, acoustical ceilings, painting, fire extinguishers, toilet and bath accessories, casework, plumbing (Section 15400 thru 15445), heating and ventilation systems (Section 15500 thru 15990), and water, sanitary, and natural gas utility services.

The work paid under this item shall also include transporting excavated materials to the wastefill area on site, spreading the materials, drying them as necessary to achieve specified compaction, performing compaction, and performing grading to achieve the required subgrade topography.

2. Measurement: Lump sum.

3. Payment: Payment shall be on a progress basis, based upon the percentage of the work completed for this item and an approved schedule of values.

U. Item 21 - Process and Mechanical Systems

1. Work Included: Furnish, install and test process and mechanical systems including all treatment equipment, pumps, mixers, chemical feed equipment, filter press, tanks, oil/water separator, clarifier, filtration system, carbon system, piping, valves, fittings, spare parts and maintenance manuals, testing/shakedown, and any other items needed to complete the systems.

2. Measurement: Lump sum.

3. Payment: Payment shall be on a progress basis, based upon the percentage of work completed and an approved schedule of values.

V. Item 22 - Instrumentation and Controls

1. Work Included: Furnish, install and test all instrumentation and controls as specified in Sections 13415 thru 13440. The work includes gauges, flow meters, process variable indicators, control stations, annunciator, control relays, level switches, integrators, counters, scales, solenoid values, pH sensors, transmitters, receivers, analyzers, transducers, times, instrument control station, and all items needed to complete the systems.

2. Measurement: Lump sum.

3. Payment: Payment shall be on a progress basis, based upon the percentage of work completed and an approved schedule of values.

-- END OF SECTION 01025 --

SECTION 01040

PROJECT COORDINATION

PART 1 - GENERAL

1.01 Description

A. The Contractor shall coordinate various elements of the work and entities engaged to perform work; and coordinate the work with existing facilities/conditions, with work by separate contractors (if any), and with work by the Owner or the Engineer.

B. The Contractor shall schedule and execute his operations so as to avoid interference with the operations of the existing facilities.

C. The Contractor shall provide the Owner written notice at least 14 days in advance of any work which may affect the Owner's operation.

1.02 Work Affecting Owner's Operations

A. Contractor shall have completed all unnecessary preparatory work and shall have all necessary personnel, materials, equipment and supplies on the site before the work is commenced.

B. Disturbances to Operations:

1. Keep existing facilities in operation unless otherwise specifically permitted in these Specifications or approved by the AlliedSignal and Buffalo Color Corporation.

2. Contractor shall perform all of his work so as to avoid interference with operations of the facility and the work of others.

3. Unscheduled interruptions resulting from construction work under the Contractor's responsibility must be returned at once to normalcy through temporary or permanent means. Temporary corrections shall be made permanent as soon as practicable. All permanent corrections must meet applicable requirements in this document.

4. Incorporate smooth transition from existing facilities to new facilities into the construction planning.

C. The Owner shall have the authority to stop or prohibit work which interfere or jeopardize the continuous and reliable operation of the facility.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

-- END OF SECTION 01040 --

SECTION 01050

FIELD SUPERVISION

PART 1 - GENERAL

1.01 Description

1. Provide supervision required to execute Contractor's construction methods.
2. Safeguard all points, stakes, grade marks, monuments, and bench marks made or established on the Work, re-established same if disturbed and rectify all Work improperly installed because of not maintaining, not protecting, or removing without authorization such established points, stakes, marks, and monuments.
3. When requested by Engineer, provide such facilities as may be necessary for Engineer to check line and grade points placed by Contractor. Contractor shall do no excavation or embankment work until all cross-sectioning necessary for determining pay quantities has been completed and checked by Engineer.
4. Contractor shall retain the services of an independent subcontractor for surveying.

1.02 Contractor's Site Superintendent

A. Contractor shall employ and retain at the site of the Work, a site superintendent capable of performing all engineering tasks required of the Contractor. Tasks included are:

1. Daily reports of Project activity to be submitted to the Engineer with all pertinent information pertaining to the Project as follows:
   a. Number of employees;
   b. Subcontractor employees;
   c. Breakdown of employees by trade;
   d. Major equipment and materials installed;
   e. Major construction equipment utilized;
   f. Location of all areas in which construction was done; and
   g. Materials and equipment received.
2. Provide all surveying equipment required including transit, level, stakes, and required surveying accessories.
3. Furnish all required lines and grades for construction of operations. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials, and equipment.
4. Maintain field office files and drawings, record drawings, and coordinate engineering services with Subcontractors. Prepare layout and coordination drawings for construction operations.
5. Check and coordinate Work for conflicts and interferences and immediately advise Engineer of all discrepancies noted.

6. Cooperate with Engineer in field inspections as required.

1.03 Records

A. Maintain a complete, accurate log of all control and survey work as its progresses.

B. On completion of foundation walls and major site improvements, prepare a certified survey showing all dimensions, locations, angles, and elevations of construction.

1.04 Submittals

A. Submit a name and address of surveyor or engineer to Engineer.

B. On request of Engineer, submit documentation to verify accuracy of field engineering work.

C. When requested by Engineer, submit certificate signed by registered engineer or surveyor certifying that elevations and locations of Work are in conformance with Contract Documents. Explain all deviations.

-- END OF SECTION 01050 --

SECTION 01051

GRADES, LINES, AND LEVELS

PART 1 - GENERAL

1.01 Description

This section includes specifications for surveying required for execution of this work. The Contractor shall retain the services of a New York State licensed Professional Land Surveyor (Surveyor). The Surveyor shall establish survey control; check and verify thickness and elevations of the cover layers with those shown on the plans and as specified; and prepare record drawings of the construction. The Contractor is responsible for controlling lift thickness and cap component thickness such that the cap conforms to the specified dimension.

(1) Data generated by optical survey measurements shall be used for quality control.

(2) The Surveyor is required, as a minimum to provide the following survey data:

A. Topography following sediment and waste soil excavation and final sub-grade preparation;

B. Top of bench elevations;

C. Alignment and top and bottom elevations of cutoff wall;

D. Location of geomembrane, including coordinates of all seams (not elevation);

E. Top of unclassified fill layer with elevations and thicknesses;

F. Top of topsoil with elevations and thicknesses;

G. Bathymetric soundings of the river bottom prior to sediment removal, after sediment removal, and after placement of rip-rap;

H. Treatment building slab-on-grade elevations and location;

I. Conveyance piping inverts;

J. Miscellaneous details (e.g., drainage features);

K. Monitoring wells and extraction wells (locations and elevations), including bottom elevations of vaults (mark the inner casing for reference); and

L. Final record drawings with all improvements shown.

(3) The data must be reduced and plotted in a form acceptable to the Engineer and provided to the Engineer, prior to proceeding to the next construction phase.

(4) The Contractor shall not proceed with placement of an overlying layer or with subsequent work phases until the Surveyor has completed survey measurements and the data have been reviewed by the Engineer.

(5) Upon completion of all services, the Surveyor shall provide to the Engineer a Letter of Certification for the surveys for use in the Certification Report.

1.02 Accuracy

(1) Optical Survey, Tape Measurements, and Electronic Measurements: Minimum accuracy of $\pm$0.01 feet in vertical measurements and $\pm$0.1 feet in horizontal measurements.

1.03 Tolerances

(1) The Contractor shall place all soils and synthetic materials to the lines, grades, slopes, and thickness shown on drawings within the tolerances specified below.

Description	Tolerances
Unclassified Fill Layer	- 0.00 feet to + 0.20 feet (Thickness)
Topsoil	- 0.00 feet to + 0.20 feet (Thickness)

1.04 Job Conditions

(1) The Contractor shall be responsible for protecting and maintaining all horizontal and vertical control points during construction.

(2) The Contractor shall be responsible for restaking intermediate lifts of required cap system.

(3) Areas which fail to meet the thickness requirements of Paragraph 1.03(1) shall be reworked or replaced as directed by Engineer at no cost to the Owner. The Contractor shall pay for the costs of all additional survey on reworked or replaced areas.

PART 2: PRODUCTS

None

PART 3: EXECUTION

3.01 Survey Measurements

(1) Prior to commencement of construction work, the Surveyor shall establish all necessary baselines, horizontal control points, and vertical control benchmarks in order to properly complete construction work and make quantity measurements. The Contractor shall establish a minimum of three vertical and horizontal control points with monuments. Survey control points shall be established such that any point within the job site can accurately be re-established and elevations obtained to the required tolerances at any time during the course of construction. The Surveyor shall tie all his baselines, horizontal and vertical control benchmarks into survey information provided by the Owner.

(2) Where appropriate, an orthogonal grid system to reference topographical measurements shall be established on centers approximately 50 feet or less and at all breaklines, crests, slope toes etc., as necessary to accurately measure the work. All cross sections shall be performed at intervals of 50 feet or less. Cross section data shall include baseline station, offset, elevation, and material type.

--END OF SECTION 01051--

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 Description

A. Submittal procedures shall conform to requirements of General Conditions and as described in this Section.

1.02 Project Schedules

A. Progress Schedule: Two weeks after award of bid, the Contractor shall submit five copies of a comprehensive progress schedule indicating a time bar for each significant category of work to be performed. Arrange schedule to indicate required sequencing and to show time allowances for submittals, inspections, weather allowances, and similar time margins. The schedule shall indicate the estimates dates for the start and completion of the various stages of the work and shall include information regarding man-loading and equipment-leading required to progress the work as shown. Following the initial revision of the schedule after the Engineer's review, print and distribute the schedule to concerned parties, including three (3) copies to the Engineer. The schedule shall be revised and redistributed as determined with each monthly pay requisition, subject to the Owner's approval, at intervals matching application for payment requests.

If at any time it appears to the Engineer that the rate of progress of the work being made is insufficient to insure completion of the work by the scheduled completion date, the Owner or its Representative may require the Contractor to take such steps as are necessary to insure completion as scheduled. Any additional costs incurred shall be the sole obligation of the Contractor.

B. Schedule of Submittals: The Contractor shall complete the attached schedule of submittals 14 days after award of contract. The schedule shall show necessary submission dates for all shop drawings, samples, product data, plans, schedules, etc.

C. Schedule of Values and Cash Flow Analysis: Prepare a schedule of values and cash flow analysis to show a breakdown of the Contract Sum corresponding with the payment request breakdown and progress schedule line items. Show the total dollar value for each unit of work scheduled and the projected monthly and cumulative expenditures for the project. The schedule of values shall be of greater detail than the bid schedule to allow for easy review and approval of each pay request. Revise each time schedule is affected by change orders or other revisions.

1.03 Shop Drawings, Product Data and Samples

The Contractor shall coordinate submittals with the progress schedule and actual work progress. Allow two weeks for the Engineer's review. Provide additional copies as required by governing authorities:

A. Shop Drawings:

1. The Contractor shall submit to the Engineer for his review, shop drawings, engineering information, product data, and samples, when requested, of all items of material and equipment as specified.

2. Initial Submittal: Submit six opaque blue/black line prints. One will be returned.

3. Final Submittal: After approval, submit six prints; with final submittal, include additional prints as necessary for job use and distribution. Maintain one print as a mark-up copy for the record drawings.

B. Product Data: Mark each copy to indicate the actual product to be provided; show selections from among options in the manufacturer's printed product data. Submit six copies to the Engineer. Where the product data are required for maintenance manuals, submit two additional copies which will be returned. Maintain one additional copy; at the project site for reference purposes.

Do not proceed with the installation of manufactured products until final review by the Engineer and until a copy of related product is in the installer's possession at the project site.

C. Samples: Submit three sets of samples when requested; one set will be returned. Provide three or more samples in each set where variations in color, pattern or texture are observable; show average condition and extreme range of variations. Submit full documentation with each set. Sample submittals are for Engineer's observation of color, texture, pattern and "kind". Maintain returned set at project site for purposes of quality control comparisons.

1.04 Miscellaneous Submittals

A. Provide copies of miscellaneous submittals as follows:

1. Warranties: Submit two executed copies, plus additional copies as required for maintenance manual.

2. Operation and Maintenance Manuals: Submit in accordance with Section 01730. Include information for all equipment and materials installed.

3. Record Drawings: Submit in accordance with Section 01720 original maintained marked-up prints.

1.05 Procedures

A. Submit Shop Drawings to the Engineer.

B. A letter of transmittal shall accompany each submittal. If data for more than one Section of the Specifications is submitted, a separate transmittal letter shall accompany the data submitted for each Section.

C. A the beginning of each letter of transmittal, provide a reference heading indicating the following:

1. Owners Name AlliedSignal, Inc.
2. Project Name Buffalo Color Area "D"
3. Contract No. 32207
4. Transmittal No. _____
5. Section No. _____

D. If a submittal deviates from the requirements of the Contract Documents, contractor shall specifically not each variation in his letter of transmittal.

E. All submittals for approval shall have a title block with complete identifying information satisfactory to Engineer.

F. All submittals shall bear the stamp of approval and signature of Contractor as evidence that they have been reviewed by Contractor. Submittals without this stamp of approval will not be reviewed by Engineer and will be returned to Contractor. The stamp shall contain the following minimum information:

Project Name: Buffalo Color Area "D"

Contractor's Name: _____

Date: _____

Item: _____

Specifications: _____

Section: _____

Page No.: _____

Para. No.: _____

Drawing No.: _____

Location: _____

Submittal No.: _____

Approved By: _____

G. A number shall be assigned to each submittal by Contractor starting with No. 1 and thence numbered consecutively. Resubmittals shall be identified by the original submittal number followed by the suffix "A" for the first resubmittal, the suffix "B" for the second resubmittal, etc.

H. Contractor shall initially submit to Engineer a minimum of six copies of all submittals.

I. After Engineer completes his review, submittals will be marked with one of the following notations:

1. Approved
2. Approved as Corrected
3. Revise and Resubmit
4. Not Approved

J. If a submittal is acceptable, it will be marked "Approved" or "Approved as Corrected". Two prints or copies of the submittal will be returned to Contractor.

K. Upon receipt of a submittal marked "Approved" or "Approved as Corrected", Contractor may order, ship, or fabricate the materials included on the submittal, provided it is in accordance with the corrections indicated.

L. If a submittal marked "Approved as Corrected" has extensive corrections or corrections affecting other drawings or Work, Engineer may require that Contractor make the corrections indicated thereon and resubmit for record purposes. Such drawings will have the notation, "Approved as Corrected - Resubmit".

M. If a submittal is unacceptable, 2 copies will be returned to Contractor with one of the following notations:

a. "Revise and Resubmit"
b. "Not Approved"

N. Upon return of a submittal marked "Revise and Resubmit", Contractor shall make the corrections indicated and repeat the initial approval procedure. The "Not Approved" notation is used to indicate material or equipment that is not acceptable. Upon return of a submittal so marked, Contractor shall repeat the initial approval procedure utilizing acceptable material or equipment.

O. Any related Work performed or equipment instaled without an "Approved" or "Approved as Corrected" Shop Drawing will be at the sole responsibility of the Contractor.

P. Submittals shall be made well in advance of the need for the material or equipment for construction and with ample allowance for the time required to make delivery of material or equipment after data covering such is approved. Contractor shall assume the risk for all materials or equipment which are fabricated or delivered prior to the approval of submittals. Materials or equipment will not be included in periodic progress payments until approval thereof has been obtained in the specified manner.

Q. Engineer will review and process all submittals promptly, but a reasonable time should be allowed for this, for the submittals being revised and resubmitted, and for time required to return the approved submittals to Contractor.

R. It is Contractor's responsibility to review submittals made by his suppliers and Subcontractors before transmitting them to the Engineer to assure proper coordination of the Work and to determine that each submittal is in accordance with his desires and that there is sufficient information about materials and equipment for the Engineer to determine compliance with the Contract Documents. Incomplete or inadequate submittals will be returned for revision without review.

S. Contractor shall furnish required submittals with complete information and accuracy in order to achieve required approval of an item within three submittals. All costs to the Engineer involved with subsequent submittals will be backcharged to the Contractor by deducting such costs from payments due the Contractor for Work completed. In the event that the Contractor requests a substitution for a previously approved item, all of the Engineer's costs in the reviewing and approval of the substitution will be backcharged to the Contractor unless the need for such substitution is beyond the control of the Contractor or provide a significant cost savings to the Owner.

-- END OF SECTION 01300 --

SUBMITTAL LOG

Client: Allied Signal
Project: Buffalo Color
Contractor: _____

Project #: 728103
Date: 1/24/96

Submittal Number	Title and Description of Submittal	Shop Drawing	Submittal Log #	REFERRED				ACTION					COPIES TO				
				Date Received	Reviewer	Date Revision Received	# of Copies	Approved	Approved as Noted	Revise & Resubmit	Not Approved	Date Revision Returned	Date Returned	Contractor	Owner	Field	File
01050	FIELD SUPERVISION																
1.02A1	Daily Reports																
1.04A	Name/Address of Surveyor Site Superintendent																
1.04B	Documentation of Field Work																
1.04C	Registered Engineer/Surveyor Certificate																
01051	GRADES, LINES, AND LEVELS																
1.01.2	Survey Drawings																
1.01.5	Letter of Certification																
01300	SUBMITTALS																
1.02A	Progress Schedule																
1.02B	Schedule of Submittals																
1.02C	Schedule of Values and Cash Flow Analysis																
01510	TEMPORARY CONSTRUCTION FACILITIES																
2.01	Temporary Facilities Layout Drawings																
01564	EROSION CONTROL																
1.03	Erosion Control Schedule																
01620	SAFETY, HEALTH, AND EMERGENCY RESPONSE																
3A	Health and Safety Plan																
3B	Daily Safety Reports and Visitor Logs																
3C	Monitoring/Sampling Results																
3D	Training Logs and Accident Reports																
3E	Employee Fitness Certification																
01650	FACILITY STARTUP																
1.03B	Facility Startup Plan																
1.03C	Temporary Connections	X															
1.03D	Validation Procedures																
1.03E	Validation Report																
1.04A	Statement of Qualifications (Foreman)																
1.04B	Regulatory Requirements																
1.04D	Pre-Startup Conference Agenda																
1.05A	Facilities Startup Schedule																
1.06A	Maintenance Records (first 3 months)																
01700	PROJECT CLOSEOUT																
1.02A1	Warranties, Maint. Agreements, Certificates																
1.02A2	Records, Manuals, Tools, Spare Parts, Keys																
01720	PROJECT RECORD DRAWINGS																
1.02A	Record Drawings (Contractor)																
1.02B	Supplemental Record Drawings (Surveyor)																
01730	OPERATION AND MAINTENANCE (O&M) DATA																
1.01A	O&M Manual																
02081	UNDERWATER AND WASTE FILL SEDIMENT REMOVAL																
1.02A	Material Handling Plan																

SUBMITTAL LOG

Client: Allied Signal
Project: Buffalo Color
Contractor: _____

Project #: 728103
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02131	DECONTAMINATION PAD AND EQUIPMENT																
2.01	Holding Tanks																
2.02	Precast Sump																
2.03	Flexible Hose																
2.04	Submersible Pump																
2.05	Pressure Washer																
02200	EARTHWORK																
1.02A	Grading, Excavation, and Backfill Plan																
1.02B	Offsite Borrow Material – Grad. and Comp. Curves																
1.02C	Field/Lab Testing Procedures and Methods																
2A	Structural Backfill – Gradation																
2B	Crushed Stone – Gradation																
3.09A	Testing Laboratory and Lab/Field Test Reports																
02275	RIP–RAP																
1.02A	Source of Stone																
1.02B	Test Reports																
02296	CUTOFF WALL																
1.05	Qualifications																
1.06.1	Work Procedures																
1.06.2	Quality Control Program																
1.06.3	Equipment Schedule																
1.06.4	Materials (bentonite, mixing water, backfill, other)																
1.06.5	Backfill Design Mix																
02350	PILES																
1.03A	Steel Analysis Certificates																
1.03B	Work Plan																
1.03C	Pile Welder Qualifications																
1.04	AWS Certification																
2.02	H–Piles																
2.03	Pile Top Plates																
2.04	Ordering Lengths																
02405	FLEXIBLE MEMBRANE LINERS																
1.02A1	Manufacturer																
1.02A2	Manufacturer Quality Control Documents																
1.02A3a–d	Installer Qualifications																
1.02A3e	Shop Drawings/Installation Schedule/Procedures	X															
1.02Af	Statement of Acceptable Foundation																
1.02A4	Manufacturer Installation Instructions																
1.02A5	Quality Control Requirements/Procedures																
1.02A6	Testing Laboratory Qualifications and Methods																
1.02B	Quality Assurance Records, Test Results, Samples																
1.02C1	Record Drawings																
1.02C2	Testing and Temperature Logs																
2.01	Sheet Geomembrane																
2.02	Extrusion Joining Resin																
02421	GEOTEXTILES AND GEONET																
1.04A	Samples																
2.02A	Separation and Cushion Geotextile																
2.02B	Reinforcement Geotextile																
2.02C	Drainage Geonet																

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02671	MONITORING WELLS																
1.02B	Installer Qualifications																
2.01	Protection (manholes and casing)																
2.02	Riser																
2.03	Well Screen																
2.04	Vent Caps																
2.05	Sand Pack																
2.06	Bentonite Seal																
2.07	Grout Mixture																
2.08	Concrete Seal																
02672	EXTRACTION WELLS																
1.02B	Installer Qualifications																
2.02	Riser and Sump																
2.03	Well Screen																
2.04	Well Cap																
2.05	Standpipe																
2.06	Sand Pack																
2.07	Bentonite Seal																
2.08	Grout Mixture																
02727	DRAINAGE PIPING																
1.04B	Shop Drawings	X															
1.04C	Manufacturer Certification																
2.02	Underdrain Piping																
02910	RIVERBANK RESTORATION/WETLAND CREATION																
1.02A	Soil Source																
1.02B	Grass Seed Vendor Certificate																
1.02C	Planting Schedule																
1.02D	Fertilizer																
1.02E	Hydroseeders (Equipment)																
1.02F	Erosion Control Fabrics																
1.03B	Delivery Certificates																
2.01	Substrate Soil																
2.02	Wooded Shoreline Plant Materials																
2.03	Created Wetland Plant Material																
2.04	Additional Seeding																
02990	FINISH GRADING, TOPSOIL, AND SEEDING																
1.02.1	Topsoil Source																
1.02.2	Grass Seed Vendor Certificate																
1.02.4	Hydroseeders (Equipment)																
2.01	Topsoil																
2.02	Grass Seed																
2.03	Fertilizer																
2.04	Mulch																
2.05	Natural Erosion Control Fabric																
2.06	Wire Staples																
03100	FORMWORK																
2.01B	Lumber																
2.01C	Plywood																

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03200	CONCRETE REINFORCEMENT																
1.03A	Shop Drawings	X															
1.03B	Mill Test Certificates																
2.01A	Reinforcing Steel																
2.01B	Welded Wire Mesh																
2.01C	Wire																
03300	CONCRETE																
1.02B	Test Reports																
1.02C	Manufacture Certification																
1.02D	Material Content																
1.02E	Ready-Mix Delivery Tickets																
1.02F	Mix Design																
2.02	Cement																
2.03	Aggregate																
2.04	Admixtures																
2.05	Bonding Agent																
2.06	Grout																
2.07	Expansion Joint Material																
2.08	Waterstops																
2.09	Sealant																
03410	PRECAST CONCRETE HOLLOW CORE SLABS																
1.03A	Shop Drawings	X															
2.02	Mix Design																
03480	PRECAST CONCRETE MANHOLES AND VAULTS																
1.3	Shop Drawings	X															
2.1	Precast Concrete Manholes and Vaults																
04200	MASONRY																
1.03A	Samples																
1.03B	Product Data, Test Reports, Certifications																
2.01	Cement																
2.02	Lime																
2.03	Water																
2.04	Sand																
2.05	Grout																
2.07	Concrete Masonry Units																
2.08	Joint Reinforcing																
05500	MISCELLANEOUS METALS																
1.03A	Shop/Erection Drawings	X															
1.03B	Test Reports																
1.03C	Shop Painting Data																
2.01	General (steel, iron, aluminum, bolts, etc.)																
2.02	Pipe Racks																
2.03	Pipe Boullards																
2.04	Steel Stairs																
2.05	Grated Platforms																
2.06	Miscellaneous Connections																
2.07	Pipe and Conduit Supports and Bracing																
2.08,9	Steel Framing																
2.10	Access Ladders																
2.11	Warning Signs																
2.12	Tank Platform																

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05521	PIPE AND TUBE RAILINGS																
1.05B	Product Data																
1.05C	Shop Drawings	X															
2.02	Metals																
2.03	Priming and Painting																
2.04	Welding Materials and Fasteners																
2.05	Fabrication																
2.06	Finishes, General																
2.07	Galvanized Metal																
05534	ACCESS HATCHES																
1.02A	Access Hatches																
1.02B	Security Systems																
07210	BUILDING INSULATION																
2.01	Manufactures																
2.02	Safing Insulation and Accessories																
2.03	Thermal Insulation																
07270	FIRESTOPPING																
1.07A	Manufacturer Data																
1.07B	Shop Drawings	X															
1.07C	Material Safety Data Sheets (MSDSs)																
07900	JOINT SEALERS																
1.02A	Samples (sealants, primers, back-up, bondbreaker)																
08110	STEEL DOORS AND FRAMES																
1.02A	Shop Drawings	X															
2.01	Steel Sheet																
2.02	Frames																
2.03	Flush Doors																
2.04	Stile and Rail Doors																
2.05	Fire Doors																
08362	SECTIONAL STEEL OVERHEAD DOORS																
1.03	Shop Drawings	X															
2.01	Product Data																
08520	ALUMINUM WINDOWS																
1.02A.1	Shop Drawings	X															
1.02A.2	Samples - Aluminum Color Finish																
1.02A.3	Samples - Window																
08710	FINISH HARDWARE																
1.03A	Product Data and Schedule																
1.03D	Maintenance Manual																
09512	ACOUSTICAL CEILING TYPE 2																
1.03A	Shop Drawings	X															
2.01	Product Data																
09900	PAINTING																
1.03A	Samples - Colors and Finishes																
1.03B	Shop Drawings	X															

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10522	FIRE EXTINGUISHERS																
1.03A.1	Product Data																
1.03A.2	Location Plan																
10800	TOILET AND BATH ACCESSORIES																
1.03A	Shop Drawings or Product Data	X															
1.03B	O&M Instructions and Keys																
11001	GENERAL PROVISIONS – EQUIPMENT																
2.02	Safety Guards																
2.03	Equipment Bases and Bedplates																
2.04	Jacking Screws and Anchor Bolts																
2.05	Drives																
2.06	Lubrication (1 – yr supply and inventory listing)																
2.07	Gears																
11197	GRINDER PUMPS																
1.04A	Pump Curves																
1.04B	Shop Drawings	X															
1.04C	Diagrams and Instructions																
1.04D	Conformance Certification																
1.04E	Test Reports																
1.04F	O&M Manuals																
11210	EXTRACTION WELL PUMPS																
1.04A	Catalog Bulletins																
1.04B	Dimensional Drawing																
1.04C	Pump Unit Weight																
1.04D	Capacity Curves																
1.04E	Installation and Operating Instructions																
1.04F	Spare Parts List																
1.04G	List of Technical Assistance Contacts																
1.04H	Certification of Chemical Resistivity																
1.04I	O&M Manuals																
1.05	Factory Test Reports																
11212	SUBMERSIBLE SUMP PUMP																
1.02A.1	Pump Curves																
1.02A.2	Material of Construction																
1.02A.3	Electric Motor Data																
1.02A.4	Wiring Diagrams																
1.02B	Shop Drawings	X															
11214	HORIZONTAL–MOUNT CENTRIFUGAL PUMPS																
1.02A	Pump Curves																
1.02B	Electric Motor Data																
1.02C	Conformance Certification																
1.02D	Anchor Bolt Placement/Details																
1.02E	Materials of Construction																
1.02F	Stuffing Box Sealing																
1.02G	Lubrication Schedule																
1.02H	Shop Test Results																
1.02I	O&M Manuals																

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11216	AIR DIAPHRAGM TRANSFER PUMPS																
2.01A.1	Manufacturer's Literature																
2.01A.2	Shop Drawings	X															
2.01A.3	O&M Manuals																
2.01A.4	Guarantee																
2.01B.1	Design Data																
11220	MIXERS (PORTABLE)																
1.04A.1	Manufacture's Literature																
1.04A.2	Shop Drawings	X															
1.04A.3	Motor Data																
1.04B	Mixer and Motor Test Reports																
1.04C	O&M Manual																
1.05	Shop Test Results																
11225	MIXERS (STATIC)																
1.04	Shop Drawings and Product Data	X															
11345	CHEMICAL FEED SYSTEMS																
1.04.1	Catalog Bulletins																
1.04.2	Dimensional Drawing																
1.04.3	Capacity Curves																
1.04.4	Installation and Operating Instructions																
1.04.5	Spare Parts List																
1.04.6	List of Technical Assistance Contacts																
1.04.7	Certification of Chemical Resistivity																
1.04.8	Design Load Calculations																
1.05	Factory Test Reports																
11360	PLATE AND FRAME FILTER PRESS																
1.04A.1	Manufacturer's Literature																
1.04A.2	Appurtenances																
1.04A.3	Assembly & Installation Drawings																
1.04A.4	Anchorage Installation																
1.04A.5	Shop Test Results																
1.04A.6	Field Test Results																
1.04B	O&M Manuals																
1.04C	Design Data, Factory Test Reports, Certificates																
11500	PROCESS TANKS																
1.03	Shop Drawings	X															
12302	WOOD CASEWORK																
1.03A	Product Data																
1.03B	Shop Drawings	X															
1.03C	Samples																
1.03D	O&M Manuals																
2.01	Wood Casewood																
2.02	Countertops																
2.03	Hardware and Accessories																
2.04	Finishes																
13020	SAFETY SHOWER AND EYEWASH																
1.04	Shop Drawings and Material Certificates	X															

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13121	PRE-ENGINEERED BUILDING																
1.03A	Product Data																
1.03B	Shop Drawings	X															
1.03C.1	Samples – Roofing and Siding Panels w/ Finishes																
1.03C.2	Samples – Fasteners																
1.03C.3	Samples – Sealants and Closures																
1.03C.4	Samples – Interior Metal Panels																
1.03D	PE Certification																
13200	OIL/WATER SEPARATOR																
1.03B	Product Data and Shop Drawings	X															
1.03C	Installation Manuals																
1.03D	O&M Manuals																
13205	INCLINED PLATE CLARIFIER SYSTEM																
1.04A	Layout and Critical Dimensions																
1.04B	Materials of Construction/Unit Weight																
1.04C	Details – Filter Openings																
1.04D	Details – Anchors and Supports																
1.04E	Certification of Material Strength																
1.04F	O&M Manuals																
1.04G	Operating Procedures																
13210	SLUDGE SETTLING TANK SYSTEM																
1.04A	Layout and Critical Dimensions																
1.04B	Materials of Construction/Unit Weight																
1.04C	Details – Tank Openings																
1.04D	Details – Anchors and Supports																
1.04E	Certification of Material Strength																
1.04F	Control Details and Wiring Diagrams																
1.04G	Performance Data (motor,gear reducer)																
1.04H	Shop Drawings	X															
13290	PRESSURE FILTRATION SYSTEM																
1.04A	Layout and Critical Dimensions																
1.04B	Materials of Construction/Unit Weight																
1.04C	Details – Filter Openings																
1.04D	Details – Control Valves																
1.04E	Details – Anchors and Supports																
1.04F	Electrical Schematics																
1.04G	Certification of Material Strength																
13295	GRANULAR ACTIVATED CARBON SYSTEM																
1.04A	Manufacturer's Literature																
1.04B	Equipment List/Layout Drawings																
1.04C	Framed Control Drawings and Operating Instructions																
1.04D	Test Reports																
1.04E	O&M Instructions																

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13220	INSTRUMENTATION																
1.03	Manufac. Data, Shop Drawings, Test Reports, O&M	X															
2.01	Pressure and Vacuum Gauges																
2.02	Magnetic Flow Meters																
2.03	Process Variable Indicators																
2.04	Control Stations																
2.05	Annunciator																
2.06	Control Relays																
2.07	Tilting Float Level Switches																
2.08	Integrators–Counters–Scalers																
2.09	Solenoid Valves																
2.10	pH Sensor/Transmitter and Receiver/Analyzer																
2.11	Current To Pneumatic Transducer																
2.12	Repeating Cycle Timer																
13440	PANELS AND CONTROL STATION HARDWARE																
1.03A	Manufacturer's Data																
1.03B	Shop Drawings	X															
1.03C	Certificates of Compliance																
1.03D	Certified Test Reports																
1.03E	O&M Manual																
2.02	Steel Panels																
2.03	Panel Hardware																
2.04	Panel Accessories																
15060	PROCESS PIPING AND PIPE APPURTENANCES																
1.03B	Shop Drawings	X															
1.03C	Erection Drawings																
1.03E	Protective Coating Schedule																
1.03F	Testing Procedures																
2.02	Black Steel Pipe & Fittings																
2.03	Galvanized Steel Pipe & Fittings																
2.04	Copper Tubing and Fittings																
2.05	PVC Sch.80 & Fittings																
2.06	Corrugated Metal Pipe																
2.07	Hose																
2.08	Polyethylene Pipe																
2.09	Mechanical Couplings																
2.10	Expansion Joints																
2.11,12	Wall Sleeves and Castings																
2.16	Sleeve Sealing Materials																
15094	PIPE HANGERS AND SUPPORTS																
1.03A	Shop Drawings	X															
1.03B	Product Data																
2.02	Hangers and Supports																

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15100	PROCESS VALVES, REGULATORS, & MISC. COMPONENTS																
1.03A	Shop Drawings	X															
1.03B.1	Assembly Instructions and Spare Parts List																
1.03B.2	Preventative Maintenance Instructions																
1.03B.3	Certificate of Seat Compatability																
1.03C	Motor Driven Actuator																
1.03D	Erection Drawings																
1.03E	Test Certificates																
2.02	Valve Appurtenances																
2.03	Gate Valves																
2.04	Ball Valves																
2.05	Globe Valves																
2.06	Ball Check Valves																
2.07	Needle Valves																
2.08	Eccentric Plug Valves																
2.09	Small Diameter Isolating Valves																
2.10	Hose Bibbs and Valves																
2.11	Solenoid Valves																
2.12	Totalizing Flow Meters																
15260	PIPE INSULATION AND HEAT TRACING																
1.04	Catalog Data and Installation Instructions																
2.02A–F	Insulation																
2.02G	Jacket																
2.03B	Heat Tracing																
15400	PLUMBING, GENERAL PURPOSE																
1.02	Shop Drawings, Product Data, Field Tests	X															
2A	Potable Water Supply System Components																
2B	Storage–Type Water Heaters																
2C	Plumbing Fixtures and Trim																
2D	Sanitary DWV																
2E	Gas Distribution Pipe & Fittings																
15410	PLUMBING PIPING																
1.04B	Product Data																
2.01	Sanitary Sewer Piping																
2.02	Water Piping (DCW,DHW)																
2.03	Natural Gas Piping																
2.04	Flanges, Unions, Couplings																
2.05	Gate Valves																
2.06	Plug Valves																
15430	PLUMBING SPECIALTIES																
1.04	Shop Drawings, Product Data, Installation Instructions	X															
2.01	Floor Drains																
2.02	Cleanouts																
2.03	Hose Bibs																
2.04	Backflow Preventers																
15440	PLUMBING FIXTURES																
1.04	Product Data and Installation Instructions																
2.01	Water Closet																
2.02	Lavoratory																
2.03	Service Sink																

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15445	PLUMBING EQUIPMENT																
1.04	Shop Drawings, Product Data, Installation Instructions	X															
2.01	Electric Water Heater																
15450	COMPRESSED AIR SYSTEM																
1.04A	Product Data (air compressor, air dryer, access.)																
1.04B	Wiring Diagrams																
1.04C	ASME Certification																
1.04D	Coordination Drawings																
1.04E	Maintenance Data																
15500	HEATING AND VENTILATION SYSTEMS																
1.05	Product Data, Shop Drawings, O&M Manuals	X															
2.01	Roof Exhaust Fan																
2.02	Wall Exhaust Fans																
2.03	Motorized Dampers																
2.04	Damper Operators																
2.05	Thermostat																
15858	INDOOR MAKE-UP AIR HANDLER																
1.03A	Shop Drawings	X															
1.03B	O&M Data																
1.04C	Test Reports																
15890	DUCTWORK																
1.06	Shop Drawings	X															
2.01	Ductwork																
2.02	Bonding Material																
2.03	Fittings																
2.04	Joints																
2.05	Hangers and Supports																
15950	AUTOMATIC TEMPERATURE CONTROLS																
2.01	Thermostats																
15990	TESTING, ADJUSTING, AND BALANCING OF HV																
1.04B.2	Testing Agency Qualifications																
1.04B.4	Test Reports and Procedures																
1.04C	Certified TAB Reports																
16111	CONDUIT																
2.02	Metal Conduit																
2.03	Liquidtight Flexible Metal Conduit																
2.04	Electrical Metallic Tubing																
2.05	Nonmetallic Conduit																
16118	UNDERGROUND ELECTRICAL WORK																
2.02	Wire and Cable																
2.03	Pull Wire																
2.04	Precast Pull Boxes																
2.04	Cast Iron Frames and Covers																

SUBMITTAL LOG

Client: Allied Signal
Project: Buffalo Color
Contractor: _____

Project #: 728103
Date: 1/24/96

Submittal Number	Title and Description of Submittal	Shop Drawing	Submittal Log #	REFERRED				ACTION					COPIES TO				
				Date Received	Reviewer	Date Revision Received	# of Copies	Approved	Approved as Noted	Revise & Resubmit	Not Approved	Date Revision Returned	Date Returned	Contractor	Owner	Field	File
16123	BUILDING WIRE AND CABLE																
2.02	Building Wire and Cable																
2.03	Analog Signal Wire																
2.05	Underground Feeder and Branch–Circuit Cable																
16130	BOXES																
2.01	Outlet Boxes																
2.02	Pull and Junction Boxes																
16141	WIRING DEVICES																
1.03	Manufacturer's Instructions																
2.01	Wall Switches																
2.02	Receptacles																
2.03	Wall Plates																
16170	GROUNDING AND BONDING																
1.06	Test Reports and Manufacturer's Instructions																
2.01	Rod Electrode																
2.02	Exothermic Connections																
2.03	Wire																
16190	SUPPORTING DEVICES																
1.03	Manufacturer's Instructions																
2.01	Anchors and Fasteners																
2.02	Steel Channel																
16195	ELECTRICAL IDENTIFICATION																
2.01	Nameplates																
2.02	Wire Markers																
2.03	Underground Warning Tape																
16401	UTILITY SERVICE																
1.03	Shop Drawings	X															
2.01A	Metering/Riser Pole																
2.01B	Load Break Switch																
2.01C	Fused Cutouts																
2.01D	Arresters																
2.01E	Cable Terminators																
16461	DRY TYPE TRANSFORMERS																
1.04	Test Reports, Manufacturer's Instructions/Certificates																
2.01	Two–Winding Transformers																
16470	PANELBOARDS																
1.04	Shop Drawings and Installation Instructions	X															
2.01	Distribution Panel Boards																
16471	POWER DISTRIBUTION SYSTEM COORDINATION																
2.01	Power System Studies and Report																

SUBMITTAL LOG

Client: Allied Signal
Project: Buffalo Color
Contractor: _____

Project #: 728103
Date: 1/24/96

Submittal Number	Title and Description of Submittal	Shop Drawing	Submittal Log #	REFERRED				ACTION					COPIES TO				
				Date Received	Reviewer	Date Revision Received	# of Copies	Approved	Approved as Noted	Revise & Resubmit	Not Approved	Date Revision Returned	Date Returned	Contractor	Owner	Field	File
16480	MOTOR CONTROL																
1.04	Shop Drawings, Product Data, Manuf. Instructions	X															
1.05	O&M Data and Spare Parts List																
2.02	Manual Motor Starters																
2.03	Magnetic Motor Starters																
2.04	Controller Overcurrent Protection/Disconnection																
2.06	Motor Control Center																
2.07	Motor Starter Panelboard																
16510	INTERIOR AND EXTERIOR LUMINARIES																
1.04	Shop Drawings, Product Data, Manuf. Instructions	X															
2.01	Ballasts, Lamps, and Accessories																
16670	LIGHTNING PROTECTION SYSTEMS																
1.05	Shop Drawings, Product Data, Manuf. Instructions	X															
2.02	Air Terminals, Grounding Rods, Conductors, Access.																
16700	OVERHEAD DISTRIBUTION																
16740	TELEPHONE SYSTEMS																
1.03	Product Data and Wiring Diagrams																
2.01	Telephone Systems																

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01330

PROJECT CONTROL

1. GENERAL

1.01 Pre-Construction Meeting

A. The AlliedSignal Inc. on site representative will schedule a pre-construction meeting at the former Buffalo Color Area D or other convenient location prior to commencement of construction activities. The meeting will be conducted to review responsibilities, personnel assignments, and site procedures.

B. Attendees: The AlliedSignal Project Manager or its designate (Site Manager), Design Engineer (Parsons) and the CONTRACTOR (and his superintendent, health and safety officer, quality control engineer, and major SUBCONTRACTORS) shall each be represented at the conference by persons familiar with, and authorized to, conclude matters relating to the Bid Specifications. Representatives from the New York Department of Environmental Conservation (NYDEC) will also be invited to attend. The agenda for the meeting will be developed by AlliedSignal and will include items of significance that could affect progress including such topics as:

1. Construction schedule;
2. Critical work sequencing;
3. Designation of responsible personnel;
4. Construction quality control and assurance procedures and protocols;
5. Procedures for processing field decisions and Extra Work Orders;
6. Procedures for processing applications for payment;
7. Distribution of contract documents;
8. Submittal of shop Drawings, product data, work plans, studies and analytical data;
9. Preparation of record documents;
10. Use of the premises;
11. Office, work and storage areas;
12. Equipment deliveries and priorities;
13. Health and safety procedures;
14. First aid;
15. Security;

16. Housekeeping;

17. Working hours;

18. Access through Buffalo Color property; and

19. Available utility tie-ins.

1.02 Progress Meetings

A. Progress meetings will be conducted by AlliedSignal SITE MANAGER at the project site every week. AlliedSignal will notify the CONTRACTOR of scheduled meeting dates.

B. In addition to the AlliedSignal SITE MANAGER and CONTRACTOR, each major subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination, or performance of future activities, shall be represented at these meetings by persons familiar with the project and authorized to conclude matters relating to progress.

C. No later than 3 working days after each progress meeting date, the AlliedSignal SITE MANAGER will distribute copies of minutes of the meeting to each party present and to other parties who should have been present. The minutes will include a brief summary, in narrative form, of progress since the previous meeting.

1.03 Problem or Work Deficiency Meeting

A. A special meeting shall be held when and if a problem or deficiency is present or likely to occur. At a minimum, the meeting shall be attended by the AlliedSignal SITE MANAGER, CONTRACTOR, and any affected subcontractors. The purpose of the meeting shall be to define and resolve the problem or work deficiency.

B. The meeting shall be documented by the AlliedSignal SITE MANAGER and minutes will be transmitted to each meeting participant no later than 3 working days after the meeting.

1.04 Other Meetings

A. The AlliedSignal SITE MANAGER will hold other meetings at his discretion during the contract.

1.05 Correspondence

A. All correspondence to AlliedSignal shall be submitted in original and two (2) copies, unless otherwise specified.

1.06 Progress Schedules

A. Throughout the project, the CONTRACTOR shall furnish in duplicate, graphic type construction schedules as specified under Section 01300 - Submittals.

1.07 Administration Of Contract

A. The CONTRACTOR shall follow the Construction Drawings strictly and execute all work in accordance with those Drawings, except as otherwise directed in writing by AlliedSignal's SITE MANAGER.

B. The Construction Drawings and Specifications shall be coordinated, so that any work shown on the Construction Drawings and not mentioned in the Specifications, and vice-

versa, shall be executed in the same manner as though mentioned in the Specifications and shown on the Construction Drawings.

C. The CONTRACTOR shall furnish and install such work and material as may be proper and suitable for preparation, basis, support, or finish for the work which is shown or specified, whether or not the same is specifically mentioned in the Specifications or shown on the Drawings. The CONTRACTOR shall be required to make plural and complete work which, on the Drawings, is shown single or partially indicated to avoid needless repetition, for the sake of brevity, and for reasons of clarity. In all cases, the intent and meaning of the Drawings and Specifications, as defined herein, shall be followed. The CONTRACTOR shall not avail himself of any errors or omissions therein, should any exist, which may be in conflict therewith.

D. Extra work may be required for the project. The procedure to be followed for completion of extra work is defined in the project contract. The CONTRACTOR shall complete and submit the necessary forms included in the contract for all extra work. Refer to Section XXI under Section I General Conditions, page 13 for procedures and Exhibits 1, 2 and 4 of Section I for additional instructions and forms.

1.08 Project Record Documents

A. The CONTRACTOR shall maintain at the job site one copy of all Construction Drawings, Construction Specifications, Extra Work Order Procedures, Addenda, ap-proved shop drawings, field orders, record documentation and drawings, and other project documentation in compliance with the various sections of these Construction Specifications.

B. The CONTRACTOR shall maintain Project Record Documents at the job site. The project documents shall be clearly marked, "Project Record Copy", and shall be maintained in good condition, available at all times for inspection by the AlliedSignal SITE MANAGER and not used for construction purposes. The CONTRACTOR shall store the Project Record Documents separate from documents used for construction.

C. Records:

1. The CONTRACTOR shall mark up the most appropriate project documents to show:

   a. Significant changes made during the construction process;

   b. Significant detail not shown in the original Construction Drawings;

   c. The location of underground utilities and appurtenances, referenced to permanent surface improvements;

   d. The location of internal utilities and appurtenances, referenced to permanent surface improvements;

   e. Any relocation of concealed structural components;

   f. Other changes as directed by AlliedSignal;

   g. Backfill placement logs;

   h. Off-site disposal.

2. The CONTRACTOR shall prepare Record Drawings showing the elevations, locations, and grades of completed work for the following components of the project:

   a. Alignment of soil bentonite slurry wall (Pre-Excavation & final survey);

   b. As-built of recovery well vaults and appurtenances;

   c. As-built of treatment building including foundation, piping, equipment & appurtenances;

   d. Elevations and locations of permanent monitoring wells (final survey);

   e. Elevations and locations of extraction wells (final survey);

   f. Alignment of active on-site utilities including conveyance piping and BRIC line vaults (final survey);

   g. Inverts of well vaults and groundwater conveyance piping (As-built);

   h. Flexible Membrane Liner panel placement & seams;

   i. Excavation depths and final limits of dredging and rip rap placement (Initial & final survey);

   j. Contour elevations of final grading, roadway, created Wetlands/Fish POD Area.

   k. Elevations and locations of site planting areas (final survey).

3. The CONTRACTOR shall submit a certificate or letter from the surveyor, certifying that elevations and locations of site construction features given on the Project Record Documents are true and in conformance with these Specifications.

4. The CONTRACTOR shall keep Project Record Documents current.

5. The CONTRACTOR shall submit the Project Record Documents with the claim for the Final Application for Payment.

1.09 Closeout Procedures

A. The CONTRACTOR shall submit written certification that the Bid Specification has been reviewed, work has been inspected, and that work is complete in accordance with Bid Specification and ready for the inspection by the AlliedSignal SITE MANAGER.

B. The CONTRACTOR shall provide all As-built documentation, all submittals required by the Construction Specifications and by governing or other authorities, to the AlliedSignal SITE MANAGER.

C. The CONTRACTOR shall submit final Application for Payment identifying the total adjusted contract sum, previous payments, and sum remaining due.

1.10 Closeout Safety Report

A. The CONTRACTOR shall submit a closeout safety report to AlliedSignal upon completion of the work. This report shall summarize the daily safety reports and provide an overview of the CONTRACTOR's performance with regard to the site specific health and safety plan and its task addenda. This report shall also include certification of final medical examination of on-site employees and equipment decontamination.

2. PRODUCTS.

Not used.

3. EXECUTIONS.

3.01 Final Cleaning

A. Upon completion of work and prior to final inspection, the CONTRACTOR shall remove all of his equipment, signs, facilities, construction materials, and trash, and shall perform any other reasonable cleanup activities requested by the AlliedSignal SITE MANAGER. All disturbed areas outside the work areas shall be revegetated or otherwise put into a conditions satisfactory to AlliedSignal. The CONTRACTOR shall remove all erosion and sediment controls unless otherwise directed by the AlliedSignal SITE MANAGER.

-- END OF SECTION --

SECTION 01510

TEMPORARY CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.01 Description

A. The Contractor shall be responsible for all temporary construction facilities required for the Work. The Contractor shall make all arrangements with utility service companies for temporary services and shall pay all costs associated therewith. The Contractor shall be responsible for all utility service costs until the Work is substantially complete. Included are all fuel, power, light, heat, and other utility services necessary for execution, completion, testing, and initial operation of the Work.

B. Temporary construction facilities include:

1. Potable water;
2. Electricity and lighting;
3. Telephone;
4. Heat, weather protection, and ventilation;
5. Fire protection;
6. Sanitary and First Aid Facilities;
7. Engineer's field office;
8. Decontamination pad and equipment;
9. Security; and
10. Other temporary facilities that may be required by the Contract.

1.02 Quality Assurance

A. Regulation: Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities.

B. Standards: Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations", and ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services."

C. The Contractor shall abide by all rules and regulations of the utility service company or authority having jurisdiction.

D. Contractor shall conform to the fire protection and prevention requirements specified herein as well as those which may be established by Federal, State, or local governmental agencies.

PART 2 - PRODUCTS

2.01 Submittals

The Contractor shall submit drawings after Notice to Proceed and prior to the pre-construction meeting to the Engineer for approval, showing the layout, furnishings, and facilities of the field office trailer and information concerning how the Contractor proposes to furnish the required utilities.

PART 3 - EXECUTION

3.01 Utility Installation

A. Electric Power Service: The Contractor shall provide all materials, equipment, and power required for temporary electricity and lighting for construction purposes to be utilized by all trades on the project. Include continuous power for construction site offices. Provide all outlets with circuit breaker protection and comply with ground fault protection requirements of NEC. The Contractor shall provide extension cords, droplights, power tools, and other small devices required. These items shall comply with Federal Construction Safety Standards while using the temporary electric facilities. Comply with applicable requirements of NEMA, NEC, UL, and OSHA standards and governing regulations.

B. Temporary Telephones: Install two telephone lines for the Engineer's Field Office. Post a list of operational and emergency telephone numbers. Engage the local utility company to install temporary service or make connections to existing service, if available. Arrange with the Company for an acceptable time when service can be interrupted to make connections. The Contractor shall obtain and pay for permits and construction required to bring temporary utilities to the site.

C. Temporary Heat and Ventilation: Sufficient temporary heat and ventilation shall be provided to assure safe working conditions and that no damage will occur to any of the Work. In addition, all enclosed areas shall be maintained at a minimum of 50°F, unless otherwise specifically excepted in the Specifications.

3.02 Engineer's Field Office

Provide one standard prefabricated or mobile unit, or the equivalent job-built field office, of at least 500 square feet for the Engineer, Owner, and NYSDEC at the site. The office shall have three separate and lockable rooms each with a minimum size of 100 square feet.

1. The office shall be adequately heated, well lighted, suitable ventilated, and cooled with a refrigerated-type air conditioning unit, complete with all piping and electrical connections. An adequate supply of cold drinking water shall be furnished and maintained. Steps and landings shall be provided. Anchor the office as required, to prevent possible roll over or tipping by winds. Contractor to empty waste baskets and perform general cleaning in and around the Engineer's Field Office.

2. Each office shall be provided with the following items:

- 1- fire extinguisher
- 1- locking file cabinet (4-drawer)
- 1- first aid kit
- 1- conference table (3 ft. x 5 ft. minimum)
- 2- shelves (3' x 1' minimum)
- 2- waste baskets
- 1- water cooler (or potable water supply)
- 1- paper cup dispenser with cups (to be replenished by Contractor)
- 4- chairs (folding or stackable)
- 1- telephone answering machine with integral phone
- 1- plain paper facsimile machine
- 1- plans table
- 1- vertical plan rack (22" x 36" minimum)
- 1- copier capable of copies up to 11" x 17" in size and all needed copier supplies
- 1- paper towel dispenser with towels (to be replenished by Contractor)

3.03 Sanitary Facilities

Suitably enclosed chemical or self-contained toilets shall be provided by the Contractor for the use of the personnel employed on the Work. Toilets shall be located near the Work site. Toilets shall be serviced at regular intervals, kept clean, and supplied throughout the course of the Work. Provide adequate sanitary facilities for both male and female onsite personnel. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of facilities. Waste from sanitary facilities shall be properly disposed at the Contractor's expense.

3.04 Potable Water

The Contractor shall furnish and maintain a safe drinking water supply readily available to all workers. Sufficient potable water shall be provided for all site activities including drinking, washing, dust control, and decontamination.

3.05 Temporary Enclosures

Provide temporary enclosures of materials and equipment as needed to provide protection from exposure, foul weather, other construction operations, and similar activities.

3.06 Barricades, Warning Signs and Lights

Comply with recognized standards and code requirements for erection of substantial barricades where needed to prevent accidents.

3.07 Termination and Removal

Remove each temporary service and facility when need has ended and approval has been given by the Engineer.

At substantial completion, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during the construction period.

-- END OF SECTION 01510 --

SECTION 01540

SECURITY

PART 1 - GENERAL

1.01 Description

A. Contractor shall protect all Work, materials, equipment, and properly form loss, theft, damage, and vandalism. contractor's duty to safely guard property shall include the Owner's property and other private property from injury or lost in connection with the performance of the Contract.

B. The Contractor shall employ watchmen as needed to provide the required security and prevent unauthorized entry.

C. Contractor may make no claim against the Owner for damage resulting from trespass.

D. Contractor shall make good all damage to property of Owner and others arising from failure to provide adequate security.

E. The site is permanently fenced along the north and east sides. No fencing exists or is required along the south and west sides or at the site boundary with the Buffalo River.

F. The Contractor shall install a secure 5-foot, high-strength polyethylene orange plastic fence and/or the temporary fencing to provide site security where the permanent fence is removed for purposes of construction. Temporary plastic fencing shall be Tenax Apli or equal with 7-foot minimum length posts set at a maximum of 10-feet apart. Fencing shall be installed prior to beginning construction of other work items and shall be repaired in an expeditious manner as necessary. one main entrance/exit gate shall be established.

G. Maintain security program throughout construction until Owner's acceptance and occupancy precludes need for Contractor's security program.

--END OF SECTION 01540--

SECTION 01564

EROSION CONTROL

GENERAL

1.01 Description

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to accomplish erosion control measures during and following construction as described herein or shown on the Contract Drawings.

A. Work included in this section:

1. Installation of sedimentation and erosion control barriers.
2. Anchoring all topsoil stockpiles with straw mulch and ringing with hay bales.
3. Inspection of all erosion control measures weekly, after each rainfall and at least daily during prolonged rainfall.
4. Repairing immediately any failed sedimentation and erosion control barrier.
5. Removing and disposing of sediment deposits in a manner that does not result in additional erosion or pollution.
6. Removal of hay bales or silt fences after completion of construction and permanent stabilization is complete.

B. Related work specified in other sections:

1. Section 02200 - Earthwork
2. Section 02275 - Rip-Rap
3. Section 02421 - Geotextiles and Geonet
4. Section 02990 - Finish Grading, Topsoil and Seeding.

1.02 Performance Requirements

A. Conform to all erosion and sedimentation control measures of the State of New York as specified in the Storm Water Management and Erosion Control Plan prepared by Parsons Engineering Science, November 1995.

B. Temporary erosion and sediment control measures shall be installed as the first step in construction, shall be continuously maintained, and shall not be removed until permanent cover is completely established and stabilized, with Engineer's approval.

1.03 Schedule

A. Taking into account specific constraints or other criteria outlined herein, the Contractor shall prepare a detailed schedule which sets forth his program of operations to effectively control erosion and sediment-runoff at all times during construction and during the one-year guarantee period following completion of the work.

1. Two copies of the schedule shall be filed with the Engineer.

2. At least one copy shall be kept at the project site at all times, and shall be made available for examination by the Engineer.

3. The schedule shall be arranged so as to include:

   a. Chronological completion dates for each temporary (and permanent) measure for controlling erosion and sediment.

   b. Location, type and purpose for each temporary measure to be undertaken.

   c. Dates when those temporary measures will be removed.

PART 2 PRODUCTS

2.01 Soil Erosion and Sediment Control Plan

The Contractor shall comply with the provisions of the Storm Water Management and Erosion Control Plan prepared by Parsons ES, November 1995.

2.02 Materials

A. Hay/Straw Bales

1. Shall be securely tied and measure, at a minimum, 14 inches by 18 inches by 30 inches long (14" x 18" x 30") or greater.

B. Geotextile

1. Reinforcement geotextile as specified in Section 02421.

2. Silt fence shall be constructed using prefabricated 24-inch height units with 4-foot spacing stakes.

C. Stakes and Fasteners

1. Shall be two #3 rebar or two 2-inch by 2-inch hardwood stakes for each hay/straw bale.

2. Shall be a 2-inch by 2-inch by 36-inch hardwood post or Standard T or U section steel posts weighing not less than 1.33 pounds per linear foot for silt fences.

D. Erosion Control Fabric

1. North American Green Type 575 or equal shall be used.

2.03 Products

A. Sediment Barriers - Sediment barriers shall be hay or straw bales, stone, silt fences or other approved materials that will prevent migration of silts and sediment to receiving waters.

B. Diversion Terraces - Diversion terraces shall be installed on the uphill side of the disturbed areas to divert surface runoff away from unstabilized slopes.

C. Interceptor Channels - Interceptor channels shall be installed across disturbed areas where the slope is running parallel to the direction of trenches.

PART 3 EXECUTION

3.01 General Requirements

A. It is the Contractor's responsibility to implement and maintain erosion and sedimentation control measures which effectively prevent accelerated erosion and sedimentation.

B. Earthmoving activities shall be conducted in such a manner as to prevent accelerated erosion and sedimentation.

C. All erosion and sedimentation control measures shall be inspected by the Contractor immediately after each rainfall and at least daily during prolonged rainfall.

1. Repair and/or maintenance of sedimentation and erosion control measures will be made as soon as needed.

2. The Contractor shall be held responsible for the implementation and maintenance of all erosion control measures on this site.

D. Land disturbance shall be kept to a minimum.

1. Restabilization shall be scheduled immediately after any disturbance.

E. Silt fences or hay bales shall be installed at the toe of all critical cut and fill slopes.

F. Catch basins (sumps) shall be protected with silt fences or hay bales throughout the construction sequence and until all disturbed areas are stabilized.

G. Erosion and sedimentation control measures shall be installed prior to all construction activities.

H. Sediment removal from temporary control structures and from permanent drainage facilities shall be the responsibility of the Contractor.

1. Sediment shall be disposed of in a manner which is consistent with overall intent of the plan and which does not result in additional erosion.

I. The erosion and sedimentation control measures described herein are intended as a general guide for the Contractor.

1. It is the Contractor's responsibility to provide any and all work necessary to prevent erosion of soil from the construction site and to provide silt fences, hay bales or other control measures as the need arises during construction at no additional cost to the Owner.

J. Remove all sedimentation and erosion control barriers after completion of construction and permanent stabilization of erosion.

K. Prior to installation of erosion control fabric, the underlying layer is to be graded as shown on the Contract Drawings and as specified in other sections.

3.02 Diversion Terraces

A. Diversion terraces shall be used as a temporary measure installed on the uphill side of the disturbed areas to divert surface runoff away from unstabilized slopes, and the project area.

3.03 Interceptor Channels

A. Interceptor channels shall be used across disturbed areas where the slope is running parallel to the direction of trenches.

B. Interceptor channels reduce erosion by intercepting storm runoff and diverting it to outlets on the lower side of the disturbed area where it can be disposed of having minimum erosion impact.

3.04 Trench Barriers

A. Trench barriers shall be used where the disturbed area is sloped in the direction of required piping, when the slope exceeds 15 percent.

B. Trench barriers shall be earth-filled sacks or piled stone, stacked to the top of the trench after installation of piping and prior to backfill, if backfill is delayed.

C. Trench barriers shall act as an erosion check by preventing the washout of the trench.

3.05 Sediment Barriers

A. Sediment barriers shall be used at storm drain sumps; across minor swales and ditches; and at other applications where the structure is of a temporary nature and structural strength is not required.

1. Sediment barriers are temporary berms, diversions, or other barriers that are constructed to retain sediment onsite by retarding and filtering storm runoff.

B. Recommended Materials and Dimensions shall be as specified in Section 2.02 of this specification.

3.06 Special Conditions

Prohibited Construction Practices - Prohibited construction practices include but shall not be limited to the following:

1. Dumping of spoil material into any stream corridor, any wetlands, any surface waters or at unspecified locations.

2. Indiscriminate, arbitrary or capricious operation of equipment in any stream corridors, any wetlands or any surface waters.

3. Pumping of silt-laden water from trenches or other excavations into any surface waters, any stream corridors or any wetlands.

4. Disposal of trees, brush and other debris in any stream corridors, any wetlands, any surface water or at unspecified locations.

5. Permanent or unspecified alteration of the flow line of any stream.

6. Open burning of construction project debris.

3.07 Adjustment of Practices

1. If the planned measures do not result in effective control of erosion and sediment runoff to the satisfaction of the regulatory agencies having jurisdiction over the project, the Contractor shall immediately adjust his program and/or institute additional measures so as to eliminate excessive erosion and sediment-runoff.

2. If the Contractor fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor.

-- END OF SECTION 01564 --

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 Section Includes:

A. Products

B. Preparation for Shipment

C. Packaging and delivery of spare parts and special tools

D. Shipment and handling

E. Inspection

F. Storage and protection

G. Inventory control

H. Products options

I. Products list

J. Substitutions

K. Systems demonstration

1.02 Related Sections

Not Used.

1.03 Products

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

C. Materials and equipment to be provided under this contract shall be standard catalogue products of manufacturers regularly engaged in the manufacture of the products and shall duplicate material and equipment in satisfactory service for a 5 year minimum.

D. Material and equipment shall meet the requirements of the contract and shall be suitable for the installation. Where two or more units of the same equipment class are furnished, the equipment shall be from the same manufacturer and shall be interchangeable. Materials and equipment shall be new and free from defects.

E. Material and equipment shall be installed in accordance with the requirements of the contract drawings and approved recommendations of the manufacturers.

1.04 Preparation for Shipment

A. When practical, equipment shall be factory assembled. The equipment parts and assemblies that are shipped unassembled shall be furnished with an assembly plan and instructions. The separate parts and assemblies shall be match-marked or tagged in a manner to facilitate field assembly.

B. Generally, machined and unpainted parts subject to damage by the elements shall be projected with an application of a strippable protective coating.

C. Equipment shall be packaged or crated in a manner that will provide protection from damage during shipping, handling, and storage.

D. The outside of the package or crate shall be adequately marked or tagged to indicate its contents by name and Equipment number, if applicable; approximate weight; any special precautions for handling; and the recommended requirements for storage prior to installation.

1.05 Packaging and Delivery of Spare Parts and Special Tools

A. Spare parts and special tools shall be properly marked to identify the associated equipment by name, equipment, and part number. Parts shall be packaged in a manner for protection against damage from the elements during shipping, handling, and storage. Spare parts and special tools shall be shipped in boxes that shall be marked to indicate the contents. Delivery of spare parts and special tools shall be made prior to the time the associated equipment is scheduled for the initial test run.

1.06 Shipment and Handling

A. Shipments shall be addressed to the Contractor who shall be responsible for their receipt, unloading, handling, and storage at the site. The Owner will not accept deliveries on behalf of the Contractor or his subcontractors or assume responsibility for security of materials, equipment, or supplies delivered to the site.

B. Arrange deliveries of products in accord with construction schedules and in ample time to facilitate inspection prior to installation.

C. Coordinate deliveries to avoid conflict with Work and conditions at site and to accommodate the following:

1. Work of other Contractors, or Owner.
2. Limitations of storage space.
3. Availability of equipment and personnel for handling products.
4. Onwer's use of premises.

D. Do not have products delivered to project site until related Shop Drawings have been approved by the Engineer.

E. Do not have products delivered to site until required storage facilities have been provided.

F. Have products delivered to site in manufacturer's original, unopened, labeled containers. Keep Engineer informed of delivery of all materials to be incorporated in the Work.

G. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts, and to facilitate assembly.

H. Materials and equipment shall at all times be handled in a safe manner and as recommended by manufacturer or supplier so that no damage will occur to them. Do not drop, roll, or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

I. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

J. Provide additional protection during handling as necessary to prevent scraping, marring, or otherwise damaging products or surrounding surfaces.

K. Handle products by methods to prevent bending or overstressing.

L. Lift heavy components only at designated lifting points.

1.07 Inspection

A. Immediately upon receipt of equipment and materials at the job site, the Contractor shall assure that products comply with requirements, quantities are correct, and products are undamaged. Should there appear to be any damage, the Engineer shall be immediately notified, and the Contractor shall be responsible for informing the manufacturers and the transportation company of the extent of damage. If the items or items require replacing, the Contractors shall take the necessary measures to expedite the replacement.

1.08 Storage and Protection

A. Store and protect materials in accordance with manufacturer's recommendations and requirements of Specifications.

B. Contractor shall make all arrangements and provisions necessary for the storage of materials and equipment. All excavated materials, construction equipment, and materials and equipment to be incorporated into the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility service company installations in the vicinity of Work. Materials and equipment shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants.

C. Areas available on the construction site for storage of material and equipment shall be as shown or approved by the Engineer.

D. Fields, grass plots, or other property shall not be used for storage purposes without written permission of the Owner, or other person in possession or control of such premises.

E. Materials and equipment which are to become the property of the Owner shall be stored to facilitate their inspection and insure preservation of the quality and fitness of the Work, including proper protection against damage by freezing and moisture. They shall be placed in inside storage areas unless otherwise acceptable to Owner.

F. Store products with seals and label intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

G. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

H. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

I. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

J. Contractor shall be fully responsible for loss or damage to stored materials and equipment.

K. Do not open manufacturers containers until time of installation unless recommended by the manufacturer or otherwise specified.

L. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.
2. Required environmental conditions are maintained on continuing basis.
3. Products exposed to elements are not adversely affected.

1.09 Inventory Control

A. Equipment and materials shall be stored in manner to provide easy access for inspection and inventory control. The Contractor shall keep a running account of all materials in storage to facilitate inspection and to estimate progress payments for materials delivered but not installed in the work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- END OF SECTION 01600 --

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01620

SAFETY, HEALTH, AND EMERGENCY RESPONSE

1. SCOPE

Soils and groundwater are contaminated with organic and inorganic constituents which are the result of the former manufacturing activities conducted on the site. The Parsons Engineering prepared Health and Safety Plan dated February, 1996 is provided for reference as part of the Bid Document.

The provisions of 29 CFR 1910.120, "Hazardous Waste Site Operations and Emergency Responses" will be required to be followed for construction activities performed as part of this contract.

The Contractor shall be responsible for preparation of a site specific Safety and Health Plan, its implementation, and related requirements as specified herein. AlliedSignal employees and representatives will abide by the Contractor's safety and health requirements.

1.01 Detected Contaminants

The following list summarizes the detected concentration range of prevalent organic and inorganic contaminants. The following list was incorporated as part of the Record of Decision (ROD) dated November 1991 prepared by the NYDEC. CONTRACTOR shall make use of ROD Tables 6-16 and 6-17 which present an Area specific tabulation of detected contaminants and provide the frequency of detection.

Contaminant Type and Media	Containment	Rance Mg/Kg Concentration
Semi-Volatile Organics/Surface Soils (0-2'):	Nitrobenzene	0.21 - 580
	Benzoic Acid	2.8
	Naphthalene	470
	2-Chloronaphthalene	66
	Phenanthrene	4.6 - 270
	Fluoranthene	4.8 - 330
	Pyrene	3.9 - 310
	Benzo(a)Anthracene	1.9 - 180
	Chrysene	2.1 - 180
	Benzo(b)Fluoranthene	3.1 - 150
	Benzo(k)Fluoranthene	140
	Benzo(a)Pyrene	1.7 - 140
	Indeno(1,2,3-cd)Pyrene	0.76 - 77

Contaminant Type and Media	Containment	Rance Mg/Kg Concentration
	Benzo(g,h,i)Perylene	0.78 - 63
	Extractable organic Halides (EOX)	11 - 2780
Inorganics/Surface Soils (0-2'):		
	Arsenic	4.5 - 77.2
	Cadmium	0.82 - 24.8
	Chromium	44.2 - 1990
	Copper	36.2 - 3580
	Iron	15200 - 537000
	Lead	8.9 - 27300
	Mercury	0.07 - 6.2
Semi-Volatile Organics/Subsurface Soils:		
	1,4-Dichlorobenzene	1.7 - 13
	1,2-Dichlorobenzene	0.91 - 110
	Nitrobenzene	0.21 - 1100
	1,2,4-Trichlorobenzene	1.2 - 150
	Naphthalene	1.9 - 8.2
	2-Chloronaphthalene	0.55 - 140
	Fluoranthene	0.19 - 14
	Pyrene	0.14 - 13
	Benzo(a)Anthracene	1.1 - 6.7
	Chrysene	0.35 - 8.2
	Benzo(b)Fluoranthene	1.6 - 9.7
	Benzo(a)Pyrene	0.09 - 5.5
	Extractable organic Halides (EOX)	11 - 360
Inorganics/Subsurface Soils:		
	Arsenic	4 - 2860
	Cadmium	0.7 - 7
	Chromium	5.7 - 440
	Copper	6 - 14500
	Iron	1750 - 360000
	Lead	8.4 - 83200
	Mercury	0.19 - 14(

Contaminant Type and Media	Containment	Rance Mg/Kg Concentration
Organics/Groundwater:		
	2-Chlorophenol	0.8 - 1800
	1,4-Dichlorobenzene	1 - 4900
	1,2-Dichlorobenzene	2 - 21000
	1,2,4-Trichlorobenzene	8 - 1200
	Naphthalene	0.3 - 4900
	4-Chloroaniline	8 - 11000
	2,4-Dinitrotoluene	2000
	2,6-Dinitrotoluene	1500 - 1700
	Benzidine	90 - 360
	1-Naphthylamine	6 - 42000
	Aniline	5 - 660
	Benzene	0.1 - 28000
	Toluene	0.09 - 4700
	Chlorobenzene	0.6 - 48000
	Ethylbenzene	0.2 - 43000
	Xylene (Total)	1 - 1700
Inorganics/Groundwater:		
	Arsenic	5.7 - 1820
	Cadmium	5 - 127
	Chromium	13 - 2140
	Copper	15 - 78700
	Iron	3940 - 405000
	Lead	5 - 3030
	Mercury	0.29 - 50

2. APPLICABLE PUBLICATIONS, REGULATIONS, GUIDELINES, AND STANDARDS

Work performed shall be consistent with the following guidelines and references and in compliance with all applicable regulations and standards including, but not limited to, those listed below. In the case that these requirements are conflicting, the one which offers the greatest protection shall be followed.

2.01 Federal Acquisition Regulations (FAR)

Clause 52.236-13 Accident Prevention.

2.02 Occupational Safety and Health Administration (OSHA) Publications

29 CFR 1926 Construction Industry Standards.

29 CFR 1910 General Industry Standards.

2.03 National Institute of Occupational Safety and Health (NIOSH) Publications

85-115 Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

2.04 U.S. Environmental Protection Agency (USEPA) Publications

Standard Operating Safety Guidelines.

2.05 American Conference of Governmental Industrial Hygienists (ACGIH) Publications

Threshold Limit Values and Biological Exposure Indices for 1995-1996.

2.06 AlliedSignal Policies

2.07 Buffalo Color Corporation Safety Regulations

3. SUBMITTALS

The Contractor shall submit the following items. Details for their contents are described in following paragraphs.

Safety and Health Program covering workers engaged in hazardous waste work.

Site Safety and Health Plan.

Daily Safety Reports.

Employee/Visitor Register.

Monitoring/Sampling Results.

Training Logs.

Accident Reports. (Environmental Excursion, Vehicle and Worker Forms)

Certification of Employee Fitness.

Monthly Man-Hours

Phase-Out Report

4. SAFETY AND HEALTH PROGRAM

All contractors performing on-site activities at hazardous waste sites are required by regulation to develop and maintain a written Safety and Health Program in compliance with OSHA standard 29 CFR 1910.120 (b) (1) through (b) (4). Written certification that such a program has been prepared and implemented shall be submitted to AlliedSignal as a preface to the required Site Safety and Health Plan (SSHP). The program including updates shall be submitted to AlliedSignal.

5. SITE SAFETY AND HEALTH PLAN (SSHP)

5.01 General

The Contractor shall prepare a Site Safety and Health Plan (SSHP) covering all work to be performed under this Contract. The SSHP shall establish, in detail, the protocols necessary for the recognition, evaluation, and control of all hazards associated with each task performed by the Contractor and all Subcontractors. The SSHP shall address site-specific safety and health requirements and procedures based upon site-specific conditions. Duplication of the general information contained in the Safety and Health Program is unnecessary. The level of detail provided in the SSHP shall be tailored to the type of work, complexity of operations to be accomplished, and hazards anticipated.

5.02 Topics

All topics required by OSHA standard 29 CFR 1910.120(b) (4) and those discussed below shall be addressed in the SSHP. Where the use of a specific topic is not applicable to the project, the SSHP shall include a statement to justify its omission and establish that adequate consideration was given the topic.

5.03 Review and Modifications

The SSHP shall be submitted to AlliedSignal for review. The Contractor will not be allowed to perform any on-site work until this plan has been accepted by AlliedSignal. Should any unforeseen hazard become evident during the performance of the work, the Site Safety and Health Officer (SSHO) shall bring such hazard to the attention of AlliedSignal, both verbally and in writing, for resolution as soon as possible. In the interim, the Contractor shall take necessary action to re-establish and maintain safe working conditions in order to safeguard on-site personnel, visitors, the public, and the environment. Should the Contractor seek modification of any portion or provision of the SSHP, such modification shall be requested by the SSHO in writing to AlliedSignal, and if approved, be authorized in writing. Any disregard for the provisions of these Safety, Health, and Emergency Response specifications and the approved SSHP shall be deemed just and sufficient cause for ordering the stopping of all work beyond the Support Zone until the matter has been rectified to AlliedSignal's satisfaction.

5.04 Site Description and Contamination Characterization

The SSHP shall include a site description and contamination characterization that addresses the following elements, as a minimum:

Location and approximate size of the site.

Site topography and accessibility by road.

Present status and capabilities of emergency response teams that would provide assistance to hazardous waste site employees at the time of an emergency.

A list of the contaminants and their concentrations found or known to be present in site areas to be impacted by the work to be performed.

A select list of contaminants which are of greatest occupational health and safety concern. Concern shall be established by evaluating a contaminant's potential for causing exposure above OSHA PELs or ACGIH TLVs. The select list shall be created by evaluating the analytical results presented in Section 1.01 and by researching sources of information

documented in the referenced ROD as well as Malcolm Pirnie, REMCOR and Parsons Engineering reports.

5.05 Hazard/Risk Analysis

The SSHP shall include a hazard/risk analysis that addresses the following elements, as a minimum:

Description of on-site jobs/tasks to be performed.

Duration of planned site activities.

Chemical, physical, biological, and safety hazards of concern for each site task and/or operation to be performed (Activity Hazard Analysis). Potential hazards that may be encountered during site work are listed below. This is not intended to be a complete list. The Contractor shall research and use additional sources of information when preparing the "Hazard/Risk Analysis" section of the SSHP.

- Normal construction hazards.
- Exposure to the site chemicals of concern, including those chemicals used as part of the construction operations, via handling contaminated soil or groundwater during site work involving intrusive operations i.e., trenching, excavation, drilling, and grading operations.
- Exposure to the site chemicals of concern by inhalation or dermal contact during normal construction operations, i.e., dust, surface seeps or stormwater handling.

Pathways for hazardous substance dispersion.

Chemical, physical, and toxicological properties of the contaminants on the select list, sources, and pathways of employee exposures, anticipated on and off-site exposure level potentials, and regulatory (including Federal, State, and local) or recommended protective exposure standards.

Exposure to hazardous substances brought on-site for the purpose of executing this Contract. If hazardous substances are used in executing the Contract, the Contractor shall comply with the requirements of 29 CFR 1910.1200, Hazard Communication.

5.06 Staff Organization, Qualification, and Responsibilities

5.06.01 General

The Contractor shall develop an organizational structure that sets forth lines of authority, responsibility, and communication. The SSHP shall include a description of this organization, qualifications, and responsibilities of each of the following individuals.

5.06.02 Certified Industrial Hygienist (CIH)

5.06.02.01 Qualifications

- The Contractor shall utilize the services of an Industrial Hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene. A resume of the proposed CIH shall be submitted with this bid. The CIH shall:

- Possess a minimum of three years experience in developing and implementing health and safety programs at hazardous waste sites or in the chemical or petroleum industry;
- Have demonstrable experience in supervising professional and technical level personnel;
- Have demonstrable experience in developing worker exposure assessment programs and ambient air monitoring programs; and
- Have working knowledge of State and Federal occupational safety and health regulations.

5.06.02.02 Responsibilities

The CIH shall:

- Be responsible for the development, implementation, oversight, and enforcement of the SSHP;
- Sign and date the SSHP prior to submittal;
- Conduct initial site-specific training;
- Be present on-site during the first week (one to three days) of construction activities;
- Visit the site at least once every other month for the duration of activities;
- Be available for emergencies;
- Provide on-site consultation as needed to ensure the SSHP is fully implemented;
- Coordinate any necessary modifications to the SSHP with AlliedSignal;
- Serve as a member of the quality control staff; and
- Provide the safety phase-out report as required by Part 8.08.

5.06.02.03 Obligations to Owner

The Contractor shall comply with AlliedSignal safety and occupational health requirements. The Contractor shall be fully aware of the rules and emergency procedures of Buffalo Color Corporation's New York facility. The CIH will be briefed by AlliedSignal's representative prior to initiating work and the CIH shall be responsible for conveying this information to his workers. The Contractor will be obligated to bring to the attention of AlliedSignal any deviations to comply with AlliedSignal's intention of safe, productive work with minimal occupational risk. The Contractor will be required to sign a safety declaration and will be responsible for furnishing to AlliedSignal the names of all employees working on site. A copy of AlliedSignal's safety declaration (CD-13 Form) is included as Attachment I.

5.06.03 Site Safety and Health Officer (SSHO)

5.06.03.01 Qualifications

The Contractor shall designate an individual to be the Site Safety and Health Officer (SSHO). The SSHO shall:

- Possess a minimum of one year experience in developing and implementing health and safety programs at hazardous waste sites or in the chemical or petroleum industry,
- Possess demonstrable experience in construction safety techniques and procedures,
- Have working knowledge of State and Federal occupational safety and health regulations,
- Have specific training in personal and respiratory protective equipment program implementation and in the proper use of air monitoring instruments, air sampling methods, and procedures, and
- Be certified in first aid/CPR by the Red Cross, or equivalent agency.

5.06.03.02 Responsibilities

The SSHO shall:

- Assist and represent the CIH in the continued on-site implementation and enforcement of the SSHP,
- Be assigned to the site on a full-time basis for the entire duration of field activities, and shall have no duties other than Health and Safety related duties.
- Perform and document daily "tailgate" safety meetings.
- Ensure that all aspects of the SSHP are complied with including preparation of records, air monitoring, daily visitor and worker logs, use of PPE, decontamina-tion, and site control,
- Consult with and coordinate any necessary modifications to the SSHP in accordance with Part 5.03, with the CIH and the Owner.
- Serve as a member of the quality control staff on matters relating to safety and health,
- Provide the information and perform the activities as required by part 5.13,
- Have authority to stop work if unacceptable health or safety conditions exist, and
- Provide the documentation as required by Parts 8.03, 8.04, 8.05, 8.06 and 8.07.

5.06.04 Health and Safety Support Personnel

For each work crew, the Contractor shall designate one person as a Health and Safety support person. These individuals shall perform activities at their location consistent with the SSHP such as air monitoring, decontamination, and safety oversight on behalf of the SSHO. They shall have appropriate training equivalent to the SSHO in the specific area(s) for which they have responsibility. They shall report to and be under the supervision of the SSHO.

5.06.05 Occupational Physician

The Contractor shall utilize the services of a licensed physician who is certified in occupational medicine by the American Board of Preventative Medicine, or who, by

necessary training and experience is Board eligible. The physician shall be responsible for developing a medical monitoring program in compliance with 29 CFR 1910.120(f).

5.07 Personal Protective Equipment

5.07.01 General

In accordance with 29 CFR 1910.120(g)(5), a written personal Protective Equipment (PPE) program which addresses all the elements listed in that regulation, and which complies with respiratory protection program requirements of 29 CFR 1910.134 is to be included in the Safety and Health Program. Therefore, the Site Safety and Health Plan (SSHP) shall detail the minimum PPE ensembles (including respirators) and specific materials from which the PPE components are constructed for each site-specific task/operation to be performed. Components of levels of protection (B, C, D and modifications) must be relevant to site-specific conditions, including heat stress potential and safety hazards. The PPE section of the SSHP shall include site-specific procedures for on-site fit-checking, cleaning, maintenance, inspection, and storage.

5.07.02 Components of Levels of Protection

5.07.02.01 Level D

Level D Protection shall consist of:

- Hard hat
- Safety glasses with side shields or safety goggles
- Work clothing as prescribed by weather (long sleeved)
- Steel toe work boots
- Hearing protection (if needed)

5.07.02.02 Modified Level D

Modified Level D Protection shall consist of all elements of Level D above plus:

- Disposable outer coveralls (chemical resistant, Tyvek or equivalent)
- Disposable chemical resistant boot covers or chemical steel toe, steel shank boots
- Disposable inner gloves
- Chemically protective outer gloves (as per PPE program)
- Air purifying respirator (APR) shall be readily available at all times and be available for immediate donning when required.

5.07.02.03 Level C

Level C Protection shall consist of:

- Hard hat
- Eye protection (if needed)
- Work clothing as prescribed by weather

- Disposable outer coveralls (chemical resistant, Saranex or equivalent) of adequate design to prevent skin contact with site contaminants
- Disposable chemical resistant boot covers or chemical steel toe, steel shank boots
- Steel toe work boots
- Hearing protection (if needed)
- Disposable inner gloves
- Chemically protective outer gloves (as per PPE program)
- APR with appropriately selected cartridges.
- Cooling vests (if necessary)

5.07.02.04 Level B

Level B Protection shall consist of all elements of Level C except substitution of Supplied Air Respirators (SAR) with 5 minute escape SCBA or Self Contained Breathing Apparatus (SCBA) for APR. All SAR or SCBA must be positive pressure/pressure demand.

5.07.03 Initial Minimum Levels of PPE by Task

The Contractor's CIH shall establish appropriate levels of protection for each work activity based on historical site information, air monitoring results, and an evaluation of the potential for dermal exposure during each task. Protocols formally changing the level of protection and the communication network for doing so shall be described in the SSHP. Any downwind change or adjustment to the levels of PPE shall be approved by AlliedSignal. Upwind changes shall be done by the Contractor based on air sampling. The following information is provided to assist in the development of bids and in plan preparation. These are minimum levels of protection by task for work at the Buffalo Color Area D site as indicated on the drawings. Any changes shall be submitted in writing to AlliedSignal with sufficient justifications for approval as part of the SSHP.

Construction Task	Minimum Level of Protection*
Site Preparation	
Mobilization	D
Erosion and Sedimentation Control Installation	D
Maintenance i.e., Equipment, Erosion Control	D
Shoreline & Wetlands Planting	D
Final Grading/Demobilization	D
Intrusive Construction	
Foundation Demolition Area D & Area A	Mod. D
Treatment Building Foundation Excavation	Mod. D
Well Installation	Mod. D
Well Head Construction & Vault Installation	D
Slurry Trench Excavation	Mod. D
Shoreline Excavation	Mod. D
Sediment & Soil Solidification & Compaction	Mod. D

Decontamination, Development, Stockpile Dewatering and Groundwater Handling	Mod. D
BRIC Water Line Work	Mod. D
Off-site or Uncontaminated Soil Handling	D
Flexible Treatment Membrane Liner (FML)	
Compacted Soil Sub-base Placement	Mod. D
Cushion Geotextile Installation	D
FML Installation	D
Drainage Fabric (GEONET/Geotextile)	D
Protective Soil and Topsoil Layer	D
Final Grade with jute matting	D
Treatment Building Construction	
Building Erection	D
Building Foundation Installation	D
Mechanical and Electrical Installation	
Piping, Valving and Appurtenances	D
Pump Installation	D
Well Pump Installation	Mod. D
Sensor Installations	D
Well Sensor Installation	Mod. D
Control Installation	D
Power and Control Components	D

* Upgrades/downgrades determined by air sampling results and potential for dermal contact.

Other tasks which are non-intrusive or performed in the Support Zone may be performed by non-hazardous waste trained workers (at the discretion of the Contractor's CIH).

5.08 Exposure Monitoring/Air Sampling

5.08.01 General

The Contractor shall write and include in the SSHP an exposure monitoring/air sampling program for all operations performed on the site. The program shall establish reporting requirements and notification procedures. Modifications of the programs shall have the concurrence of AlliedSignal. The Contractor shall monitor/sample air quality to establish:

- Concentrations of air contaminants in the workers' breathing zones (BZ),
- Levels of oxygen, flammable or explosive materials, and toxic substances in confined spaces and in the atmosphere; and
- Concentrations of air contaminants along the site perimeter.

5.08.02 Baseline Air Monitoring

Baseline air monitoring data shall be collected for three days during site mobilization. Baseline air monitoring data shall be used to determine increases in air emissions during

the construction activities at the site, and will be used to ascertain the necessity for upgrading the respiratory protection levels.

The data shall be collected using an Organic Vapor Detector (OVD) such as an HNu photoionization detection meter (PID), or equivalent. The site boundary shall be surveyed with the OVD three times, morning, afternoon and evening, during each testing day. Monitoring shall be conducted at 250-foot maximum intervals along the entire site boundary. Closure intervals of 100 feet shall be used for monitoring downwind levels during collection of baseline data.

Measurements shall be collected for a maximum period of five minutes at each station. The highest OV reading shall be recorded for each station.

Air monitoring data shall be documented and submitted to AlliedSignal within three days at the end of monitoring period.

5.08.03 Monitoring and Sampling for Breathing Zone (BZ) Concentrations

Breathing zone concentrations shall be determined to establish proper levels of PPE and to document employee exposure levels.

5.08.03.01 Real time (direct reading) monitoring

The Contractor shall utilize direct reading instruments to monitor for contaminants in workers' breathing zones. The following direct reading instruments shall be utilized, as a minimum:

- Organic vapor monitor utilizing either a photoionization detector or a flame ionization detector.
- Total dust monitor.
- Calorimetric detector tubes.
- Oxygen and combustible gas meter.

5.08.03.02 Personnel exposure monitoring

The CIH or SSHO shall perform monitoring and will be responsible for ensuring compliance with all requirements of 29 CFR 1910.120(h). Personal air sampling shall be performed at a minimum during the installation of extraction wells and excavation of contaminated. In order for the sampling to be meaningful for establishing the level of PPE needed for this contract the air sampling must be conducted in contaminant source areas. Therefore, the initial operations shall be performed in the most highly contaminated areas. Personal air monitoring frequencies after the first week of operations shall be designated in the approved SSHP. The individual(s) selected for personal air monitoring shall be the individual(s) expected to have the greatest exposure during the initial activities. Full-shift or near-full-shift breathing zone samples shall be collected. Sampling shall utilize personal sampling pumps with sorbet tubes and filter cassettes, using NIOSH methods. Samples shall be analyzed by an American Industrial Hygiene Association accredited laboratory. NIOSH sampling and analytical methods for monitoring employee exposure shall be chosen by the CIH after initial air sampling results have

been reviewed. Initially, the site specific personal exposure monitoring techniques shall be capable of detecting Aromatic Hydrocarbons.

5.08.04 Monitoring and Sampling at the Site Perimeter

In cases where contamination is detected during remedial activities, perimeter air monitoring will be required to assure that off-site migration of VOC's is not occurring.

5.08.05 Heat/Cold Stress Monitoring

5.08.05.01 General

The Contractor's CIH shall develop a heat stress/cold stress monitoring program for on-site activities. Details of the monitoring program, including work/rest schedules and physiological monitoring requirements, shall be described in the SSHP. Monitoring shall be performed by a person with a current first aid/CPR certification who is trained to recognize the symptoms of heat and cold stress.

5.08.05.02 Heat Stress

The climate at the site combined with the requirements for personal protective equipment may create heat stress. For workers who wear perme-able clothing, the Contractor shall follow recommendations for monitoring requirements and suggested work/rest schedules in the current ACGIH Threshold Limit Values for Heat Stress. For workers who wear semipermeable or impermeable clothing, the Contractor shall follow the technical guidelines in "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" (NIOSH Publication 85-115).

5.08.05.03 Cold Stress

To guard against cold injury the Contractor shall provide appropriate clothing and warm shelter for the rest periods. Procedures to monitor and avoid cold stress shall be followed in accordance with the current TLVs for Cold Stress as recommended by the ACGIH.

5.09 Standard Operation Safety Procedures, Engineering Controls, Work Practices

The SSHP shall address the engineering controls and safe work practices to be implemented for the work covered by these specifications. These shall include, but not be limited to the following:

- Site rules/prohibitions (buddy system, eating/drinking/smoking restrictions, etc.)
- Protocols for operation of heavy construction equipment in accordance with 29 CFR 1926.
- Descriptions of safety inspection and preventative maintenance requirements for the operation of machinery or mechanized equipment, including written inspection reports.
- Utility clearances.
- Site "housekeeping".
- Fall protection.
- Safe clearance.
- Sanitation (In accordance with 29 CFR 1910.120(n)).

- Electrical hazards.
- Communication.
- BRIC water line and demolition activities.
- Slurry Wall Excavation.
- Excavation and trenching. Include provisions to maintain dust emissions at a minimum level.
- Sounding.
- Dredging.
- Riprap
- Solidification. Include provision to maintain dust emissions at a minimum level.
- Flexible membrane liner installation.
- Well Installation, including vaults.
- Building Erection, including foundation construction.

5.10 Site Control and Work Zones

5.10.01 General

In order to control the spread of contamination and the flow of personnel and materials into and out of the work area, the Contractor shall establish a site control section in the SSHP. This section shall describe the methodology to be used by the SSHO in determining the modification of work zone designations, procedures to limit the spread of contamination, and general limitations to be observed by site personnel. The Contractor shall clearly lay out and identify the work zones in the field and shall limit equipment, operations, and personnel in the zones as required by these specifications and described in the SSHP.

5.10.02 Support Zone

The Support Zone (SZ) shall be established on the site and is defined as the area outside the zone of significant contamination. The Support Zone shall be clearly delineated and shall be secured against active or passive contamination from the work site. The function of the Support Zone is to provide:

- An entry area for personnel, material, and equipment into the Exclusion Zone of site operations.
- Location for support facilities.
- A storage area for clean safety and work equipment.

5.10.03 Contamination Reduction Zone (CRZ)

The CRZ shall serve as the personnel and equipment decontamination area.

5.10.04 Exclusion Zone (EZ)

The EZ boundary shall be set by the Contractor so that it encompasses areas around individual intrusive construction activities being performed. The Contractor shall control entry into this area and exit may only be made through the CRZ.

5.11 Decontamination

5.11.01 General

The Contractor shall establish decontamination procedures for on-site personnel who perform activities in the Exclusion Zone and for equipment utilized in the Exclusion Zone. Decontamination shall be performed in the CRZ prior to entering the Support Zone from the Exclusion Zone. The Contractor shall refer to Chapter 10.0 of the technical guidance publication "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" (NIOSH 85-115) when preparing these procedures. Procedures shall be described in the SSHP. The Contractor shall train employees in the procedures and enforce the procedures throughout site operations.

5.11.02 Decontamination Pads

All contaminated soils and decontamination fluids shall be contained and collected to prevent contaminant migration. A decontamination pad shall be constructed for heavy equipment decontamination as needed by the Contractor. The Contractor's planned location for a decontamination pad and construction details of a new pad shall be provided to AlliedSignal prior to construction.

5.11.03 Waste Disposal

Liquid and solid waste generated during construction activities shall be managed in accordance with Section 01800 - CONSTRUCTION WASTE.

5.11.04 Fuel & Lubricant Storage

Contractor shall designate an area for fuel and liquid storage. The SSHP shall describe the procedure for safe handling during filling and refueling operations.

5.12 Emergency Equipment and First Aid

The SSHP shall describe the emergency and first aid equipment to be utilized. The following items, as a minimum, shall be immediately available for on-site use:

- First aid equipment and supplies approved by the Consulting physician.
- Emergency eyewashes/showers (comply with ANSI Z-358.1).
- Two Self-Contained Breathing apparatus shall be dedicated for emergency use only, maintained on-site, and located in an area that is immediately accessible to the CRZ and the SZ.
- Spill control materials and equipment.
- Fire extinguishers with a minimum rating of 2A-10B:C shall be provided at all site facilities and at any other site locations where flammable or combustible materials present a fire risk.

5.13 Emergency Response and Contingency Procedures

5.13.01 General

The Contractor shall prepare an Emergency Response Plan in compliance with 29 CFR 1910.120(1), which addresses the following elements, as a minimum:

- Pre-emergency planning and procedures for reporting incidents to appropriate government agencies for potential chemical exposures, personal injuries, fire/explosions, environmental spills, and releases.
- Personnel roles, lines of authority, communications.
- Posted instructions and a list of emergency contacts (physician, nearby medical facility, fire and police departments, ambulance service, federal/state/local environmental agencies, CIH, Owner's representatives).
- Emergency recognition and prevention.
- Contingencies to combat spills and releases of hazardous chemicals.
- Site topography, layout, and prevailing weather conditions.
- Criteria and procedures for site evaluation (emergency alerting procedures) employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control. Specific procedures for decontamination and medical treatment of injured personnel. Route maps to nearest pre-notified medical facility. Criteria for initiating community alert program, contacts, and responsibilities. Procedures for critique of emergency responses and follow-up.

5.13.02 Notification of Authorities

The Contractor shall contact and meet with both Buffalo Color Corporation and with the local emergency response agencies prior to start of construction. The purpose of the meeting is for the resolution of conflict (if conflict exists) and to insure that the emergency responders are equipped to respond to an emergency on the AlliedSignal Buffalo Color Area D site.

6.0 TRAINING

6.01 General

All employees working on-site with the potential for exposure to hazardous substances, health hazards, or safety hazards shall meet the minimum training requirements as specified in 29 CR 1910.120. These employees shall have completed the required 40 hours of hazardous waste training and shall have three days of field experience in hazardous waste work. All other employees working on site shall receive 24-hour training as required in 29 CFR 1910.120(e)(3)(ii) and (iii). All supervisory personnel shall have received an additional eight hours of training as required for management of personnel and activities associated with hazardous waste site activities. Employees shall also receive a minimum of eight hours refresher training annually as needed based on their anniversary of 40-hour or 24-hour training. A copy of the certifications for all hazardous training undergone by employees must be kept on site, and should be made part of the Health and Safety Plan as in Appendix.

6.02 Site-Specific

6.02.01 Initial Training

An initial site-specific training session shall be conducted by the CIH prior to commencement of work or entering the site. This training shall cover site hazards, procedures, and all contents of the approved SSHP. All site employees, including those working in the support zone, shall attend this training. Elements to be covered as part of the site specific training are:

- Names of personnel and alternates responsible for site safety and health and emergency response for hazardous waste operations.
- Safety, health and other hazards present on the site.
- Location of subsurface utility lines
- Use of personal protective equipment.
- Work practices by which the employee can minimize risks from hazards.
- Safe use of engineering controls and equipment on the site.
- Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards.
- Use of monitoring equipment.

6.02.02 Periodic Training

Periodic on-site training shall be provided by the Contractor at least weekly and prior to each change in operation.

6.02.03 New Employees

Training of new employees shall be conducted prior to allowing them to work in the Contamination Reduction Zone or the Exclusion Zone.

7.0 MEDICAL SURVEILLANCE

7.01 General

The CIH, in conjunction with the Occupational Physician, shall detail, in the SSHP, the medical monitoring program that includes scheduling of examinations, certification of fitness, compliance with OSHA requirements, and information provided to the physician. The program shall, as a minimum, outline the requirements specified below:

7.02 Compliance with OSHA

The Contractor shall ensure the physician performs the medical examination prescribed in 29 CFR 1910.120 for workers performing work in areas other than the Support Zone. Accordingly, the Contractor shall furnish the physician with:

- Information on the employee's anticipated or measured exposure;

PPE Use;

- A description of the employee's duties;
- A copy of 29 CFR 1910.120
- Information from previous examinations not readily available to the examining physician.
- A copy of Section 5.0 of NIOSH Publication 85-115 (Reference 2.03, of this section).

7.03 Physician's Opinion

The Contractor shall obtain a copy of the physician's written opinion about employees' ability to perform hazardous waste site work and furnish copies to the CIH, the Contracting Officer, and the employee before work beings. The opinion shall contain:

- The physician's recommended limitations upon the employee's assigned work;
- The physician's opinion about increased risk to the employee's health resulting from work; and
- A statement that the employee has been informed and advised about the results of the examination.

7.04 Frequency of Examinations

The Contractor shall make medical examinations available to employees:

- Before they start work;
- Annually thereafter;
- On termination of employment;
- On completion of work on this contract;
- If the employee develops signs or symptoms of illness relating to work place exposures;
- If the physician determines examinations need to be conducted more often than once a year, and
- When an employee develops a lost time injury or illness during the period of this contract. The supervisor must be provided with a written statement signed by the physician prior to allowing the employee to return to the work site after injury or illness resulting in a lost time workday. The written statement shall be submitted to the Contracting Officer as part of the weekly safety report (see also Paragraph 8.0: LOGS, REPORTS, AND RECORDKEEPING, of this section).

7.05 Content of Examination

The following parameters shall be included in the medical surveillance program as a minimum. The actual parameters selected shall be the responsibility of the Occupational Physician and shall meet the requirements of 29 CFR 1910.120, 1910.134 and ANSI Z88.2.

- Complete medical and occupational history (initial exam only).
- General physical examination including an evaluation of all major organ systems.
- Pulmonary function testing including FVC and FEV1.0.

- CBC with differential.
- Biological blood profile (SMAC-21 or equivalent).
- Urinalysis with microscopic examination.
- Audiometric testing (as required by Hearing Conservation Program).
- Visual acuity.
- Chest x-ray. (This test to be performed no more frequently than every four years, unless directed by Occupational Physician.)
- Electrocardiogram (as directed by Occupational Physician).

7.05.01 Substance Abuse Prevention Program

To promote a safe environment for employees of AlliedSignal, its clients, suppliers, and contractors, certain behavior is prohibited in the work place. Businesses under contract with AlliedSignal in any capacity are required by contract to prohibit that behavior of their employees when their employees are present on AlliedSignal's work places. Prohibited are the use, manufacture, sale, possession or transfer of illegal drugs and controlled substances in the work place on AlliedSignal's premises. Violation of this requirement, may be considered by AlliedSignal to be a material breach of contract and subject the Contractor to all remedies available to AlliedSignal at equity, contract, and law. In addition, bidders are advised that violation of this requirement shall be considered in the evaluation of the Contractor as being qualified to supply personnel under future contracts with AlliedSignal. Bidders' attention is invited specifically to those articles in the terms of the contract related to drug abuse prevention, indemnity and termination.

Substance Abuse Prevention. The possession, use, manufacture, distribution or dispensation of any illegal drug or controlled substance is prohibited on Buffalo Color Area D property (the site). In addition, Contractor personnel working on the site are expected to report to work in proper condition and not under the influence of any controlled substance.

The Contractor agrees to provide for work on the site, only those personnel who understand the requirement of Paragraph 7.05.01 and who will comply. Contractor agrees that such personnel shall be chemically screened in accordance with the standards shown below.

Violation of this article may, as AlliedSignal's option, be deemed by AlliedSignal to be a material breach of this contract and subject the contract to termination for default, as well as other remedies at contract, law, or equity.

Drug Screening. Prior to having employees perform work on the site, Contractor shall provide documentation that these employees have undergone and passed a screening test for illegal/unauthorized substances not more than two (2) weeks prior to their initial assignment for work at AlliedSignal's property.

A qualified laboratory must use an immunoassay screen and gas chromatography/mass spectrometry confirmation. Confirmation levels are specified in the tables below.

CG/MS CONFIRMATION SENSITIVITY LEVELS

Drug, Drug Group or Drug Metabolites	Typical Detection Threshold, Nanograms/ml
Amphetamines	
Amphetamines	500
Methamphetamine	500
Cocaine Metabolites	150
Opiates	300
Phencyclidine	25
Marijuana Metabolites	15

7.06 Recordkeeping

Medical records must be retained in accordance with CFR 1910.120 (for the duration of employment plus 30 years).

Contractor must maintain records as follows:

- The name and Social Security Number of the Employee.
- Physician's written opinions, recommended limitations and results of examinations and tests.
- Any employee medical complaints related to exposure to hazardous substances.
- A copy of the information provided to the examining physician by the contractor (with the exception of the standard and its appendices).

The physician's written opinions and recommended limitations documents for all employees are to be on site and should be incorporated in the Health and Safety Plan as an appendix.

8.0 LOGS, REPORTS, AND RECORDKEEPING

8.01 General

The Contractor shall maintain logs and reports covering the implementation of the SSHP and other requirements of this section. The formats shall be developed by the Contractor and submitted as part of the SSHP.

8.02 Daily Safety Log and Inspection Report

The daily safety log and inspection report shall include practices and events that affect safety and health, safety and health discrepancies encountered, and safety and health issues brought to the supervisor's attention. Each entry shall include:

- Date.
- Work area checked.
- Employees present in work area.

- PPE and work equipment being used in each area.
- Special health and safety issues and notes.
- Signature of preparer.

8.03 Safety Reports

Accident, Excursion or Injury reports shall be submitted to the Owner immediately (within 15 minutes) of the incident reported. When required information shall be recorded on the attached forms where appropriate. The completed Forms or Reports shall be submitted to AlliedSignal within three days of the incident.

- Vehicle Accident Report - Exhibit 1
- TELCON, Injury, Illness, Incident Summary Sheet - Exhibit 2
- Form C-155694A Investigation and Findings of Injury/Illness - Exhibit 3
- Form C49 Environmental Excursion/Incident Report Form - Exhibit 4

8.04 Employee/Visitor Register

- Date.
- Name.
- Agency or company.
- Purpose
- Time entering site.
- Time exiting site.

8.05 Monitoring/Sampling Results

- Date.
- Type of equipment utilized.
- Equipment I.D. number.
- Monitoring results for each work location or monitoring station with time of readings.
- Analytical results for personal exposure sampling.
- Personnel or location monitored/sampled with description of activity being performed.
- Sample numbers.
- Miscellaneous information related to monitoring/sampling performed.

8.06 Training Logs

Training logs shall be completed by the SSHO and submitted to the Owner upon request and at the completion of the work. These logs shall be used to document all on-site training. The format to be used for reporting shall be shown in the SSHP. The following information shall, at a minimum, be included:

- Date.

- Employees in attendance and signature.
- Visitors in attendance.
- Description of training activity and/or topics covered.
- Equipment utilized.
- Signature of instructor.

8.07 Man Hours

At the completion of each month of work, the Contractor shall provide AlliedSignal with a summary of the total hours worked. Monthly summaries shall be completed on the Monthly Construction Man Hours Form - Exhibit 5. Forms shall be submitted by Wednesday 1:00 PM of the first full week of the subsequent month.

8.08 Phase-Out Report

At the completion of the work, the Contractor shall submit a phase-out report. The report shall be submitted to AlliedSignal within 20 working days following completion of the work, prior to final acceptance of the work. The following minimum information shall be included:

- Summary of the daily safety reports which outlines the overall performance of Health and Safety by the Contractor.
- Documentation of medical certifications for site personnel.
- Final decontamination documentation including procedures and techniques used to decontaminate equipment, vehicles, and on-site facilities.
- Complete summary of air monitoring accomplished during the project.
- Signature of the Contractor and the CIH (and date Signed).

-- END OF SECTION 01620 --

SECTION 01620

SAFETY, HEALTH & EMERGENCY RESPONSE

ATTACHMENT I

AlliedSignal's Safety Declaration
CD-13 Form

CONSTRUCTION SPECIFICATION
NO. CD-13
Safety Rules

1. The following rules and regulations are to be followed by you and your employees. (Provisions of OSHA shall be followed and shall supersede these rules when in conflict.)

2. The Allied Field Office will arrange for indoctrination of special plant safety requirements for all contractor personnel, including subcontractors. The Plant Safety Department will submit Form CD-13-2 5/88 (Sheet 14 of 15) to Allied Field Office signifying that the duly authorized and designated representative and agent of the Contractor has been properly trained.

3. The Contractor will be responsible for the safety indoctrination of each of his employees and the employees of his subcontractors. The Safety and Occupational Health Compliance Form CD-13-1 5/88 (Sheet 13 of 15) is to be submitted to the Allied Field Office weekly, for all new employees.

4. The Contractor shall require all Contractor personnel, including subcontractors to sign "Contractor's Employee Safety Declaration" Form CD-13-3 12/85 Sheet 15 of 15. To be submitted to the Allied Field Office weekly, for all new employees.

A. Housekeeping

1. Good housekeeping is considered synonymous with safety and shall be policed on a daily basis. Burnables on the site must be avoided where possible and when not possible should be removed daily and not allowed to accumulate.

2. Tools, supplies and materials must be maintained in an orderly fashion. Walkways and work areas must be kept free of obstacles.

3. Boards containing nails must not be discarded unless the nails are bent over or removed. Good housekeeping must be maintained in the interest of safety and fire protection.

B. Permits

When it is necessary to work in any operating area, the operating supervisor in charge must be contacted and a permit obtained so you and your men may be warned in case of emergency, and to insure compliance with plant rules.

Construction Contractors will arrange for all clearances and permits outlined below through AlliedSignal's Construction Superintendent's Office.

1. **Work Permits**

a. Work permits shall be issued as clear indications that work has been authorized by area supervision and that proper precautions have been taken to assure the safety of persons who may be in the area, and to protect company equipment and property from possible damage.

b. Work Permits are required before any person shall begin work in the area to repair, replace or modify existing equipment, install or construct new machinery or fixtures or to perform special services.

c. Work permits must be secured before drilling through floors and walls or making any excavation in any way on the Plant Site. Clam Shells or other digging equipment must not be used within ten (10) feet of any existing underground installations without specific authorization.

d. Work Permits must be obtained before any work is done that will in any way obstruct traffic in Plant.

e. Work Permits will:

(1) Indicate date work is to be started including time work is to start and estimated time it is to stop.

(2) Describe location of work, i.e., building, department, area, floor or field location.

(3) If work is to be on equipment, give name of equipment, apparatus number and enough information to describe to operating supervision where work is to be done.

(4) Describe work that is to be undertaken in enough detail that the AUTHORIZER knows what is to be done, where it is to be, and why it is to be done.

f. **Exception**:

In new areas under construction where no AlliedSignal employees are working and which are detached from existing installations in such a manner that a fire originating therein would not endanger existing buildings, a Work Permit may not be required. Areas falling in this

category must be so authorized by the AlliedSignal Construction Superintendent.

2. **Burning and Welding**

a. Flame Permits (includes welding and burning permits) are required before the following equipment may be used in an operating plant (separate permits must be secured for each area and/or shift):

(1) Equipment utilizing an open flame such as acetylene burning or welding, lead burner's torch, propane torch, melting pot and similar devices.

(2) Arc-producing equipment such as arc welding or cutting electrodes and similar devices.

(3) Spark producing equipment such as portable grinders, abrasive saws, jack hammers and similar devices.

b. Welding leads must not be attached to railroad tracks anywhere in the plant any time. Welding leads must not be attached to steel work or any operating vessel or pipeline without the permission of AlliedSignal's Construction Superintendent or persons authorized by him to grant such permission.

c. All welding machines are to be grounded directly to object being welded within ten (10) feet of weld being made, unless prescribed otherwise.

d. When any welding or cutting operating is in progress, proper precautions must be taken to prevent the ignition of materials, equipment and building. Fire extinguishers are to be accessible at all times to prevent any possibility of fire during cutting or welding operations. Each truck or movable piece of power equipment to be equipped with fire extinguishers.

e. Oxygen or other pressure cylinders must not be moved from one location to the other without the gauges being removed and the valve caps being in place. Such cylinders must not be raised by crane or winch except when a regular cradle is used. Do not use any type of choker to hoist bottles. Throughout the work area where bottles are temporarily stored prior to using same, set all bottles in upright position with caps in position and chained or tied at all times. Do not store or use in horizontal position. Do not permit empty bottles to accumulate

on the job site. Remove to empty storage location, place in upright position and cap. Also maintain storage facilities for full bottles.

f. Welding hoods and welding goggles to be worn at all times during welding, cutting or heating operations. Craftsmen assisting welders are to wear flash goggles. Welding shields are to be used. Eye protection and hard hats shall be work where and as required.

g. Upon completion of any type welds, mark HOT with soapstone or chalk to prevent burns to personnel.

3. **Tank Entry**

a. A Tank Entry Permit is required for any operation that requires an employee to enter or work inside any existing tank, sump tank car, tower, fire box, sewer or gas manhole that has been in service or is connected to plant service or process lines.

b. On construction or installation of new equipment, a Tank Entry Permit is required by construction personnel only when the new installation is located within an operating area or is connected to active service or process lines.

c. Preparatory measures necessary to make the tank or confined area safe for entry before the Tank Entry Permit is issued shall include the following and will be done by the Plant or Contractor:

(1) Vessels or tanks, that contain hazardous solvents, or residue shall be cleaned or washed in a manner acceptable for cleaning the particular vessel.

(2) All service and process lines that transport solvents, corrosive liquids, gas or other hazardous materials must either be disconnected, or blanked with metal blanks of sufficient thickness to withstand any pressure that may develop in the lines. Steam lines may be left intact provided the line can be double blocked and an open bleed line is located between the two valves. Water lines may be left in place, but must be valved off.

When valves are used as blocks, they shall be tagged and chained in the closed position in accordance with the standing tagging procedures.

Valves that are pneumatically or electrically operated, are not to be considered block valves.

(3) All electrically powered stirrers, agitators or similar mechanisms designed to operate inside the vessel are to be locked out and tagged in accordance with standing procedures covering the subject. When such stirrers or agitators are pneumatically driven, the air supply must be disconnected at the motor.

(4) Atmospheric tests shall be made to determine the presence of flammable and toxic vapors. An additional test shall be made to determine the presence of sufficient oxygen to sustain life. Atmospheric and vapor tests shall be made by assigned personnel and recorded.

(5) Attention shall be given the surrounding area to correct any conditions and suspend adjacent operations that could create a hazard to personnel while inside the vessel.

(6) Vessels equipped with radioactive controls or sensing devices will have the radioactive source rendered safe according to manufacturer's recommendations. After shielding the radioactive source, locks are to be applied to units.

When shielding has been completed, the standard danger tag shall be affixed to all radioactive source holders.

After radioactive sources have been rendered safe, entry into the vessel may be made only after the interior of the vessel has been checked with a source detection instrument and found to be within permissible ranges of radioactivity.

(7) An outside source for fresh air shall be provided for the vessel. It is permissible to use a blower for this source; however, an air mover is acceptable if surrounding atmosphere is not contaminated and after atmospheric tests have been made to assure the air mover has been connected to a source of compressed air.

(8) A life line and safety harness shall be used.

(9) A ladder and a self-contained gas mask shall be available at the manhole for emergency use.

(10) A standby observer shall be stationed at the manhole and instructed to remain at his station until the vessel is clear of

personnel. The watcher shall be instructed to keep a visual contact with those inside the vessel, or, if vision is obstructed, to make frequent verbal checks with those on the inside.

(11) Special protective clothing or other personal protective equipment shall be provided for men assigned to enter or work in vessels that have contained materials of a corrosive nature, when entry is being made for the propose of washing the vessel, or when the unusual nature of the entry indicates a need for special clothing or equipment.

(12) When entry is to be made in a vessel located in an area hosing other activities or operations, employees in the immediate area are to be made aware of the intended entry.

(13) When the plant supervisor responsible for issuing the Permit feels a particular job needs special precautions beyond the ones prescribed, he may require these additional precautions before issuing the Tank Entry Permit.

d. After approvals have been given to enter a tank or vessel, all persons authorized to enter the tank must sign the permit in the space provided for their signature, and the standby observer must sign in the space provided for his signature.

e. When the Tank Entry Permit has been completed, it shall be affixed to the tank, normally in the vicinity of the manhole, and entry into the tank may be made.

f. The Tank Entry Permit does not constitute approval for use of open flames or spark-producing tools inside a tank, vessel or confined space. For jobs requiring the use of open flames or spark-producing tools within a tank, vessel or confined area the regular Flame Permit shall be issued in addition to the Tank Entry Permit.

C. **Ladders and Scaffolding**

1. Ladders and scaffolding of all types are to be checked regularly and maintained in good repair. All work scaffold planks are to be free of knots and other defects.

2. Planks used on top of patent scaffolds for work platform are to have cross members at each end to prevent planks from creeping or sliding. Straight and extension ladders are to have safety shoes on lower

section. Single straight or extension ladders must be tied securely to prevent the ladder from slipping.

D. **Valves and Switches**

1. Only Operations personnel are authorized to operate any valves, electrical switches or other equipment connected to the operating section of the Plant.

2. Adequate protective measures approved by AlliedSignal must be observed when Contractor's employees are working near or over live electrical equipment.

3. All pipelines, vessels or other apparatus must be treated as if they were in service and, therefore, dangerous if opened.

4. When breaking a pipeline joint, even with the understanding that the pressure has been vented and the line is clean, proper safety equipment must be worn and a line breaking permit or written permission must be secured from operating supervisor.

E. **Openings and Hoistways**

1. All floor openings, excavations or other openings, where persons might fall through or into, must be guarded and lighted in an acceptable manner when left open at night or unattended.

2. When working overhead, the area underneath must be protected at all times to prevent personnel from walking below.

3. Hoist areas for materials and equipment throughout construction area are to be roped off and marked with a "Danger" sign. Overhead working areas are to be marked "Danger - Men Working Above". None of these designated areas are to be used as a thoroughfare or working area.

F. **Ropes and Cables**

1. All rope blocks and hand lines are to be in good condition at all times and stored out of weather. Be cautious where chemicals of any type exist which might weaken the rope.

2. All cables and rigging equipment must be in good condition at all times and proper inspection program set up and maintained.

3. Proper type and sized chokers and slings to be used on all types of hoisting equipment. Wood softeners to be placed between metal and chokers to prevent slippage of load. Be positive load is secure and balanced before hoisting.

G. **Protective Clothing and Equipment**

1. Proper respiratory equipment is to be used for spray painting or other operations hazardous to health. Provide as much ventilation as possible in these areas. Safety belts are to be worn for painting of steel structures where height prevents using ladders or scaffolds.

2. Eye protection, which complies with OSHA Standard 1910.133, must be worn by personnel engaged in the following jobs:

   a. Welding or cutting.

   b. Repairing, connecting or disconnecting chemical lines and pumps from service.

   c. Use of pneumatic impact tools or use of chisels for cutting or chipping masonry or metal.

   d. Grinding, buffing and polishing operations.

   e. Handling corrosive chemicals - acids, caustics, solvents, Dowtherm, ethylene glycol.

   f. Specific areas within the plant where required by Plant Safety Regulations.

3. In addition to minimum protection, additional protection is prescribed when a person is engaged in work of a known hazardous nature. The following jobs are among those that require additional protection, together with the required protection:

   a. When handling corrosive materials or irritants such as acids, caustics, Dowtherm or solvents. - PLASTIC OR RUBBER SPASHPROOF MONOGOGGLE.

   b. When working on pipelines, valves, pumps and similar equipment that may contain hazardous materials under pressure such as acids, caustics, steam, hot water, Dowtherm, molten polymer, or ethylene glycol. - PLASTIC FACE SHIELD.

c. Welding, cutting, burning. - CUP GOGGLE WITH FILTER LENS OR WELDING HOOD.

d. Cleaning with compressed air. - DUST TIGHT COVER GOGGLES.

e. Chipping metal, breaking masonry using pneumatic impact tools, stud guns, grinding with portable grinders, and miscellaneous heavy work. - IMPACT CUP GOGGLES OR IMPACT MONOGOGGLE.

4. Protective clothing, face shields or masks and gloves are to be worn at all times in any type of acid cleaning and wash for cleansing metal parts, valves, etc.

H. **Forbidden**

1. The use of intoxicating liquors or drugs in any form, horseplay of any description, running from work areas at quitting time are positively prohibited. Violation of any kind will be cause for immediate dismissal. Any new hire or employee reporting for work under the influence of liquor, will not be admitted to the site. It will be the Superintendent's decision whether this man may return at a later date.

2. Defective or improperly maintained tools or equipment are not to be used.

3. Craftsmen deliberately dropping or throwing tools and material from ladders, scaffolds or work platforms onto the floor, will be liable to immediate dismissal.

I. **First Aid**

1. Regardless of how slight an injury may be, relating to cuts, bruises or eye injuries, they must be reported immediately to First Aid.

2. In Contractor's Field Office and/or First Aid Facilities, names, addresses and phone numbers of the following are to be placed on wall where they may be accessible without delay: Ambulance Service, Hospitals, Fire Department, all doctors designated by Insurance Company to perform medical services for Contractors.

J. **Fire Protection**

1. The use of gasoline for cleaning purposes is prohibited. Gasoline or other flammable liquids must be handled and stored in an approved manner. Approved safety cans must be used for small quantities of gasoline. All outside storage tanks and drums used for storage of gasoline, fuels, oils, cleaning solutions of any type are to be well marked identifying contents. Use lock type faucets or nozzles. Be sure to place and retain at all times proper type extinguisher at gasoline storage. Also be sure to post "No Smoking" signs.

K. **General**

1. All gears and moving parts of power equipment in shops or construction area are to be fitted with satisfactory guards.

2. When necessary to place motor trucks inside of building for loading and unloading of materials and equipment by overhead crane, the craftsmen performing the rigging and the truck driver should move a safe distance from the truck until load is safely lowered or raised to location.

3. Abusing of tools is prohibited. Handle all welding, gauges, cutting and welding heads and hose with care. Do not throw or drop carelessly. Each welding machine and lead should be tagged with an identifying number and assigned to a welder. Retain all welding leads in orderly fashion. When possible, secure and place leads overhead or in other manner to prevent a tripping hazard.

4. ALL SAFETY REGULATIONS MUST BE FOLLOWED TO INCLUDE PLANT SAFETY RULES. Contractor will publish specific job rules for his work after approval by AlliedSignal's Construction Superintendent.

5. Under no circumstances shall these Rules and Regulations be violated. Any person or persons found violating them shall be discharged immediately at AlliedSignal's request.

6. Contractor shall obtain copies of local and/or state safety codes and shall advise his superintendent to become familiar with and adhere to subject codes.

7. Safety Locks, Tags and "Do Not Adjust or Operate" Tags.

a. Safety Locks will be used in an operating area to provide a safety lock-out system to insure the safety of any employee against the accidental start-up of machinery, or electrical equipment on which he may be working.

(1) Safety locks shall be issued to individual employees and shall be used by them to lock electric power disconnect switch or breaker of the equipment in the open position so that the switch cannot be operated and the machine cannot be started.

(2) In cases where the electrical breaker cannot be locked in an open position, or on interlocked equipment, fuses must be removed from the circuit by an electrician or a qualified member of supervision and tagged out.

(3) After locking the breaker, the person applying the lock shall attempt to start the unit at the starter switch to insure that the circuit is clear. Work may then begin on the unit.

(4) Lock will remain in place as long as the employee is working on the unit. It will be removed from the breaker by the lock owner, after completion of his part of the job.

(5) When more than one person is working on a single machine, a multiple lock-out device will be applied so that each man can affix his personal lock to the beaker. When multiple locks are used, the lock owner must remove his lock as he leaves the job.

b. Safety Tags will be used:

(1) On valves that have been closed because of leakage in process lines or in equipment.

(2) On valves that are closed to separate operating equipment scheduled for repair, alterations, special tests or inspections.

(3) On valves that have been closed to separate new installations from operating units.

(4) On all new valves that are inserted or added to an existing operation by either Maintenance or Construction personnel.

While the tagging of valves, electrical breakers, and operating of Controllers that connect with existing operating equipment are the responsibility of operating personnel, the tagging of key valves and key points within the new construction is the responsibility of Construction Supervision responsible for the installation. The Contractor shall not close existing valves, breakers, and operating controllers without the approval of operating personnel.

c. Do Not Adjust or Operate Tags

When machinery and equipment are not to be operated or adjusted for operational reason, the "Do Not Operate or Adjust Tag" will be used.

8. A good facial seal is necessary when wearing respiratory equipment. This cannot be attained with a beard or excessively long sideburns which cover the sealing surfaces. Mustaches and goatees do not generally interfere with the facial seal. Hair on facial sealing surfaces (beards, long sideburns, etc.) will not be allowed on employees subject to respirator use.

SAFETY & OCCUPATIONAL HEALTH COMPLIANCE

TO: AlliedSignal Construction Superintendent _____.

FROM: Contractor _____.

The employees listed below:

	Name	If Employed by Sub-Contractor List Sub's. Name		Name	If Employed by Sub-Contractor List Sub's. Name
1.			11.		
2.			12.		
3.			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

have started to work in the _____ plant of AlliedSignal.

All the Safety rules outlined in CD-13, and all special safety and occupational health matters pertaining to this plant its chemical operations have been explained to those contractor employees listed above.

We believe that these employees understand the rules and risks of work in this plant and that they fully intend to work safely within the spirit and letter of the documents mentioned above. If we observe any deviations, we will call it to their attention immediately and take any other corrective action, including dismissal, to comply with AlliedSignal's intention safe, productive work with minimal occupational risk.

of

RG- ↑ p/s check are there any words left off? I just typed what's here. Q

_____

_____

CONTRACTOR'S SAFETY DECLARATION

TO: AlliedSignal Construction Superintendent _____.

FROM: Plant Safety Representative _____.

As the duly authorized and designated representative and agent of _____, hereinafter called "Contractor", I hereby certify and agree for myself and for and on behalf of Contractor that:

(1) I have been advised and instructed by the Company and/or Division or plant concerning working conditions including hazards, if any, involved in the job and/or job location in which Contractor and Contractor's agents and employees will be working or present;

(2) I have already instructed or will immediately instruct all such agents and employees with respect to such conditions and/or hazards and the proper safety precautions to be observed in regard thereto. I will also see to it that each Contractor employee signs form CD-13-3 5/88 and will submit these weekly for all new employees;

(3) All necessary, adequate and operative protective clothing and equipment have been or will be immediately issued to all such agents and employees, together with full instructions and training for their use;

(4) Procedures including employee clothing and equipment requirements will be put into effect; that all such agents and employees will be properly supervised to insure compliance in the use of protective clothing and equipment and in the strict observance of safety rules and regulations; and

(5) The following items among other items, were specifically covered:

A.) General safety rules and regulations

B.) Special safety and occupational health matters pertaining to this plant and its chemical operations.

Date: _____ _____

Signature of Contractor's Representative for himself and for and on behalf of Contractor

_____

Signature of AlliedSignal employee giving instructions

CD-13-2 5/88

CONTRACTOR'S EMPLOYEE SAFETY DECLARATION

TO: AlliedSignal Construction Superintendent_____.

FROM: Contractor_____.

I have been instructed in detail on and understand the following:

1. The existence and requirements of the OSHA Hazard Communications Standard.
2. The chemical hazards present in the areas where I will be working.
3. The hazards associated with these chemicals.
4. Where the Plant maintains the written Hazard Communications Program.
5. The list of Material Safety Data Sheets and the location of these sheets.

_____
Employee Signature

_____
Employee Name Printed

_____
Contractor Name Printed

SECTION 01620

SAFETY, HEALTH & EMERGENCY RESPONSE

Exhibit 1
Vehicle Accident Report

DRIVER'S ACCIDENT REPORT

C-1919 (11/81)

GIVE DETAILS AS FULLY AS POSSIBLE.
DO NOT DELAY REPORT. IF EXTREMELY SERIOUS, USE TELEPHONE OR TELEGRAPH.

COMPANY _____ DEPT. _____ CODE _____
LOCATION _____
ADDRESS _____
TRAVELERS OFFICE _____

TIME

DATE OF ACCIDENT _____ 19__ DAY OF WEEK _____ HOUR _____ A.M. P.M.

FOR OFFICE USE
☐ PREVENTABLE ☐ NON PREVENTABLE

LOCATION

PLACE WHERE ACCIDENT OCCURRED

☐ CITY
☐ SUBURBAN STATE _____ OR TOWNSHIP _____
☐ RURAL _____ MILES NORTH-SOUTH _____ MILES EAST-WEST OF ☐ LIMITS OF ☐ CENTER OF _____ CITY OR TOWN

IF ACCIDENT WAS OUTSIDE CITY LIMITS INDICATE DISTANCE FROM NEAREST TOWN. USE TWO DISTANCES AND TWO DIRECTIONS IF NECESSARY.

ROAD ON WHICH ACCIDENT OCCURRED _____ GIVE NAME OF STREET OR HIGHWAY NUMBER (U.S. OR STATE)

☐ AT (TS INTERSECTION WITH:
(NAME OF INTERSECTION STREET OR HIGHWAY NO.) _____
OR ___ FEET NORTH-SOUTH ___ FEET EAST-WEST OF _____
☐ NOT AT

SHOW NEAREST INTERSECTING STREET OR HIGHWAY. INDICATE CORNER, CURVE, BRIDGE, RAILROAD CROSSING, ALLEY, DRIVEWAY, CULVERT, UNDERPASS, OVERPASS, NUMBERED TELEPHONE POLE, OR OTHER IDENTIFYING LANDMARK. GIVE EXACT DISTANCE, USING 2 DIRECTIONS AND 2 DISTANCES IF NECESSARY.

MOVING

ACCIDENT INVOLVED
☐ ANOTHER COM'L VEHICLE
☐ PASSENGER CAR
☐ PEDESTRIAN
☐ _____ (SPECIFY OTHER)

FIXED

☐ BUILDING OR FIXTURE
☐ PARKED VEHICLE
☐ _____ (SPECIFY OTHER)

TYPE

☐ HEAD ON ☐ REAR END (☐ YOU HIT ☐ YOU WERE HIT)
☐ SIDESWIPE ☐ OTHER (DESCRIBE) _____
☐ RIGHT ANGLE
☐ NON COLLISION (DESCRIBE) _____

DRIVERS

	COMPANY VEHICLE NO. 1	VEHICLE NO. 2
		DRIVER'S NAME
		ADDRESS
		CITY & STATE
		DRIVER'S LICENSE
	☐ CHAUFFEUR ☐ OPERATOR ☐ BEGINNER	☐ CHAUFFE ☐ OPERATO ☐ BEGINNE
	AGE ___ SEX ___ DRIVING EXPERIENCE ___ YEARS	AGE ___ SEX ___ (IF VEHICLE DRIVEN BY OTHER THAN OWNER)
	DATE EMPLOYED ___ MONTH ___ DAY ___ YEAR	
	HOURS ON DUTY SINCE LAST PERIOD OF 8 CONSECUTIVE HOURS OFF DUTY ___	ACTUAL HOURS OF DRIVING SINCE LAST PERIOD OF 8 CONSECUTIVE HOURS OFF DUTY ___
	CONDITION OF DRIVER ___	OWNER'S NAME ___ ADDRESS ___ CITY & STATE ___

VEHICLES

	COMPANY VEHICLE NO. 1	VEHICLE NO. 2
	TYPE OF VEHICLE	
	MAKE ___ YEAR ___ SER. NO. ___	MAKE ___ YEAR ___ SER. NO. ___
	STATE ___ LIC. NO. ___ LICENSE	STATE ___ LIC. NO. ___
	REGISTERED OWNER	
	DESCRIBE DAMAGE	
	ESTIMATE COST OF REPAIRS	

INJURED

	NAME	ADDRESS	AGE	SEX	DESCRIBE INJURIES
DRIVER VEHICLE 1					
DRIVER VEHICLE 2					
PASSENGER VEH. ___					
PASSENGER VEH. ___					
PEDESTRIAN					

IF MEDICAL AID WAS RENDERED GIVE NAME OF DOCTOR _____

WHERE WAS INJURED TAKEN _____

WITNESSES

IMPORTANT! BE PARTICULAR TO SECURE THE NAMES AND ADDRESSES OF DISINTERESTED WITNESSES, BYSTANDERS, OR PERSONS IN THE IMMEDIATE VICINITY WHO MAY HAVE SEEN THE ACCIDENT OR HEARD ANY STATEMENT MADE BY THE PERSON DAMAGED.

NAME	ADDRESS	REMARKS
POLICE	BADGE NO.	STATION

TURN THE PAGE - COMPLETE BOTH SIDES

Do not fill in data referring to other driver unless you are sure of your information.

MOVEMENT

VEHICLES

1	2	
☐	☐	Going straight ahead
☐	☐	Passing
☐	☐	Being passed
☐	☐	Turning
☐	☐	Pulling from curb or loading zone
☐	☐	Pulling into curb or loading zone
☐	☐	Backing
☐	☐	Stopped in traffic lane
☐	☐	_____ (specify other)

PEDESTRIAN

- ☐ Walking with traffic
- ☐ Walking against traffic
- ☐ Coming from behind parked vehicle
- ☐ Crossing at intersection
- ☐ Crossing not at intersection
- ☐ Alighting from a vehicle
- ☐ Working on roadway
- ☐ Playing in roadway
- ☐ _____ (specify other)

PASSENGER

- ☐ Boarding vehicle
- ☐ Alighting from vehicle
- ☐ Caught in doors
- ☐ Seated
- ☐ In motion in vehicle
- ☐ Other (describe)

CONDITIONS

DRIVERS AND PEDESTRIAN

1	2	Ped.	
☐	☐	☐	Influenced by alcohol
☐	☐	☐	Had not been drinking
☐	☐	☐	Asleep or fatigued
☐	☐	☐	Sick
☐	☐	☐	Physical defects
☐	☐	☐	Not known
☐	☐	☐	No defects

VEHICLES

1	2	
☐	☐	Defective brakes
☐	☐	Defective steering
☐	☐	Defective lights
☐	☐	Defective tires
☐	☐	No defects
☐	☐	_____ (specify other)

WEATHER & VISIBILITY

- ☐ Clear
- ☐ Raining
- ☐ Snowing
- ☐ Sleeting
- ☐ Fog
- ☐ _____ (specify other)
- ☐ Daylight
- ☐ Darkness
- ☐ Dusk Dawn

ROADWAY

- ☐ Under repair
- ☐ Holes or ruts
- ☐ Slippery
- ☐ Muddy
- ☐ Icy or snowy
- ☐ No defects

CONTRIBUTING FACTORS

VEHICLES

1	2		1	2	
☐	☐	Did not have right-of-way	☐	☐	Improper backing
☐	☐	Following too closely	☐	☐	Improper traffic lane
☐	☐	Failure to signal intentions	☐	☐	Improper parking
☐	☐	Speed too fast for conditions	☐	☐	No improper driving
☐	☐	Disregarded traffic signs or signals	☐		_____
☐	☐	Improper passing		☐	_____ (specify other)
☐	☐	Improper turning			

Was car #1 equipped with seat belts? Yes ☐ No ☐

Were seat belts in use? Yes ☐ No ☐

SPEED

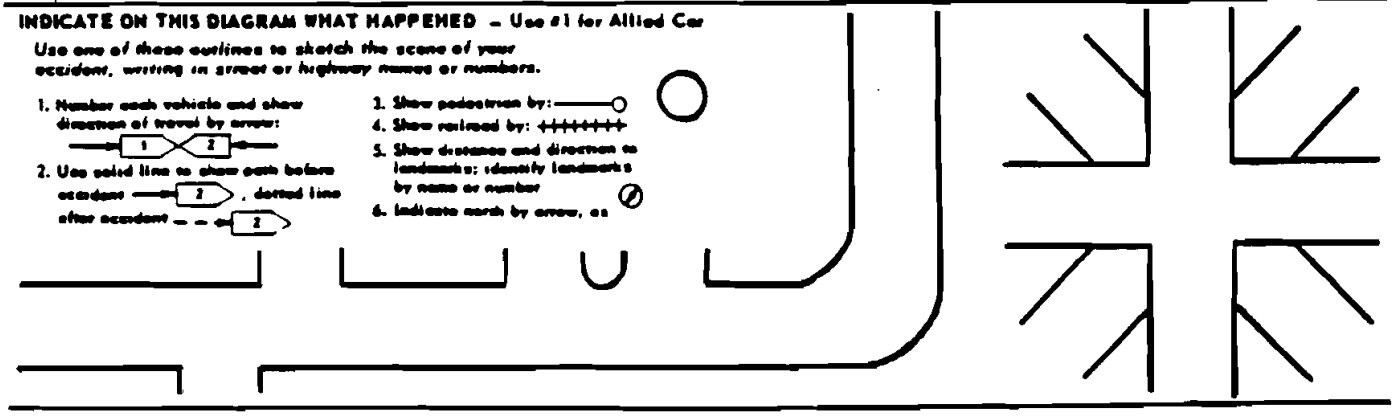
VEHICLES

1	2	
☐	☐	Exceeding legal limit
☐	☐	Too fast for conditions
___MPH	___MPH	Safe Speed
___MPH	___MPH	Estimated speed when danger noticed
___MPH	___MPH	Estimated speed at moment of impact

INDICATE ON THIS DIAGRAM WHAT HAPPENED – Use #1 for Allied Car

Use one of these outlines to sketch the scene of your accident, writing in street or highway names or numbers.

1. Number each vehicle and show direction of travel by arrow: 1 2
2. Use solid line to show path before accident 2, dotted line after accident 2
3. Show pedestrian by: ——○
4. Show railroad by: +++++++
5. Show distances and direction on landmarks; identify landmarks by name or number
6. Indicate north by arrow, as ⊘



DRIVER'S ACCOUNT OF ACCIDENT
(REFER TO VEHICLES BY NUMBER)

USE THIS SPACE FOR LISTING ADDITIONAL INJURED PERSONS. ALSO EXPLAIN QUESTIONS NOT FULLY ANSWERED BY CHECKING IN THE BOXES PROVIDED.

IF MORE SPACE IS NEEDED USE ANOTHER FORM OR A SHEET OF PAPER THE SAME SIZE.

Advise if traffic light, stop or yield signs disregarded.

Driver's Suggestions for PREVENTING future accidents of this type: _____

Supervisor's Suggestions for PREVENTING future accidents of this type: _____

SIGNATURE (PERSON SUBMITTING REPORT)	SIGNATURE – SUPERVISOR	DATE OF REPORT	☐ DRIVER ☐ SUPERVISOR ☐ INVESTIGATOR

SECTION 01620

SAFETY, HEALTH & EMERGENCY RESPONSE

Exhibit 2
TELLON - Injury, Illness
Incident Summary Sheet

** T E L C O N **

Reported By:———————— Time———— Date:————————

☐ Injury
☐ Illness
☐ Incident

From:———————————— Date:————
(Location)

Date of Injury:———————— Time:————

Name of Injured:————————————

Job Title:————————————

Age:———— Company Service:————————

Job Service:————————————

WHAT HAPPENED:

RESULT:

OSHA RECORDABLE CODE DEFINITIONS ONLY

CODE	INJURY
01	Fatalities
02	Lost Workday Cases
03	Cases w/day from work
05A	Restricted Duty Cases
06	Cases w/o lost W.D.s

Enter Appropriate Codes From Code Descriptions Above Under OSHA Classification

e.g. Restricted Injury Description 02/5A
Illness Type/ Description 07C/013

CODE	ILLNESSES
07A	OCC skin diseases/disor.
07B	Dust disease of lungs
07C	Respiratory Condition Due to Toxic Agents
07D	Poisoning toxic matl.
07E	Disorder Due to Physical Agents
07F	Disorder Associated With Repeated Trauma
07G	All other OCC Illness
08	Fatalities
09	Lost Workday Cases
010	Cases w/day from work
12A	Restricted Duty Cases
013	Cases w/o lost W.D.s

Example: To record respiratory lost workday illness case away from work: 07C/09/010.

OSHA CLASSIFICATION:

MONTH TO BE REPORTED:

COMMENTS:————————

FAX IMMEDIATELY TO

SECTION 01620

SAFETY, HEALTH & EMERGENCY RESPONSE

Exhibit 3
Investigation & Findings of
Injury/Illness

Allied Signal

ALLIED-SIGNAL INC.
INVESTIGATION AND FINDINGS OF INJURY ILLNESS

REPOR
No.

SPACES 27-59 — Enter as outlined below

DATE OF ACCIDENT-Example: May 1, 1987 enter as 05 01 87 (leading zeros must be used here and all remaining spaces except name)

NAME — Last name first beginning in Space 36. Leave one space between last and first name or initials. Do not use Jr., Sr., etc.

SECTOR & LOCATION — Code assigned by Corporate Risk Management. Do not use accounting, sales or other code. For assistance contact Risk Management in Morristown, 201-455-4527 or 5981.

OPTIONAL DEPT Code — Space 59 Alpha code only as desired for location purpose only

SPACES 60-73 — Enter appropriate code from Code Definitions above. ALL SPACES MUST BE COMPLETED

SECTOR

COMPANY DIVISION

LOCATION

COMPLETED BY DATE

ALL CODING SPACES BELOW MUST BE COMPLETED

DATE OF ACCIDENT MO.	DAY	YR	T C		NAME OF CLAIMANT (Last name first)	SECTOR CODE	LOCATION	DEPT	BASIC CAUSE	SEVERITY	POSITION	TYPE OF INJURY	PART OF BODY	TYPE OF ACCIDENT	FILED FOR	CONTRIBUTORY CAUSE	AC
27		32	33	34-35		51 52 53 54	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
			C																		0

SOCIAL SECURITY NO.	NAME OF LOCATION CONTACT	TELEPHONE NO. OF LOCATION	INSURED
			ALLIED-SIGNAL INC.

DATE ACCIDENT REPORTED	DATE OF BIRTH	JOB TITLE	PERFORMING REGULAR JOB ☐ YES ☐ NO	YEARS ON JOB
TIME OF ACCIDENT	TYPE OF MACHINERY/EQUIPMENT INVOLVED IN ACCIDENT*			COMPANY SERVICE
DID THIS ACCIDENT INVOLVE A THIRD PARTY — FELLOW EMPLOYEE NOT INCLUDED — WHO MAY BE RESPONSIBLE — IF SO, IDENTIFY		TIME SHIFT BEGAN		LAST DATE INJURED GIVEN SAFETY TALK OR ATTENDED A SAFETY MEETING

OSHA Code 75

= DAYS AWAY*

= DAYS RESTRICTED*

EST DATE RETURN

SAFETY RULES

Was a safety rule or practice violated? _____

Was it written? _____ Should it be? _____

TRAINING/INSTRUCTION

Had employee received adequate instruction? _____

Re-Instruction? _____

DESCRIPTION OF ACCIDENT OR EMPLOYEE'S ACCOUNT OF ILLNESS *(Use separate sheet if necessary)*

RESULTS OF ACCIDENT OR ILLNESS *(Diagnosis, type of injury, nature of illness or disease, etc.)*

BASIC CAUSE *(and contributory cause(s), if any)*. EXPLAIN FULLY IN LIGHT OF ACT, CONDITION OR PERSONAL FACTOR

TYPE OF MEDICAL TREATMENT PROVIDED *(other info pertinent to OSHA recordability)**

CORRECTIVE MEASURES TAKEN AND/OR RECOMMENDED

INVESTIGATED BY		REVIEWED BY		REVIEWED BY	
(Supervisor)	*(Date)*	*(Safety Supervisor)*	*(Date)*	*(Location Executive)*	

Allied Signal

INVESTIGATION AND FINDINGS OF INJURY ILLNESS

No.____

SPACES 27-59 — Enter as outlined below

DATE OF ACCIDENT-Example May 1, 1987 enter as 05 01 87 (Leading zeros must be used here and all remaining spaces except name)

NAME — Last name first beginning in Space 36 Leave one space between last and first name or initials Do not use Jrs etc

SECTOR & LOCATION — Use code assigned by ... Do not use accounting sales or other code ... for assistance contact

OPTIONAL DEPT Code — Space 59 Alpha code only as desired for location purpose only

SPACES 60-73 — Enter appropriate code from Code Definitions above ALL SPACES MUST BE COMPLETED

SECTOR

COMPANY/DIVISION

LOCATION

COMPLETED BY DATE

ALL CODING SPACES BELOW MUST BE COMPLETED

DATE OF ACCIDENT MO.	DAY	YR	T C		NAME OF CLAIMANT (Last name first)	SECTOR CODE	LOCATION	DEPT	BASIC CAUSE	SEVERITY	POSITION	TYPE OF INJURY	PART OF BODY	TYPE OF ACCIDENT	FILED FOR	CONTRIBUTORY CAUSE	AGE
27		32	33	34-35		51 52 53 54	58	59	60 61	62	63	64 65	66	67 68	69	70 71	72 7
			C														0

SOCIAL SECURITY NO	NAME OF LOCATION CONTACT	TELEPHONE NO OF LOCATION	INSURED

DATE ACCIDENT REPORTED	DATE OF BIRTH	JOB TITLE	PERFORMING REGULAR JOB ☐ YES ☐ NO	YEARS ON JOB
TIME OF ACCIDENT	TYPE OF MACHINERY/EQUIPMENT INVOLVED IN ACCIDENT*			COMPANY SERVICE

DID THIS ACCIDENT INVOLVE A THIRD PARTY — FELLOW EMPLOYEE NOT INCLUDED — WHO MAY BE RESPONSIBLE — IF SO IDENTIFY

TIME SHIFT BEGAN

LAST DATE INJURED GIVEN SAFETY TALK OR ATTENDED A SAFETY MEETING

OSHA Code 75

= DAYS AWAY*

= DAYS RESTRICTED*

EST DATE RETURN

SAFETY RULES

Was a safety rule or practice violated? _____

Was it written? _____ Should it be? _____

TRAINING/INSTRUCTION

Had employee received adequate instruction? _____

Re-instruction? _____

DESCRIPTION OF ACCIDENT OR EMPLOYEE'S ACCOUNT OF ILLNESS *(Use separate sheet if necessary)*

RESULTS OF ACCIDENT OR ILLNESS *(Diagnosis, type of injury, nature of illness or disease, etc.)*

BASIC CAUSE *(and contributory cause(s), if any)* EXPLAIN FULLY IN LIGHT OF ACT CONDITION OR PERSONAL FACTOR

TYPE OF MEDICAL TREATMENT PROVIDED *(other info pertinent to OSHA recordability)**

CORRECTIVE MEASURES TAKEN AND/OR RECOMMENDED

INVESTIGATED BY	REVIEWED BY	REVIEWED BY
(Supervisor) *(Date)*	*(Safety Supervisor)* *(Date)*	*(Location Executive)* *(Dat*

SECTION 01620

SAFETY, HEALTH & EMERGENCY RESPONSE

Exhibit 4
Environmental Excursion/Incident Report Form

AlliedSignal

ENVIRONMENTAL EXCURSION/INCIDENT REPORT FORM

1. Report No._____ Excursion____ Incident____

2. Facility: _____ ID#_____

3. Start of Excursion/Incident Date:_____ Time:_____
4. End of Excursion/Incident Date:_____ Time:_____
5. Excursion/Incident became Known: Date:_____ Time:_____

6. Describe the Occurrence:

_____

_____

_____

_____

_____

_____

7. List parameters released/exceeded, amounts and limits (Specify units of measure)

Parameter:_____ Actual Value: _____ Limit:_____

Parameter:_____ Actual Value: _____ Limit:_____

Parameter:_____ _____ Actual Value: _____ Limit:_____

8. Cause of the Excursion/Incident _____

_____

_____

_____

_____

Notifications Made

9.	Agency/Group	Person contacted	Time/Date	Comments
National				
State				
Local				
Allied-Signal				

10.	Corrective Actions Taken
a.	
b.	
c.	

11.	Planned Corrective Actions	Person Responsible	Completion Date Target
a.			
b.			
c.			

C49 2/93

#	Comments

Prepared By		Approved By:	
Print Name		Print Name	
Date Prepared		Date Approved	

Actual Corrective Actions Completed		
#	Corrective Action	Date Completed

ALLIEDSIGNAL INC. WORLD-WIDE EXCURSION/INCIDENT REPORTING SYSTEM

Detailed Instructions for Completing the AlliedSignal World-wide Excursion/Incident Form

The Excursion/Incident Report Form is a two-sided form. The front side contains 11 numbered sections within which the required information will be placed. The back side contains:
A. A series of lines which can be used to provide additional information for any numbered section on the front.
B. A signature section for the preparer and the approval by facility management.
C. A section to record the completion of corrective actions to document that all actions committed to have been addressed.

The form is to be completed by the person responsible for environmental quality at the facility, approved by the facility executive and forwarded to the Sector designated contact within 5 working days of when an incident or excursion becomes known.

Section 1. Report Number and Excursion/Incident Classification

Each facility will establish a sequential report numbering system for excursions and incidents. Each report number will start with the year number (i.e. 93) and end with a sequential suffix number to identify each excursion/incident. For example: **93-12,** would denote the twelfth excursion or incident for the facility in the year 1993. A log should be kept at each location indicating the excursion/incident number and a brief description of the excursion or incident.

Each event will be classified by the location as either an incident or an excursion using the guidance provided. If you are not sure whether an event is an incident or excursion consult your division or sector contact. Do not delay reporting because you are unsure of the proper category.

Section 2. Facility and Facility ID Number

The city and country of the facility location should be placed in the facility blank. The ID# is the 8 digit code number used for the waste tracking, excursion/incident and action plan tracking systems. If you are unsure of your 8 digit code number, please call your Sector Environmental Quality contact.

Section 3. Start of Excursion/Incident

Blanks are provided for the date and time the excursion/incident started.
For an excursion which becomes known from sampling results such as a wastewater parameter, the start time should be the time of the grab sample or the time the composite sample started.
For any event it represents the best approximation of the beginning of the incident or excursion described in the report.

Section 4. End of Excursion/Incident

Blanks are provided for the date and time the excursion incident ended.
For an excursion that resulted from a grab sample this section should be blank.
For an excursion that resulted from a composite sample, this area will contain the end of the composite period.
For releases or other events it represents the best approximation of the end of the incident or excursion described in the report.

Section 5. Excursion/Incident became Known

This is the time and the date when facility personnel were first aware of the excursion or incident.
For a water or air sample result it is the time when the analysis is received from the laboratory or agency.
For an incident involving a complaint, it is the time and date of the complaint.
For releases or other events it is the time and date that the incident or excursion was discovered by facility personnel.

Section 6. Describe the Occurrence

What specifically happened? If there was a release, where did it go? Describe any impacts and community/media response. If more room is required, turn to the back of the form, place a 6 in the number column and continue the description. The cause should be explained in section 8. Try not to include information which appears in other sections of the form unless it is necessary to describe the event.

ction 7. List Parameters released/exceeded, amounts and limits

In this section, space is provided for up to three parameters for a single event. The parameter is either the specific chemic involved or the standard exceeded in the case of certain secondary indicators such as biological oxygen demand. If a complaint involved, the parameter might be "odor" or a more general parameter such as "emissions". In each case where the actual measured calculated value of the excursion or incident parameter is known, it should be placed in actual value. If there is a regulat standard for the discharge, spill or emission, record this under "Limit". In each case where numerical values are used be sure specify units such as milligrams per liter (mg/L) or kilograms (Kg.).

Section 8. Cause of the Excursion/Incident

In order to facilitate continuous improvement, it is necessary to thoroughly understand why an excursion or incident took place. person responsible should investigate the circumstances surrounding the excursion or incident and report root causes if possible. E cause detailed should be supplied with corresponding corrective action in Section 10 or 11.

Section 9. Notifications Made

Each facility is expected to have an emergency action plan, spill plan and contingency plan which contains up-to-date information external and internal notifications necessary for any event. This form is to record that those notifications were made, the per spoken or written to, the time and date of the notification and a small comment area. Comments are expected to be items like, "Foll up with letter", "Phone not answered", "call back", "Letter mailed" etc. Space is provided for two contacts at each level of governm and AlliedSignal. If more space is required continue on the back of the form

Section 10. Corrective Actions Taken

This area allows the environmental quality person to note up to three corrective actions which have been made following the excurs or incident. These may be actions related to recovery, clean-up, immediate retraining, immediate equipment repair and like ite If additional space is required continue on the back of the form.

Section 11. Planned Corrective Action

This area provides space for the environmental quality person to note up to three corrective measures which are yet to be accomplish These may be retraining, new or modified equipment, or new programs. Using this area is a commitment on behalf of the facility accomplish the corrective action. A person responsible and a target date for completion is required for each entry in this secti Each facility should have a system to track and assure completion of each item committed to in this section. To facilitate documentation of completing action items, a section is provided on the back of the form to record the completion dates of speci actions.

Signature Section

The report will be signed and dated by the person responsible for environmental quality at the location. The report must then subsequently signed by the location executive as an acknowledgement that information about the incident or excursion has been conve to the executive and that the executive agrees to fund and facilitate the required future corrective actions. Please print or t the person's name under the signature for ease of identification.

Actual Corrective Actions Completed

After a copy of the excursion/Incident report has been sent to the Sector contact, longer term corrective actions will take pla The completion of these actions should be documented in this section. The document should remain active at the facility until committed actions are documented as completed.

SECTION 01620

SAFETY, HEALTH & EMERGENCY RESPONSE

Exhibit 5
Monthly Construction
Man-Hours Form

AlliedSignal

Engineered Materials Sector
Morristown, NJ

MONTHLY CONSTRUCTION MANHOURS

LOCATION _____

REPORTING PERIOD _____

CONTRACTOR	MANHOURS

TOTAL HOURS _____

MONTHLY SAFETY STATISTICS:

FIRST AID CASES _____
OSHA RECORDABLES ★ _____
LWDA CASES ★ _____

★ Please attach investigation report.

_____
Report prepared by

SECTION 01630

SUBSTITUTIONS

PART 1 - GENERAL

1.01 Description

A. Requests for review of a substitution shall conform to the requirements of Article 6.7 of the General Conditions and shall contain complete data substantiating compliance of proposed substitutions with Contract Documents.

1.02 Contractor's Options

A. For materials or equipment (hereinafter products) specified only by reference standard, select product meeting the standard, by any manufacturer, fabricator, supplier or distributor (hereinafter manufacturer). To the maximum extent possible, provide products of the same generic kind from a single source.

B. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named which complies with Specifications.

C. For products specified by naming several products or manufacturers and stating "or equal", submit a request for a substitution for any product or manufacturer which is not specifically named.

D. For products specified by naming only one product or manufacturer and followed by words indicating that no substitution is permitted, there is no option and no substitution allowed.

E. Where more than one choice is available as a Contractor's option, select product which is compatible with other products already selected or specified.

1.03 Substitutions

A. During a period of 30 days after date of commencement of Contract Time, Engineer will consider written requests from Contractor for substitution of products or manufacturers, and construction methods (if specified).

1. After end of specified period, requests will be considered only in case of unavailability of product or other conditions beyond control of Contractor.

B. Submit 6 copies of request for substitution. Submit separate request for each substitution. In addition to requirements set forth in Article 6.7 of General Conditions, include in request the following:

1. For product or manufacturers:

a. Product identification, including manufacturer's name and address.

b. Manufacturer's literature with product description, performance and test data, and reference standards.

c. Samples, if appropriate.

d. Name and address of similar projects on which product was used, and date of installation.

2. Any substitution must be reviewed and approved by NYSDEC and the Engineer.

3. For construction methods (if specified):

a. Detailed description of proposed method.

b. Drawings illustrating method.

4. Such other data as the Engineer may required to establish that the proposed substitution is equal to the product, manufacturer, or method specified.

C. In making request for substitution, Contractor represent that:

1. Contractor has investigated proposed substitution, and determined that it is equal to or superior in all respects to the product, manufacturer, or method specified.

2. Contractor will provide the same or better warranties or bonds for proposed substitution as for product, manufacturer or method specified.

3. Contractor waives all claims for additional costs or extension of time related to proposed substitution that subsequently may become apparent.

D. Proposed substitutions will not be accepted if:

1. Acceptance will require substantial revision of Contract Documents.

2. They will delay completion of the Work, or the work of other contractors.

3. They are indicated or implied on a Shop Drawing and ar not accompanied by a formal request for substitution from Contractor.

E. If the Engineer determines that a proposed substitute is not equal to that specified, Contractor shall furnish the product, manufacturer, or method specified at no additional cost to the Owner.

F. Approval of a substitution will not relieve Contractor from the requirement for submission of Shop Drawings as set forth in the Contract Documents.

-- END OF SECTION 01630 --

SECTION 01650

FACILITY STARTUP

PART 1 GENERAL

1.01 Summary

A. Except as specifically noted in individual technical Sections, this Section governs the requirements for facilities and system startup.

B. Exceptions in an individual technical Section modify only the individual Article and topic; other topics and Articles in this Section remain in force unless specifically deleted by the technical Section.

C. Section Includes:

1. Section 01300 - Submittals.
2. Section 01400 - Contractor's Quality Control Services.
4. Section 01700 - Project Closeout.

1.02 System Description

A. Design Requirements:

1. Design temporary connections and utility lines to meet the specified design requirements of the component, subsystem, and system to which they are connected.
2. Include required restraints.
3. Do not place structural loads on permanent facility elements beyond their design load capacity.
4. Provide dielectric unions on temporary connections wherever dissimilar metals connect.
5. Provide safety valves and similar safety devices on temporary connections wherever they would be required if the connections were permanent.
6. Divide subsystems according to the P&ID ladder diagrams wherever practical.

B. Performance Requirements:

1. Performance requirements for components, subsystems, and the system are specified in individual Sections.

1.03 Submittals

A. Provide submittals according to Section 01300.

B. Facilities Startup Plan:

1. Provide a Facility Startup Plan for the extraction wells and treatment plant for acceptance not less than 20 days prior to startup, incorporating the requirements of this Section.
2. The Facilities Startup Plan is the responsibility of the Contractor who is solely responsible for its means, methods, techniques, sequences, procedures, coordination, completeness, accuracy, and validity.

3. Individual sections of the Startup Plan may be accepted by Engineer, with Engineer's prior approval, but must be incorporated into the final accepted Startup Plan.
4. Rejection of individual sections of the Startup Plan by Engineer is not a cause for a claim of delay.
5. Identify each person or organization who will have a functional part in the startup, and identify their duties and responsibilities.
6. Provide for contingencies on validation failure.

C. Temporary Connections:

1. Provide complete information on temporary connections in the form of shop drawings or a complete written description or a combination of both.
2. Provide separate drawings or descriptions, or both for each item or subsystem identified in the startup plan.

D. Validation procedures:

1. Provide a complete written description of each test, simulation, and startup, including:
   a. Schedule.
   b. Listing of components included.
   c. Listing of individuals or organizations involved, and assigned responsibilities.
   d. Test equipment required, accuracy, and calibration information.
   e. Detailed listing of procedures necessary to demonstrate compliance with performance requirements specified in technical Sections.

E. Validation reports: Provide validation reports indicating compliance with performance requirements in technical Sections for Engineer's certification.

1.04 Quality Assurance

A. Qualifications:

1. Provide complete foremen's qualifications for Owners approval, indicating 3 years of experience operating and maintaining this type of equipment, or academic and factory training to operate and maintain this type of equipment, or another acceptable combination of relevant training and experience. AlliedSignal reserves the right to reject foremen who, in their sole opinion, are not qualified by experience and training to operate and maintain the equipment.

B. Regulatory Requirements:

1. Include information relating to regulatory requirements for operation and maintenance of equipment.

C. Certifications: Provide certification required under other sections.

D. Pre-Startup Conference:

1. Arrange for a pre-startup conference scheduled not less than 10 days prior to training.
2. Conference to be attended by AlliedSignal, Engineer, Contractor, Contractor's startup and installation foremen, and other responsible parties.

3. Prepare an agenda for approval prior to conference, to include as a minimum:
    a. Startup and demonstration schedule.
    b. Facilities examination.
    c. Problem resolution.

1.05 Sequencing and Scheduling

A. Facilities Startup Schedule:
    1. Provide as a sub-schedule of the main project schedule.
    2. Include submittal, and approval of submittals required for components.
    3. Address each subsystem individually.

1.06 Maintenance

A. Provide maintenance on components through completion of the Reliability Demonstration.

PART 2 PRODUCTS

2.01 Temporary Connections

Not Used.

2.02 Chemical and Operating Fluids

A. Provide chemicals and operating fluids required for validation and reliability demonstration.

B. Provide maintenance and replacement parts required during the reliability demonstration.

PART 3 EXECUTION

3.01 Component Validation

A. Validate each component by one or more of the following procedures, as approved:
    1. Testing to show compliance with specifications.
    2. Simulation of actual operation by a method certified as acceptable and valid by both the component manufacturer and the Engineer.
    3. Certification by an independent testing laboratory that the component type meets a specified industry standard.
    4. Where procedures are specified in individual Sections, substitute procedures will not be accepted without prior written approval.

B. Validate components at component or subsystem level as soon as conditions permit and prior to system startup and testing.

C. Component validation must include:
    1. Full range of operation of each component.
    2. Emergency procedures.
    3. Normal start-up and shutdown procedures.
    4. Out-of-parameter correction.
    5. Validate components individually and as part of a subsystem test.

3.02 Examination

A. Prior to validating components or subsystems, verify that:

1. Startup submittals have been accepted.
2. Manufacturers' have certified component installations wherever required.
3. Coordination with manufacturers' representatives for required field services is completed.
4. Facility is enclosed weather-tight.
5. Auxiliary systems are in proper operation.
6. No safety defects remain unresolved.
7. Provisions have been made for disposal of solids and liquids generated.
8. Both hand and automatic operation of equipment is operational.
9. Equipment is lubricated and serviced, and is ready for continuous operation.

3.03 Preparation

A. Protection:

B. Temporary connections:

1. Provide temporary connections as indicated on approved submittals.
2. Test temporary connections by the same method that would be required if the connections were permanent.

C. Effluent collection, removal, and disposal:

3.04 Testing Requirements

A. Conduct tests using non-process, clean fluids prior to process fluid testing.

B. Effluent from testing not meeting specified system effluent quality are the property of Contractor, who is responsible for legal disposal.

3.05 Testing of System

A. Validate subsystems and components before beginning system validation.

B. Perform system tests only to certify system, not to certify components or subsystems.

C. System performance is based on specified component performance and system output boundary conditions.

3.06 Reliability Demonstration

A. Operate and maintain the system for not less than 3 months continuously and at full capacity to demonstrate that the system performs according to specifications.

B. Any system operation outside of specified operating boundary conditions requires a restart of the Reliability Demonstration period for a time specified by the Engineer up to the original time period.

C. Document actions taken and procedures developed that are not covered in the operations manuals, and provide as an appendix to the operating manuals.

D. Where required in individual specification Sections, at the end of the Reliability Demonstration, replace or clean filters, replace fluids, and perform other replacement and adjustment requirements.

3.07 Field Quality Control

A. Tests:

1. Calibrate test equipment used to validate compliance immediately prior to testing.
2. Check calibration of testing equipment immediately after validation tests.
3. Revalidation, including the requirements of this Article, is required whenever test equipment is out of calibration at the completion of the validation testing.

B. Inspection:

C. Manufacturer's Field Service:

3.08 Adjusting and Cleaning

A. After the successful completion of the demonstration period, perform the following:

1. Lubricate and service dynamic equipment in accordance with manufacturer's instructions.
2. Clean facility surfaces to a "like-new" condition.
3. Clean equipment inside and out to a "like-new" condition. Dynamic equipment in the process stream such as screw conveyors, pumps, and valves do not require the interior to be cleaned.
4. Preform other cleaning, adjusting, and replacement requirements included in other sections of these specifications.

-- END OF SECTION 01650 --

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 Description of Requirements

Provisions of this section apply to the procedural requirements for the actual closeout of the Work, not to administrative matters such as final payment. Closeout requirements relate to both substantial and final completion of the Work; they also apply to individual portions of completed work as well as the total Work. Specific requirements contained in other sections have precedence over the general requirements contained in this section.

1.02 Procedures at Substantial Completion

A. Prerequisites: Comply with the General Conditions and complete the following before requesting inspection of the Work, or a designated portion of the Work, for certification of substantial completion. A representative of the Owner and the Engineer will perform the substantial completion inspection.

1. Submit executed warranties, maintenance agreements, inspection certificates and similar required documentation for specific units of work, enabling the Owner's unrestricted occupancy and use.

2. Submit record documentation, maintenance manuals, tools, spare parts, keys and similar operational items.

3. Complete final cleaning, and remove temporary facilities and tools.

B. Inspection Procedures: Upon receipt of Contractor's request, the Engineer, and the Owner's project manager will either proceed with inspection or advise the Contractor of prerequisites not fulfilled. Following initial inspection, the Engineer will either prepare the certificate of substantial completion, or advise the Contractor of work which must be performed prior to issuance of the certificate of completion. The Engineer and the Owner project manager will repeat the inspection when requested and assure that the Work has been substantially completed. Results of the completed inspection will form the initial "punch-list" for final acceptance.

1.03 Procedures at Final Acceptance

A. Reinspection Procedure: The Engineer and the Owner's project manager will reinspect the Work upon receipt of the Contractor's notice of completion, except for those items whose completion has been delayed due to circumstances that are acceptable to the Engineer. Upon completion of reinspection, the Engineer will either recommend final acceptance and final payment, or will advise the Contractor of work not completed or obligations not fulfilled as required for final acceptance. If necessary, this procedure will be repeated.

1.04 Record Documentation

Refer to Section 01055.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 Operator Instructions

Require each installer of systems requiring continued operation and maintenance by the Owner's operating personnel, to provide on-location instruction to the Owner's personnel, sufficient to ensure safe, secure, efficient, non-failing utilization and operation of systems.

3.02 Final Cleaning

At the time of project close out, clean and return the Work area to its original condition. Complete the following operations before requesting the Engineer's inspection for certification of substantial completion:

A. Remove non-permanent protection and labels.

B. Clean exposed finishes.

C. Touch-up minor finish damage.

D. Remove debris.

E. Sweep and wash paved areas.

F. Police yards and grounds.

-- END OF SECTION 01700 --

SECTION 01720

PROJECT RECORD DRAWINGS

PART 1 - GENERAL

1.01 Description

A. This section specifies the requirements for recording of field modifications made during construction, to be marked on the design Construction Drawings by the Contractor (Record Drawings) and for preparing Supplemental Record Drawings by the Surveyor to be submitted to the Owner and Engineer.

B. Maintenance of Documents

1. Maintain in Contractor's field office in clean, dry, legible condition complete sets of the following: Drawings, Specifications, Addenda, approved Shop Drawings, Samples, photographs, Change Orders, other modifications of Contract Documents, test records, survey data, Field Orders, and all other documents pertinent to Contractor's work.

2. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by the Engineer.

3. Make documents available at all times for inspection by Engineer, Owner, and NYSDEC.

4. Record documents shall not be used for any other purpose and shall not be removed from the Contractor's office without the Engineer's approval.

C. Related work specified elsewhere.

1. Section 01051 - Grades, Lines, and Levels

1.02 Submittals

A. Record Drawings

The Contractor shall clearly and neatly mark up in red ink one set of paper prints to show the record conditions. These record marked prints (Record Drawings) shall be kept current and available on the job site at all times. All changes from the contract plans which are made in the work, or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. The Record Drawings shall be jointly inspected for accuracy and completeness by the Engineer and a responsible representative of the Contractor prior to submission of each monthly pay estimate. The drawings shall include but not be limited to the following:

1. Installations of any kind or description known to exist within the construction area. The locations shall include dimensions to permanent features.

2. The location and dimensions of any changes within the design features of any kind or description known to exist within the construction area. The locations shall include dimensions to permanent features.

3. Correct grade or alignment of roads, structures, utilities, or project component.
4. Correct elevations.
5. Changes in details or dimensions.
6. The topography and grades of all drainage structures installed or affected as part of the project construction.
7. Additional information obtained from working drawings.
8. Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the record prints.
9. Additional work ordered by the Engineer or Owner.
10. Depths of various elements of foundation in relation to datum.
11. Horizontal and vertical location of underground utilities and appurtenance referenced to permanent surface improvement.
12. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

B. Supplemental Record Drawings

This section covers the preparation and submittal by the Surveyor retained by the Contractor of Supplemental Record Drawings. The Contractor will retain and coordinate with the independent Surveyor in obtaining field measurements necessary to prepare the supplemental drawings. The Supplemental Record Drawings shall include but not be limited to the following:

1. A topographic survey of the site following sediment and waste soil excavation, final subgrade preparation and unclassified fill layer and topsoil placement. The survey should, as a minimum, show ground surface elevations on a 50 foot by 50 foot grid and at all grade changes and also indicate the thickness of the cover layers. The survey should adequately extend beyond the limits of work to properly overlap existing conditions (i.e; the railroad, etc.).
2. Preliminary Submittal

   The Contractor shall prepare two (2) copies of the Record Drawings and the Surveyor shall prepare the two (2) copies of the Supplemental Record Drawings. These drawings shall be submitted to the Engineer following completion of that phase of work (within 7 calendar days) for review and approval. These drawings shall be neat, legible, and accurate. The review by the Engineer shall be expedited to the maximum extent possible (expected to be within 7 calendar days). If upon review, the drawings are found to contain errors and/or omissions, they shall be returned to the Contractor and/or Surveyor for corrections. The Contractor and/or Surveyor shall complete the corrections and return the drawings to the Engineer within 10 calendar days for subsequent review.
3. Final Record Drawing Preparation
   a. Upon approval of the Record Drawings and Supplemental Record Drawings submitted, these drawings shall be modified by the Engineer, as necessary, to add any

additional information which is pertinent to the project. These drawings shall be part of the permanent records of this project.

b. Each drawing to be submitted by the Contractor shall be lettered or stamped with the words "RECORD DRAWING" in 1-inch high printed letters followed by the name of the Contractor and the Engineer. All original contract drawings shall be marked by the Engineer either "Record" denoting no revisions on the sheet, or "Revised Record" denoting one or more revisions.

c. The Supplemental Record Drawings to be submitted by the Surveyor shall:

   1. be stamped and signed by the Surveyor retained by the Contractor;

   2. be prepared on a 24" by 36" reproducible sheet with the same Allied Signal Ledger and title block used for contract drawings.

   3. shall locate all work referenced to the limits of the project area; and

   4. have all locations referenced to the site horizontal coordinate system. The grid coordinate system shall be shown on all record drawings. Elevations shall be referenced to the vertical control established for the project.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

--END OF SECTION 01720--

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 General

A. Provide operation and maintenance data in the form of instructional manual for use by the Owner's personnel for:

1. All equipment and systems.
2. All valves, gates, and related accessories.
3. All instruments and control devices.
4. All electrical gear.

B. Definitions:

1. Operation and Maintenance Data:

a. The term "Operation and maintenance data: includes all product related information and documents which are required for preparation of the plant operation and maintenance manual. It also includes all data which must accompany said manual as directed by current regulations of any participating government agency.

b. Required operation and maintenance data includes, but is not limited to, the following:

(1) Complete, detailed written operating instructions for each product or piece of equipment including: equipment function; operating characteristics; limiting conditions; operating instructions for startup, normal emergency conditions; regulations and control; and shutdown.

(2) Complete, detailed written preventive maintenance instructions as defined below.

(3) Recommended spare parts lists and local sources of supply for parts.

(4) Written explanations of all safety considerations relating to operation and maintenance procedures.

(5) Name, address, and phone number of manufacturer, manufacturer's local service representative, and Subcontractor or installer.

(6) Copy of all approved Shop Drawings, and copy of warranty bond and service contract as applicable.

2. Preventive Maintenance Instructions:

a. The term "preventive maintenance instructions" includes all information and instructions required to keep a product or piece of equipment properly lubricated, adjusted, and maintained so that the item functions economically throughout its full design life.

b. Preventive maintenance instructions include, but are not limited to, the following:

(1) A written explanation with illustrations for each preventive maintenance task.

(2) Recommend schedule for execution of preventive maintenance tasks.

(3) Lubrication charts.

(4) Table of alternative lubricants.

(5) Trouble shooting instructions.

(6) List of required maintenance tools and equipment.

C. Submittals:

1. General: Submit operations and maintenance data to the Engineer within 90 days after approval of Shop Drawings.

2. Number of Copies: Six of each item.

3. Letter of Transmittal: Provide a letter of transmittal with each submittal and include the following in the letter:

a. Use 8-1/2 inch by 11 inch paper. Larger drawings or illustrations are acceptable if neatly folded to the specified size in a manner which will permit easy unfolding without removal from the binder. Provide reinforced punched binder tab. Or provide fly-leaf for each product.

b. All text must be legible typewritten or machine printed originals or high quality copies of same.

c. Each page shall have a binding margin of approximately 1-1/2 inches and be punched for placement in a three ring looseleaf or triple post binder. Provide binders. Identify each binder with the following:

(1) Title "OPERATING AND MAINTENANCE INSTRUCTIONS".

(2) Title of Project.

(3) Identity of building or structure as applicable.

(4) Identity of general subject matter covered.

d. Use dividers and indexed tabs between major categories of information such as operating instructions, preventive maintenance instructions, or other. When necessary, place each major category in a separate binder.

e. Provide a table of contents for each binder.

f. Identify products by their functional names in the table of contents and at least once in each chapter or Section. Thereafter, abbreviations and acronyms may be used if their meaning is explained in a table in the back of each binder. Use of model or catalog numbers or letters for identification is not acceptable.

-- END OF SECTION 01730 --

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01800

CONSTRUCTION WASTE

1.0 SCOPE. This section covers the handling, temporary storage and disposal of wastes generated during construction. The CONTRACTOR shall furnish all labor, materials, and equipment required for temporary storage, labeling, removal, transport and disposal of uncontaminated construction wastes. The CONTRACTOR shall furnish all labor, materials, and equipment required for handling, temporary storage, labeling and sampling contaminated soil, debris and liquids.

2.0 GENERAL. The work shall consist of the handling, sampling and placement of material (soil and debris) from trenching and excavation, as well as decontamination water generated during construction. The work shall also consist of the handling, transport and disposal of personnel protective equipment (PPE), municipal type construction waste and debris. In general, non-hazardous wastes shall be sampled, if required, and disposed of by the CONTRACTOR. Decontamination water shall be sampled and disposed of by the CONTRACTOR. Some wastes will require temporary storage to manage, sample, treat or dispose of the wastes. Contaminated materials excavated from areas designated on the drawings shall be managed as specified in this Technical Specifications. All work shall be conducted in strict compliance with all applicable local, state and federal regulations, statutes, codes and policies. Compliance shall be the responsibility of the CONTRACTOR.

Refer to Section 01620 - SAFETY, HEALTH, AND EMERGENCY RESPONSE of the Bid Document, for a list of site contaminants which may be encountered during execution of the work.

3.0 APPLICABLE PUBLICATIONS. Work performed shall be in compliance with the following regulations including, but not limited to those listed below. In the case that these requirements are conflicting, the one which offers the greatest protection shall be followed.

3.01. Code of Federal Regulations-Transportation-Subchapter C -- Hazardous Materials Regulations.

49 CFR 173	Shippers - General Requirements for Shipments and Packaging
49 CFR 178	Shipping

3.02. Code of Federal Regulations - Protection of the Environment Subchapter I -- Solid Waste.

40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Wastes
40 CFR 263	Standards Applicable to Transporters of Hazardous Wastes

4.0 POTENTIALLY CONTAMINATED AREAS. Initial excavation and dredging shall be to the depth and extent shown on the drawings and material shall be placed in stockpiles and/or compacted in accordance with the CONTRACTOR's Plan of Operation. CONTRACTOR shall continuously screen the excavated or dredged material with an organic vapor detector from the perimeter and side of the stockpile areas in accordance with paragraph 4.03 of this specification. CONTRACTOR's employees and subcon-tractors shall wear personal protective equipment as specified in CONTRACTOR's HASP.

Sediments and silt that is collected in erosion control devices such as silt fences and hay bales, shall be handled in a similar manner as the excavated soils present where the devices are installed.

4.01 Soil, Sediment and Debris Handling Requirements.

General. Excavation areas at the Buffalo Color Area D site shall be monitored for potential contamination as specified in the CONTRACTOR's Health and Safety Plan. Contaminated soils or wastes encountered during excavation shall be kept segregated from uncontaminated soils. Those contaminated soils or debris excavated and stockpiled by the CONTRACTOR shall be placed and compacted by the CONTRACTOR in the center of the area to be capped. Uncontaminated soils may be used as general unclassified fill by the CONTRACTOR. Those contaminated and uncontaminated sediments dredged and stockpiled by the CONTRACTOR shall be solidified, placed and compacted by the CONTRACTOR in the center of the area to be capped.

CONTRACTOR shall handle all contaminated soils, sediment and debris in a manner which minimizes wind and water erosion, leachate generation from rainfall and spillage. Spillage occurring during excavation or dredging shall be minimized and cleaned/removed immediately by the CONTRACTOR. The CONTRACTOR shall be responsible for maintaining all Buffalo Color Corporation parking areas and roadways impacted by CONTRACTOR's activities. The parking areas and roadways used by the CONTRACTOR shall be kept free of spilled soil, tracked soil and debris on a daily basis.

Air emissions including fugitive dusts, volatile organic vapors and odors shall be minimized employing procedures described by both the CONTRACTOR's Health and Safety Plan.

4.02. Soil Excavation Procedures. Areas to be excavated shall be clearly delineated (staked) and surveyed by the CONTRACTOR in accordance with the Technical Specifications and the Drawings prior to initiating excavation. Prior to excavation CONTRACTOR shall obtain AlliedSignal Inc.'s on-site representative approval of the delineated excavation areas. All excavation areas shall be surrounded by temporary run-on and run-off control berms, hay bales, silt fencing, or other means as specified to prevent adjacent areas, including the Buffalo River, from becoming contaminated by the contaminated soils or waste.

During non-slurry wall excavations in Areas identified during either past investigations or the progress of work, continuous air monitoring for organic vapors shall be conducted in the worker breathing zone.

The CONTRACTOR shall minimize the amount of open excavation and backfill excavated areas promptly. Excavating that will remain open longer than 8-hours shall require temporary fencing. CONTRACTOR shall promptly install temporary high visibility fencing around excavations that remain open.

4.03. Field Screening Criteria For Excavated Soils and Sediments. Material shall be inspected during excavation to determine areas of contamination. Field inspections to be performed immediately after materials have been excavated or dredged include a visual inspection and organic vapor detector (OVD) scan.

Removed material which can be visibly identified as contaminated (i.e., discoloration, petroleum staining, etc.) shall be stockpiled. Material which does not exhibit visible contamination shall be screened continuously in the field for organic vapors using an OVD. Any soil exhibiting organic vapor concentrations above 50 parts per million volume (50 ppmv) shall be separated and handled as contaminated material.

As a minimum, soil and sediment shall be screened based on the following criteria:

Test Result/Action Level	Definition and Response
OVD < 50 ppm or equal to:	Material is uncontaminated and can be reused for backfill.
OVD > 50 ppm; or visible contamination of soil matrix, presence of trash, or cinders; a strong chemical odor; or free product on exposed water table or sediment run-off.	Considered potentially contaminated. Material shall be stockpiled, solidified as required, and compacted on-site.

5.0 COLLECTION AND TEMPORARY STORAGE OF UNCONTAMINATED CONSTRUCTION WASTE. When wastes require temporary storage, the CONTRACTOR shall segregate all office wastes, visqueen, protective clothing, surface debris and any other construction waste and place in bulk storage vessels, "sealed" non-leaking dumpsters or other furnished by the CONTRACTOR. Materials such as silt fencing shall also be containerized and disposed of off-site by the CONTRACTOR. The storage units shall be maintained to prevent leakage or dispersion of materials. Drums and bulk storage vessels shall be staged to the satisfaction of, and in a location approved by AlliedSignal. All contaminated and non-contaminated wastes shall be kept segregated.

If required by the AlliedSignal Inc.'s on-site representative, all storage units shall be labeled by the CONTRACTOR. Each storage vessel shall at a minimum be labeled with a unique sequential number, beginning with the number "1", the date, contents and estimated volume. A waste generation log shall be maintained by the CONTRACTOR. One copy of the log shall be given to AlliedSignal. The CONTRACTOR shall dispose of the wastes on a monthly basis through a permitted waste hauler. Storage units shall be reused to the maximum extent practicable.

6.0 MANAGEMENT OF LIQUID WASTES. Liquid wastes including decontamination, dewatering and groundwater shall be containerized then processed through the Waste Water Treatment Plant (WWTP). The CONTRACTOR shall be responsible for handling, storage, sampling, transporting fluids and treatment of potentially contaminated water. Used engine oil, lubricants and other liquid wastes shall be managed and disposed of or recycled off-site by the CONTRACTOR.

All decontamination fluids shall be containerized and treated at the on-site WWTP. The CONTRACTOR shall be responsible for containerizing and transferring fluids to the WWTP.

7.0 MANAGEMENT OF NON-LIQUID WASTES. Solid or semisolid wastes from dredging, trenching and excavation operations shall be handled and stockpiled at the site by the CONTRACTOR in a location approved by AlliedSignal Inc. and manner consistent with the CONTRACTOR's Plan of Operations. Semisolid wastes shall be dewatered then blended with a solidification agent prior to stockpiling. CONTRACTOR may elect to stockpile the material to allow additional dewatering to occur prior to solidification. Uncontaminated debris removed from identified excavation Areas, hay bales used for sedimentation control, as well as wood, paper, leather, rubber and cloth debris, shall be handled and compacted in the center of the site by the CONTRACTOR. Contaminated personnel protective equipment (PPE), contaminated construction debris and other material unsuitable for re-use or compaction and other wastes shall be disposed of off-site. Placement of contaminated wastes in storage units shall be approved by AlliedSignal. CONTRACTOR shall sample, where appropriate, wastes requiring off-site disposal.

8.0 TRANSPORTATION OF HAZARDOUS WASTES. The CONTRACTOR shall share the responsibility with AlliedSignal Inc. to transport and dispose of all hazardous wastes. The CONTRACTOR will be responsible for containerizing, labeling, manifesting, characterizing, placarding, marking, temporarily storing, loading and transporting these materials in accordance with the applicable Federal, state and local regulations for wastes traveling on public roads after approval.

Each transport container of hazardous waste shall be visually inspected by the CONTRACTOR for leaks, and rips, or container damage prior to being loaded. Containers which are found to be leaking or damaged shall not be allowed to be loaded. The CONTRACTOR shall prepare transport containers to prevent spillage or contamination.

The CONTRACTOR is required to utilize a pre-approved AlliedSignal Waste Management Contractor. AlliedSignal will require CONTRACTOR to issue the character-ization data and manifest documentation at least seven working days prior to scheduling transportation. An AlliedSignal Inc. Representative will approve the characterization data and sign the manifests for wastes requiring off-site disposal.

All waste characterization and manifest documentation shall be included in the CONTRACTOR's Final Close-out Report.

AlliedSignal reserves the right to contract directly with the approved Waste Management Contractors for transport and disposal.

-- END OF SECTION 01800 --

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.01 Description

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to perform the demolition of subsurface utilities, fencing, former building foundation systems, fencing, reinforced concrete walls, or other structures described herein or as shown on the Contract Drawing C-2.

A. Work included in this section:

1. Demolition and onsite disposal of reinforced concrete foundation systems and substructures.
2. Partial Demolition, onsite disposal, and removal of subsurface drainage piping.
3. Removal and onsite disposal of outfall structures.
4. Plugging and partial removal of branch piping from a 54-inch diameter water supply main.
5. Removal/in-place closure of monitoring wells, pumping wells, observation wells, and piezometers.
6. Removal of a low density non-aqueous phase liquid (LNAPL) recovery system including power poles and a temporary shed.
7. Removal and scrap, resale, or onsite disposal of demolished structures or subsurface elements necessary to achieve design subgrade preparation.

B. Related work specified in other sections:

1. Section 01001 - General Requirements
2. Section 02080 - Underwater Waste Fill and Sediment Removal
3. Section 02200 - Earthwork

1.02 Applicable Codes, Standards, and Specifications

The publications listed below form a part of the specifications to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society of Testing and Materials (ASTM)

ASTM C150-89 Type I Portland Cement

PART 2 - PRODUCTS

2.01 Grout for Well Abandonment

A. Grout for well abandonment shall be a Portland Cement/bentonite grout mixture. The grout shall consist of a mixture of Portland Cement (ASTM C150 Type I), bentonite and water in the

proportions of one 94 pound bag of Type I Portland Cement, 3.9 pounds of powdered bentonite, and 6 gallons of portable water.

2.02 Bentonite

A. Baroid - Ben Seal

B. Equal

PART 3 - EXECUTION

3.01 General

A. Demolition shall include removal, crushing, and disposal onsite of all foundation systems, subsurface discharge piping, outfall structures, portions of branch piping from the 54-inch size water supply main, fencing, and other structures or portions thereof necessary to remove waste fill outside the proposed cutoff wall, install the cutoff wall, establish final subgrade elevations, provide slope stabilization, perform cap construction, and other work necessary to establish the finish site grading and contour plan. Demolition shall also include in-place closure or removal of monitoring wells, pumping wells, observation wells, and piezometers.

B. Concrete debris shall be crushed to less than one foot in size. Demolition debris shall be disposed of on site and incorporated beneath the landfill cap.

C. Contractor shall conduct demolition activities with appropriately sized equipment adequate to perform the intended work in an expeditious manner. Blasting shall not be permitted.

D. Contractor shall verify well/piezometer location, identification, and construction prior to demolition.

E. Well/piezometer abandonment/demolition equipment shall be decontaminated in accordance with decontamination procedures presented below.

3.02 Foundation Systems

A. Remove and dispose of reinforced concrete foundation systems only to the extent necessary to install the perimeter cutoff wall, perform slope stabilization, and achieve final site grades. Any old foundation piling encountered within the proposed cutoff wall excavation shall be extracted and disposed on site.

3.03 Drainage Pipe and Outfalls

A. Remove and dispose of all perimeter drainage outfall structures.

B. Remove and dispose of subsurface drainage piping. Piping shall be terminated no closer than two feet to the inside perimeter of the cutoff wall. The ends of the piping shall be plugged and sealed with at least two feet of expensive concrete fill.

3.04 Water Supply Branch and Main

A. Remove and dispose of the inactive portions of two existing branch water supply pipings which are fed from an active 54-inch water supply main as shown on Drawings. The Contractor shall protect the water supply main, butterfly valves, and any active branch pipings to avoid any damages that may cause rupturing of the live water supply system. The Contractor shall inform both the Buffalo River Improvement Corporation (BRIC) and Buffalo Color Corporation (BCC)

of any work related to the water lines. BRIC owns the 54-inch pipe and supplies water to BCC through the 24-inch branch pipe.

B. The 10-inch steel branch water line, located near the Conrail railroad bridge shall be disconnected south of the butterfly valve. A blank flange shall be placed on the pipe remaining with the valve. The concrete valve pit shall be filled with new concrete to a minimum of three feet above the valve.

C. The 24-inch steel branch water line, located near the abandoned railroad overpass, shall be disconnected south of the 24-inch pipe tee. Since the pipe supplies water to BCC, proper arrangement should be made with BCC for the disconnection activities. BCC will be shut down and therefore will not need the water service during July 1 to 7 and October 14 to 20 in 1996. The Contractor is expected to work on the 24-inch pipe only during one of the BCC shut-down periods and with a BCC representative present. A blank flange shall be installed on the south side of tee, leaving the north branch active to BCC. The inactive side of tee shall have a two cubic yard concrete thrust block installed behind blind flange.

D. The disconnected pipes can be scraped or disposed on site under the proposed cap.

3.05 Fencing Removal

A. Remove the eastern perimeter fencing as shown on Drawings. Portions of the removed fencing may be re-used by the Contractor. The remaining non-useable fencing shall be disposed of onsite.

3.06 Well/Piezometer Abandonment

A. The Contractor shall review available well/piezometer information and confirm well/piezometer identifications and location prior to commencing abandonment operations.

B. Well materials and soil cuttings shall be disposed within the confines of the proposed cap area. No disposed well materials shall be greater than 15 feet in length. Well materials may be removed for resale or scrap.

C. Group 1 wells/piezometers include 2-inch and 6-inch, single-cased, PVC or steel construction (refer to Table 02050 for well/piezometer construction details). Group 1 wells/piezometers terminate at or above the glacial till confining layer (estimated elevation of 535 feet above mean sea level) and will be abandoned by pulling all associated construction material, as described below.

D. Well Casing pulling procedures include the following:

1. The Contractor shall lower a drill rod down into the well and perforate the bottom well cap.

2. The Contractor shall add the grout to the well casing and riser prior to pulling the casing.

3. The Contractor shall pull the well by grappling the protective casing with appropriate devices and pulling the casing and well materials as a single unit.

4. The Contractor shall add grout on an intermittent basis to ensure that the void spaces are adequately filled with grout as the casing and well are withdrawn. Grout is to be added until the level is within five feet of existing ground surface. The balance of the boreholes is to be backfilled with site soil by the Contractor.

5. If all of the well materials are not withdrawn during the pulling process, overdrilling of the remaining portions may be required by the Contractor as directed by the Engineer/Supervising Geologist.

E. Group 2 wells include single-cased (MW-1) and double cased (MW-7) 2-inch, stainless wells extending below the clay confining layer (refer to Table 02050 for well/piezometer construction details). The Group 2 wells will be removed by overdrilling as described below.

F. Overdrilling procedures shall include the following procedures

1. Decontamination

a. All drilling equipment shall be inspected for integrity of hydraulic and oil fluid handling systems and general overall cleanliness. Leaking hoses, tanks, and hydraulic lines shall be replaced or repaired prior to beginning work.

b. All drilling equipment, tools, and materials shall be steam cleaned upon arrival at the site, between well/piezometer locations, and prior to site demobilization.

2. Overdrilling

a. The Contractor shall lower a drill rod down the well and perforate the bottom well screen.

b. The Contractor shall install cement bentonite grout into the casing by using a tremie pipe placed at the bottom of the well. The casing shall be grouted to a minimum of two feet above the confining layer.

c. The Contractor shall advance minimum 4 1/4-inch I.D. hollow stem augers to a minimum depth of two feet below the total depth of the original boring and withdraw the well materials within the augers. If left in place, the outer casing for MW-7 shall be cut to a minimum of one foot below final subgrade.

3.07 Other

A. It is anticipated that other subsurface structures may be encountered during the course of construction. Demolition and disposal of other unknown subsurface structures shall be as directed by the engineer or owner's designated site representative. Reimbursement for additional work shall be in accordance with the terms and conditions of the contract

-- END OF SECTION 02050 --

TABLE 02050

BUFFALO COLOR AREA "D"
MONITORING WELLS/PIEZOMETERS TO BE DECOMMISSIONED

Well Identification	Depth (Feet)	Diameter (Inches)	Screen Length (Feet)	Construction	Suggested Decommisioning Method
Group 1 Well/Piezometers					
MW-2-88	16	2	5	Stainless Steel	Pull & Grout
MW-3-88	16	2	5	Stainless Steel	Pull & Grout
MW-4-88	18	2	5	Stainless Steel	Pull & Grout
MW-5-88	16.25	2	5	Stainless Steel	Pull & Grout
MW-6-88	16	2	5	Stainless Steel	Pull & Grout
MW-8-88	16.8	2	5	Stainless Steel	Pull & Grout
MW-9-88	16.75	2	5	Stainless Steel	Pull & Grout
MW-10-88	16.5	2	5	Stainless Steel	Pull & Grout
MW-11-88	31	2	5	Stainless Steel	Pull & Grout
MW-12-88	23.5	2	5	Stainless Steel	Pull & Grout
MW-13-88	23.5	2	5	Stainless Steel	Pull & Grout
PZ-1-88	18	2	5	PVC	Pull & Grout
PZ-2-88	17	2	5	PVC	Pull & Grout
PZ-3-88	18	2	5	PVC	Pull & Grout
PZ-4-88	20	2	5	PVC	Pull & Grout
W-1-79	18	2	2	PVC	Pull & Grout
W-2-79	17	2	2	PVC	Pull & Grout
W-3-79	18.5	2	2	PVC	Pull & Grout
W-4-79	27.5	2	2	PVC	Pull & Grout
W-5-79	28	2	2	PVC	Pull & Grout
W-6-79	20	2	5	Black Steel	Pull & Grout
W-6R-88	18	2	5	Stainless Steel	Pull & Grout
W-7-88	20	2	5	Black Steel	Pull & Grout
W-8-88	20	2	5	Black Steel	Pull & Grout
W-9-88	20	2	5	Black Steel	Pull & Grout
W-12-83	18	2	5	Black Steel	Pull & Grout
W-13-83	18	2	5	Black Steel	Pull & Grout
W-14-83	20	2	5	Black Steel	Pull & Grout
W-15-83	20	2	5	Black Steel	Pull & Grout
RP-1	25	2	20	PVC	Pull & Grout
RP-2	26	2	20	PVC	Pull & Grout
RP-3	27	2	20	PVC (1)	Pull & Grout

TABLE 02050

BUFFALO COLOR AREA "D"
MONITORING WELLS/PIEZOMETERS TO BE DECOMMISSIONED

Well Identification	Depth (Feet)	Diameter (Inches)	Screen Length (Feet)	Construction	Suggested Decommisioning Method
RP-4	27	2	20	PVC	Pull & Grout
RP-5	25	2	20	PVC	Pull & Grout
RP-6	27	2	20	PVC	Pull & Grout
RP-7	27	2	20	PVC	Pull & Grout
RP-8	27	2	20	PVC	Pull & Grout
PW-1	23.5	2	15	PVC (1)	Pull & Grout
PW-2	27	6	20	Metal	Pull & Grout
OB-1	23	2	16	PVC (1)	Pull & Grout
OB-2	23	2	16	PVC (1)	Pull & Grout
OB-3	26	2	20	PVC (1)	Pull & Grout
OB-4	26	2	20	PVC	Pull & Grout
Group 2 Wells					
MW-1-88	67.5	2	5	Stainless Steel	Overdrill and Grout
MW-7-88	64.5	2	5	Stainless Steel	Overdrill and Grout

(1) Records do not indicate material type; assumed PVC.

(2) Work plan indicates only temporary piezomters were to be installed, so not sure if these still exis

(3) Well material used was the only well construction found in background information.

SECTION 02081

UNDERWATER WASTE FILL AND SEDIMENT REMOVAL

PART 1 - GENERAL

1.01 Description

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to perform the removal of underwater waste fill and sediments as shown on the Contract Drawings, specified herein and in accordance with the attached Public Notice issued by the U.S. Army Corps of Engineers.

A. Work included in this section:

1. Underwater waste fill and sediment removal and riverbank grading for installation of riprap, both above and below the river surface.

B. Related work specified in other sections:

1. Section 01051 - Grades, Lines, and Levels;
2. Section 02200 - Earthwork;
3. Section 02275 - Riprap;
4. Section 02421 - Geotextiles.

1.02 Submittals

A. Material Handling Plan

The Contractor shall prepare and submit for approval, prior to beginning work, a Materials Handling Plan. The Materials Handling Plan shall present in detail the equipment, materials, sequencing, procedures (including surveying and equipment control procedures to be used for sediment removal within the river channel), and areas to be utilized by the Contractor for underwater waste fill and sediment removal.

PART 2 - PRODUCTS

2.01 Materials

The required materials are described in the Erosion and Sedimentation Control Plan prepared by the Engineer.

PART 3 - EXECUTION

3.01 General

A. The work performed under this Specification shall be constructed to the lines, grades, elevation, slopes and cross sections indicated on the Drawings, specified herein, and/or directed by the Engineer.

B. Protection: Existing items not designated to be demolished or removed shall be protected from damage. Such items include sheet piling and wooden barriers adjacent to the draw bridge.

C. Silt curtain(s) shall be installed to control the turbidity of the river water in accordance with the Stormwater Management and Erosion Control Plan.

3.02 Underwater Waste Fill and Sediment Removal

A. A mechanical scooping method will be used for the waste fill and sediment removal and handling. Hydraulic dredging is not acceptable.

B. Removal operations shall be conducted in accordance with the approved Stormwater Management and Erosion Control Plan, including the use of silt fences and silt curtains.

C. The Contractor shall minimize fill and sediment water volume during excavation/dredging activities to the extent possible, including decanting of standing water prior to crossing the river edge (within the silt curtain area) and placement of sediment in a flat area within the cap limits to facilitate drainage of remaining water. All underwater excavation (dredging) shall be performed by mechanical (not hydraulic) methods.

D. The Contractor shall install a floating containment curtain around the containment area subject to excavation/dredging to prevent migration of sediment or other contaminants into the Buffalo River such that no visible evidence of floating contaminants or disturbed sediment may be seen discharging from the containment area during excavation/dredging. Contractor shall install the curtain such that:

1. the curtain shall have sufficient buoyancy to remain floating at all times while deployed in the Buffalo River;

2. the curtain shall extend from the water surface (i.e., from the flotation device) to the river bottom, the depth of which will vary from 0 to 20 feet, depending on distance from water's edge, as shown on the Drawings;

3. the curtain shall be weighted at the bottom (i.e., at the river bottom) to secure a seal with the river bottom at all times i.e., 24 hours a day, 7 days a week during the period of excavation/dredging operations;

4. the curtain shall be securely anchored to remain in position around and outside the "active" containment area during any excavation/dredging operations. Prior to relocating the curtain to the next area, excavation/dredging shall be discontinued for a sufficient period of time to permit settlement of any disturbed sediment;

5. the curtain shall be positioned such that it does not encroach on the limit of Corps of Engineers' channel, a shown on the Drawings; and

6. the top (water level) of the curtain shall include a sorbent boom which shall prevent migration of floating contaminants into the Buffalo River. Any such contaminants shall be collected and properly disposed of by the Contractor. The boom shall comply with all requirements of the "Stormwater Management and Erosion Control Plan", which is an appendix to the Buffalo Color Remedial Design Report (Parsons Engineering Science Report, February 1996 or current).

As necessary to accommodate flow in the affects zone of the Buffalo River or to equalize hydrostatic pressure between the containment area and the rest of the River, the Contractor shall incorporate sections of filter screen or flap gates into the design of the curtain.

The Contractor shall provide for onsite supervision of the installation and subsequent relocation(s) of the curtain by a qualified field representative.

The Contractor shall propose a system of emergency response to mitigate potential release of sediments or floating contaminants into the river, should release from the floating sediment containment curtain occur. This system shall include, at a minimum, a silt curtain with sorbent booms, and a means for rapidly deploying sorbent booms.

A shop drawing and deployment/work plan shall be submitted to Engineer for approval before the curtain is utilized.

E. The Contractor shall not over-excavate/dredge any area without the prior approval of the Engineer. Excavation, disposal, and backfilling costs resulting from unauthorized over-excavation/dredging shall be at the Contractor's expense.

F. The Contractor shall place all excavated/dredged materials within the confines of the cutoff wall for gravity dewatering. Proper erosion and sedimentation control such as earth berm and silt fencing shall be installed around the sediment disposal area. Contractor shall follow the requirements described in the Stormwater Management and Erosion Control Plan.

G. Prior to cap installation, the Contractor shall solidify the waste fill and sediment material disposed within the limits of the cap as necessary to provide adequate support for the installation. Solidification agents may include cement kiln dust, cement, quick lime, or equivalent materials approved by the Engineer. The type, source, and ingredients of the solidification agent shall be identified in the Contractor's Material Handling Plan. The Contractor shall designate and construct, as necessary, areas within the confines of the cut-off wall for temporary storage of the waste fill and sediments prior to solidification treatment.

H. Earth subgrade surfaces on which the riprap is to be placed shall be cut to the lines and grades shown on the Drawings and as necessary to provide an even and stable surface in accordance with specification Section 02200-Earthwork. Surveying to confirm final grade limits shall be conducted in accordance with Section 01051 - Grades, Lines and Levels and the Material Handling Plan for sediment removal.

I. The ground surface on which riprap is to be placed shall be free of brush, trees, stumps, and other objectionable material and shall be dressed to a smooth and stable surface.

-- END OF SECTION 02081 --

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO ATTENTION OF

January 19, 1996

CENCB-CO-PS
CENCB-CO-TE

PN-96-09

Public Notice

OPERATION AND MAINTENANCE
MAINTENANCE DREDGING AND DREDGED MATERIAL DISCHARGE

BUFFALO RIVER AND SHIP CANAL

ERIE COUNTY, NEW YORK

This Public Notice has been prepared and distributed pursuant to 33 CFR 337.1, "Practice and Procedure: Discharge of Dredged Material into Waters of the U.S. or Ocean Waters; Operation and Maintenance; Final Rule" (53 Federal Register, page 14916, 26 April 1988). Its purpose is to advise all interested parties of the proposed project and to provide an opportunity to submit comments, or request a public hearing.

The U.S. Army Corps of Engineers, Buffalo District, anticipates the need to dredge and discharge material excavated from the Federal navigation channels of the Buffalo River and Ship Canal, in order to maintain sufficient depth for deep-draft commercial vessels. The attached map (Figure 1) shows the authorized limits and depths of the Federal navigation channels. Up to an additional one foot of material may be removed to insure the minimum depth.

The 1996 dredging operation is tentatively scheduled to be performed during the period between 15 June and 1 October. In accordance with New York State Department of Environmental Conservation (NYSDEC) Permit No. 9-9909-00039/00001-0 (effective through December 31, 1999), dredging in the Buffalo River Channel will be scheduled between 15 June and 1 October, and dredging in the Ship Canal will occur between 1 July and 1 October. Other resource agencies have requested that dredging in the Buffalo River, downstream of the Ohio Street Bridge, be performed after 31 July, and dredging in the Ship Canal be accomplished after 31 August. The Buffalo District will make an effort to conform to these latter requests, to the maximum extent practicable.

Sediments will be removed from the channel bottom by a mechanical or hydraulic dredge and placed into hoppers aboard ship or scow for transport to the discharge site. The method of excavation will be determined by the Contractor performing the maintenance dredging. In previous years, clamshell bucket-type dredging has been used to complete the required work.

An estimated total of 120,000 cubic yards of material will be dredged and discharged this year from the Buffalo River and Ship Canal Federal navigation channels. It is anticipated that approximately 100,000 and 20,000 cubic yards of this total will be dredged from the Buffalo River and Ship Canal channels, respectively.

The material to be dredged consists primarily of silts, clays and sands. The United States Environmental Protection Agency (USEPA) has concurred with the Buffalo District's determination that all material in the Buffalo River and Ship Canal Federal navigation channels is unsuitable for open-lake discharge. Therefore, all material dredged from these areas will be placed in Confined Disposal Facility (CDF) No. 4 located on the southern shore of Lake Erie, adjacent to the south harbor entrance and Bethlehem Steel property (shown in Figure 1).

The NYSDEC has granted Section 401 State Water Quality Certification for the discharge of this dredged material into CDF No. 4.

The environmental effects of the dredging operation are documented in the ***Final Environmental Impact Statement, Operation and Maintenance, Buffalo Harbor, New York (1972); Supplemental Information Report and Section 404(b)(1) Evaluation, Operation and Maintenance, Diked Disposal Site No. 4, Buffalo Harbor, New York (1983); and Environmental Assessment and Section 404(b)(1) Evaluation, Operation and Maintenance, Buffalo Harbor, Black Rock Channel and Tonawanda Harbor (1993).*** These documents, and supplemental documentation, have been filed with the USEPA, Washington, DC. Copies are available for examination at the Buffalo District office.

There are no registered historic properties or properties listed as being eligible for inclusion in the National Register of Historic Places that will be affected by this project. By this notice, the National Park Service is advised that currently unknown archaeological, scientific, prehistorical or historical data may be lost or destroyed by the work to be accomplished.

Based on the review of the available environmental data, we have determined that the proposed work will not affect any species proposed or designated by the U.S. Department of the Interior as threatened or endangered, nor will it affect the critical habitat of any such species. Therefore, unless additional information indicates otherwise, no further formal consultation pursuant to Section 7 of the Endangered Species Act Amendments of 1978 will be undertaken with the U.S. Fish and Wildlife Service.

The work will be undertaken in a manner consistent, to the maximum extent practicable, with the State Coastal Zone Management (CZM) Program.

The decision whether to perform dredging will be based on an evaluation of the probable impact, including cumulative impacts of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the

proposal will be considered including the cumulative factors thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership and, in general, the needs and welfare of the people.

Any person who has an interest which may be affected by the discharge of this dredged material may request a public hearing. The request must be submitted in writing to the undersigned within 30 days of the date of this Public Notice. The request must clearly state the interest which may be affected, and the manner in which the interest may be affected, by this activity.

This activity is being coordinated with the following agencies, as well as other appropriate Federal, State and local agencies and organizations:

New York State Department of Environmental Conservation
New York State Department of State
New York State Office of Parks, Recreation and Historic Preservation
U.S. Army Corps of Engineers, Coastal Engineering Research Center
U.S. Coast Guard
U.S. Department of the Interior, Fish and Wildlife Service
U.S. Environmental Protection Agency

Questions and comments concerning this project should be referred to Mr. Scott W. Pickard of my Technical Support Branch, or Mr. Donald E. Borkowski, P.E., Chief of Physical Support Branch, who may be contacted by calling 716-879-4404 and 716-879-4284, respectively (FAX 716-879-4357), or by writing to the following address:

District Commander
Department of the Army
U.S. Army Engineer District, Buffalo
ATTN: CENCB-CO-TB/CENCB-CO-PS
1776 Niagara Street
Buffalo, New York 14207-3199

-4-

This Public Notice is published in conformance with Code 33 of the Federal Regulation 337.1. All dredging and dredged material disposal will be performed in conformance with Sections 313 and 404 of the Clean Water Act (33 USC 1323 and 1344, respectively).

for THOMAS J. PIECZYNSKI, P.E.
Chief
Construction-Operations Division

Attachments

NOTICE TO THE POSTMASTER: It is requested that the above notice be conspicuously displayed for 30 days from the date of issuance.

buffalo.pn

FIGURE 1. Buffalo Harbor, Erie County, New York - Federal navigation project.

SECTION 02131

DECONTAMINATION PADS AND EQUIPMENT

PART 1 - GENERAL

1.01 Summary

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to perform all work described herein or shown on the Contract Drawings.

A. Work included in this section: Complete installation of operating decontamination pads including, but not limited to, the following equipment:

1. Holding tanks (2)
2. Precast sump
3. Flexible hose
4. Submersible pump
5. Grout
6. Pressure washer
7. Concrete slab
8. Corrugated plastic sidewalls (1 pair)
9. Trench Drain

B. Related work specified in other sections:

1. Section 01105 - Health and Safety
2. Section 01510 - Temporary Construction Facilities
3. Section 02200 - Earthwork
4. Section 03400 - Precast Concrete Manholes and Vaults
5. Section 03300 - Cast-In-Place Concrete

1.02 System Description

A. Contractor shall furnish and install all materials, equipment, controls, and incidentals required to provide one operational decontamination pad and will include all equipment outlined in paragraph 1.0 A. of this section, as well as subgrade preparation, reinforced concrete slab-on-grade, and trench drain.

B. Performance Requirements

1. All equipment furnished under this Section shall be suitable for the installation as shown and specified. The size, capacity, and type of construction materials specified shall be understood to establish minimum requirements only.

C. Description: New Decontamination Pad

1. Construct new decontamination pads site as per the details shown on Drawing C-16.
2. The equipment to be installed includes two (2) 1,000-gallon storage tanks, one (1) pressure washer, one (1) precast concrete manhole and cast iron cover, a submersible sump pump, and all associated valves and fittings.
3. Install 6 foot high corrugated plastic sidewalls along the entire length of each curb.
4. The pads are to include all necessary piping, nozzles, valves, etc. to provide a fully functioning system.

1.03 Quality Assurance

A. Manufacturer's Qualifications: The manufacturer shall have experience in the production of substantially similar equipment, and shall show evidence of satisfactory operation in at least five installations.

1.04 Delivery, Storage, and Handling

A. Store materials to permit easy access for inspection and identification. Keep all materials off the ground, using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.

PART 2 - PRODUCTS

2.01 Holding Tanks

Provide and install one (1) tank to store wastewater from the decontamination process and one (1) tank to store clean water for the pressure washer at each decontamination pad.

A. The process tanks will be designed and manufactured by Nalgene of Nalge Co. of Rochester, New York or approved equal.

B. Each tank will have openings to accommodate venting ports, sample ports, and piping connections at several locations on the tank as shown on drawings.

C. The tanks shall be as specified below:

Capacity	1000 gal (each tank)
Description	Vertical, cylindrical, closed top with manway, flat bottom
Material	HDPE
Size	72 inch high x 66 inch diameter
Fittings	Flanged
Process	Bulk Storage

2.02 Precast Sump

A. Provide one (1) precast sump at each decontamination pad as shown on drawing. Provide Kistner Concrete sanitary manhole model MH-4STCB and Neenah manhole frame and cover model, or equal.

B. Refer to Division 2, Earthwork, for related material and quality assurance requirements.

2.03 Flexible Hose

A. Hose shall be flexible, braided, 2-inch diameter to pump waste from the submersible sump to the waste tank.

2.04 Submersible Pump

Furnish and install one (1) submersible non-clogging wastewater pump at each decontamination pad. The pump shall be equipped with a 1.5 HP, submersible electric motor connected for operation on 230 volts, 1 phase, 60 hertz, 3-wire service, with 7 feet of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards. The pump shall be supplied with a mating 2-inch discharge connection and be capable of delivering 30 GPM at 11 feet total dynamic head (TDH). The pump shall be fitted with 13 feet of lifting chain or stainless steel cable. The working load of the lifting system shall be 50 percent greater than the pump unit weight. The liquid to be pumped consists of process decontamination wastewater.

2.05 Pressure Washer

A. Manufacturer - Furnish and install one (1) pressure washer unit at decontamination pad. Pressure washer units shall be Model 5830 as manufactured by the Hotsy Corporation, or equal.

B. The pressure washers shall be specifically designed, constructed and installed in conformance with the following conditions.

Operating Flow Rate:	6 gpm
Operating Pressure:	1800 psi
Operating Temperature:	180°F
Electrical Supply Required:	240V, Single Phase
Pump Sizing:	7.5 Hp, Direct Drive
Mobility:	Temporary, Non-Rollable
Hose Length:	100 ft. (min.)
Shell Material of Construction:	Heavy Gauge Steel, Angle Iron Frame
Dimensions	64-inch L x 35-inch W x 55-inch H

PART 3 - EXECUTION

3.01 Decontamination Pad

A. Decontamination pad shall be placed on a prepared subgrade. Subgrade preparation shall consist of removal of up to two feet of existing soil, placement of 12 inches of compacted granulated fill material to decontamination pad subgrade per Section 02200 - Earthwork.

B. Install subsurface sumps, drainage piping, and conduit runs as required.

C. Install reinforced concrete decontamination pad in accordance with Division 3 - concrete. Pad shall be constructed as a monolithic concrete placement with skid resistant broom finish.

D. Install decontamination pad equipment. Startup, test, and make operational as necessary to provide a functional system.

E. Prevent cross-contamination of areas not in the landfill footprint by decontaminating all equipment which comes in contact with potentially-contaminated materials.

F. Potentially contaminated water from decontamination activities shall be disposed of onsite (within the cutoff wall limits), or by treatment and disposal offsite in a manner acceptable to the Owner and Engineer. No potentially contaminated water from decontaminating activities shall be allowed to migrate offsite.

G. Remove and properly dispose of appurtenances of decontamination pad at the conclusion of the work, when it is no longer needed.

-- END OF SECTION 02131 --

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 Description:

The description specified under this section consists of all labor, supervision, tools, materials, equipment, testing and other services necessary to perform the work specified herein and shown on the drawings.

A. Work Included in this section:

1. Site clearing and grubbing
2. Existing fill excavation
3. Unclassified excavation
4. Subgrade preparation
5. Unclassified backfill
6. Visually contaminated materials
7. Structural backfill/crushed aggregate
8. Pea gravel
9. Utility pipe backfilling
10. Compaction requirements
11. Testing requirements

B. Related Work Specified in Other Sections

1. Section 01001 - General Requirements
2. Section 02050 - Demolition
3. Section 02080 - Underwater Waste Fill and Sediment Removal
4. Section 02131 - Decon Pad and Equipment
5. Section 02275 - Riprap
6. Section 02990 - Finish Grading, Topsoil and Seeding

1.02 Submittals

A. Grading, Excavation and Backfill Plan: Prior to the start of earthwork operations, the Contractor shall submit a grading, excavation and backfill plan for all earthwork operations to be accomplished under this section. The plans shall show the proposed sequence of operations, the type, rated capacity, and quantity of equipment to be used. The plans shall show proposed methods for shoring, sheeting, bracing, locations of stockpiles, drainage, dewatering methods, control and removal of surface water, groundwater intrusion control and plans to protect exposed excavations. Filling and backfilling plans shall show the sequence and timing of

backfill operations, compaction procedures, testing procedures and protection of finished grades as the work is accomplished. Sheeting, shoring, and bracing shall be designed by a licensed engineer retained by the Contractor.

B. Submit the source of all off site borrow materials with gradation curves and proctor density tests for: unclassified fill materials, structural fill, pipe bedding fill, and other fill materials proposed for use in the work.

C. Submit field and laboratory testing procedures, methods, prior to the start of work and copies of test reports as the work progresses.

PART 2 - PRODUCTS

A. Structural backfill/crushed aggregate shall conform to NYSDOT for Type 4 granular fill materials. Materials furnished for Type 4 shall consist of stone, or sand and gravel or blends of these materials. Materials furnished shall be well graded from fine to coarse and shall be free of mud, debris, organic matter or other deleterious materials. Structural backfill/crushed aggregate shall be used under building foundations and decon pad and for road and utility pipe bedding.

Gradation for Type 4 structural fill/crushed aggregate shall conform to:

Sieve Size Designation	Percent Passing by Weight
2 inch	100
1/4 inch	30-65
No. 40	5-40
No. 200	0-10

B. Pea gravel shall conform to ASTM D448. The materials furnished shall be free from organic or other deleterious materials. Pea gravel shall be used in the perimeter underdrain.

Gradations for pea gravel shall conform to:

Sieve Size Inch	Percent by Weight Passing
1	100
3/4	90-100
1/2	20-55
3/8	0-15
No. 4	0-5

Alternative gradations may be used, subject to approval by the Engineer.

C. Satisfactory materials for general use as unclassified fill or backfill shall be materials classified in ASTM D 2487 as GW, GP, GC, SW, SP, SM, SC, and CL and shall be free from roots and other organic matter, trash, debris, frozen materials, and stone larger than 2 inch in any dimension. Additionally, any material classified as SM shall have not more than 25 percent by weight passing the No. 200 sieve. CL soils shall have a liquid limit no greater than 30 and a plasticity index no greater than 15. The material shall be obtained from approved sources offsite. Unclassified fill to be placed underwater shall be granular such as sand or sand and gravel mixture with no more than 5 percent non-plastic fines passing the No. 200 sieve. The placement of a continuous gravel fill that would allow bentonite slurry to escape from the proposed cutoff wall is not acceptable.

D. Unsatisfactory Materials: Unsatisfactory materials shall be materials that do not comply with the requirements of satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials, stones larger than 2 inches, and materials classified in ASTM D 2487 as Pt, OH, and OL. Unsatisfactory materials also include man-made fills, or refuse.

E. Visually contaminated materials shall be materials that contain noticeable amounts of oily-looking non-aqueous phase liquid (NAPL). Visually contaminated materials shall be removed from the created wetland area and placed under the cap.

PART 3 - EXECUTION

3.01 Site Clearing and Grubbing

A. Site clearing shall extend to the entire Area "D" limits shown on the Drawings. Contractor shall exercise care to protect properties, and other appurtenances adjacent to the clearing and grubbing limits. Damage to adjacent properties shall be restored at the Contractor's expense.

B. All areas to be graded shall be cleared and grubbed of all roots, brush, trees, vegetation, debris and other items that would interfere with earthwork operations. Trees and other woody debris shall be chipped and stockpiled for use as mulch for erosion control. All other materials including roots and stumps shall be buried under the cap.

3.02 Drainage and Dewatering

A. General: Drainage and dewatering shall consist of the control of surface and groundwater, regardless of origin, nature, or quantity, flowing toward and tending to collect in fills, backfills, or excavations. This water shall be controlled in a manner providing effective, continual drainage of excavations, fills, and surrounding area. Control measures shall be taken by the time the excavation reaches the groundwater level in order to maintain the integrity of the *in-situ* material. The Contractor shall provide qualified personnel and equipment, including standby power and pumping equipment, to operate and maintain continuously, water control facilities as required to divert or remove water, from whatever the source, until backfilling is completed.

B. Surface Water Control: Diversion ditches, dikes, and gradings shall be provided and maintained as necessary during construction to prevent external surface water from entering excavated areas. Precipitation on the slopes and base of excavations shall be controlled in the manner indicated in paragraph GROUND WATER CONTROL. Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undercutting of foundations. Excavation slopes and backfill surfaces shall be protected so as to prevent erosion and sloughing.

C. Ground Water Control: Ground water flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation, and to eliminate interference with orderly progress of construction.

D. Disposal of Ground and Surface Water: Disposal water shall not pollute lake, stream, pond, or other water sources and shall not silt, clog, or otherwise damage natural or man-made drainage systems either above or below grade. The use of a silt barrier is mandatory and shall comply with all local regulations. Potentially contaminated water from dewatering operations or surface runoff shall be disposed of by percolation on site, or by treatment and disposal off site in a manner acceptable to Owner and Engineer. No potentially contaminated water from dewatering operations or surface runoff shall be allowed to migrate off site.

3.03 Shoring

Shoring shall be furnished and installed as necessary to protect workmen, earthen embankments, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed in a manner to prevent caving as excavations are backfilled.

3.04 Excavation

A. General: Excavation of every description shall conform to the lines, grades, dimensions, and elevations indicated, and all work incidental thereto. Excavation below indicated depths will not be permitted except to remove wet, unstable, or otherwise unsatisfactory material. When unsatisfactory material is encountered below the grades shown, the Engineer shall be notified and the material shall be removed as directed, and replaced with satisfactory material. Unsatisfactory material removed below the depths indicated shall be replaced to the indicated excavation grade with satisfactory materials equal in thickness to the bottom of the overdepth excavations. Satisfactory material shall be placed and compacted as specified. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Engineer.

B. Excavation for Utilities and Drainage Trenches: Trenches for underground utilities system and drain lines shall be excavated to the required alignments, depths, grades, and necessary widths for proper laying of pipe, cables, or ducts. The banks of pipe trenches shall be as nearly vertical as practicable. Sheeting and bracing, where required, shall be placed within the trench width specified. Care shall be taken not to over excavate. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Excavated materials not required or not suitable for backfill shall be removed and disposed of under the landfill cap. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length. Stones shall be removed as necessary to avoid point bearing. If unstable, or otherwise unsatisfactory material that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such material shall be over excavated to the depth directed to allow for construction of a stable bearing surface for pipe. The trench shall be backfilled to the proper grade with satisfactory materials. Care shall be exercised to minimize disturbance to the compacted subgrade when encountered during trench excavation. Special requirements related to specific utilities is as follows:

C. Electrical System: The banks of trenches for electrical cables and duct lines need not be kept vertical but may be sloped or widened to such general limits as necessary, provided there is not interference with other utilities.

D. Ditches, Swales, and Perimeter Drains: Ditches, swales, and perimeter drains shall be cut accurately to the cross sections and grades indicated. Roots stumps, rock, and foreign matter in the sides and bottom of subgrade shall be trimmed and dressed or removed and the finished grades shall conform to the slope, grade, and shape of the section indicated. Care shall be taken not to excavate below the grades indicated. Excessive excavation shall be backfilled to grade with satisfactory material and compacted as specified. Permanent excavated features shall be maintained until final acceptance of the work. Excavated material shall be disposed of under the landfill cap.

E. All soil between the cutoff wall and clearing and grubbing limits and/or dredging limits shall be excavated to the depths shown. This material shall be classified as existing fill and disposed of under the landfill cap.

F. Excavation for Structures: Excavation shall be made accurately to the lines, grades, and elevations shown or as directed. Foundation pits and trenches shall be of sufficient size to permit the placement and removal of forms for the full length and width of footings and foundations. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until immediately before the concrete is to be placed.

G. Stockpiles: Stockpiles of satisfactory materials shall be placed and graded as specified herein. Stockpiles shall be kept in a neat and well-drained condition at all times, giving due consideration to drainage from adjacent properties and the surface shall be sealed by rubber-tired equipment. Stockpiles shall be within the confines of and at least 40 feet away from the proposed cutoff wall location to minimize potential slope stability problems.

3.05 Ground Surface Preparation

A. Fills and Embankments: After clearing has been completed, the Contractor shall make an inspection to determine the condition of the cleared areas. Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as specified. Sloped surfaces steeper than one vertical to four horizontal shall be plowed, stepped, benched, and broken up as so that the fill materials will bond with the existing material.

B. Backfills: The excavation shall be cleaned of trash, debris, and loose soil materials. Surfaces shall be trimmed to dense undisturbed or well-compacted materials.

C. Bedding Material: Areas on which bedding material are to be placed shall be trimmed and dressed to conform to the slope, lines, and grades indicated.

3.06 Subgrade Preparation

A. Construction: Subgrade shall be shaped to line, grade, and cross section shown. Approved subgrades that are disturbed by Contractor's operations or adverse weather shall be over excavated, filled, and compacted as specified to the required density prior to further construction thereon. Recompaction over underground utilities shall be accomplished by hand compaction.

3.07 Backfill

A. Unclassified Backfill: Satisfactory materials shall be used in the construction of earth embankments and in bringing fills to lines and grades shall be placed in horizontal layers as specified hereinafter. Oversize material (e.g., > 6 inches)) shall be removed prior to placing satisfactory materials in fill and embankment areas. Uniform distribution of moisture shall be obtained by mixing with disc harrow pulverizers or otherwise manipulating the soil prior to compaction. Material having a moisture content in excess of that specified shall be dried prior to placing. The surface of each lift shall be scarified before the next lift is placed. When compaction is to be accomplished by use of hand or hand-operated machine compactors, the layer thickness of each lift shall not exceed 6 inches in uncompacted thickness. When compaction is to be accomplished other than by hand or use of hand-operated machine compaction, the layer thickness of each lift shall not exceed 8 inches in uncompacted thickness or as specified hereinafter.

B. Backfills: Backfill shall not begin until subgrade preparation has been approved; underground utilities systems have been inspected, tested, and approved. Backfill shall be brought to indicated finish grade. Backfill shall be of satisfactory materials placed and compacted as specified.

C. General Trench Backfilling: Trenches shall not be backfilled until all required pressure tests are performed and until the utilities systems installed conform to the requirements specified in sections covering the installation of the various utilities. Trenches shall be backfilled to the ground surface with satisfactory material that is suitable for the specified compaction. Backfill shall be brought up evenly on both sides of pipe for the full length of pipe in layers not exceeding 6 inches in uncompacted thickness. Each layer shall be compacted with mechanical tampers or rammers as specified. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled in layers not exceeding 8 inches in uncompacted thickness. Trenches improperly backfilled shall be reopened to the depth required for removal of improperly placed backfill, then refilled and compacted as specified, or the condition shall be otherwise corrected as approved.

D. Pipe Trenches: All utility piping and perimeter drainage piping shall be bedded with crushed stone as specified under Part 2 Products. Crushed stone bedding and fill shall be placed in accordance with the design drawing details.

E. Structural Backfill: Structural backfill conforming to NYDOT Type 4 as specified under Part 2 products shall be placed under footings, slabs, structures and pavements to a minimum compacted thickness of one foot. Compaction requirements shall be specified under paragraph 3.08 of this section.

3.08 Compaction

A. Density: Field in-place density shall be determined in accordance with ASTM D 1556.

B. Earth Embankments, Fills, and Backfills: Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired roller, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction without pumping or rutting with the equipment used. Each layer shall be compacted to not less than the percentage of maximum density specified below:

Compaction	ASTM 0698 Percent Laboratory Maximum Density
Fills, earth embankments, and backfill	90
Under structures, building slabs, paved areas, and in utilities trenches	100
Cover Soil	*
Subgrades	**

* Cover soil for the cap shall be compacted in approximately 12-inch lifts with a minimum of 3 passes by a vibrating roller compactor weighing 2 tons or more.

** Subgrades of *in situ* material shall be proof rolled to a smooth compact surface without evidence of pumping.

C. Protection: Newly graded areas shall be protected from traffic and erosion. Settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. The storage or stockpiling of materials on the finished subgrade will not be permitted. Work shall be conducted in accordance with the environmental protection requirements of the contract. The finished subgrade shall not be disturbed by traffic or other operations and shall be protected and maintained by the Contractor in a satisfactory condition. Excavations, fill and backfill, embankments, and foundations shall be protected from frost damage. Displacement damage that occurs from frost action, including the loss of strength or thawing, shall be repaired or replaced as approved.

D. Finishing: The surface of excavations, embankments, fills and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Except for areas below river water surface, surfaces of embankments or excavated areas shall be within 0.1 foot of the grades and elevations indicated and surface of the finished subgrade shall not show deviation greater than 0.2 foot in any section. For areas below the river water surface, a grade tolerance of 1 foot is allowed.

3.09 Testing

A. Earthwork Testing: Laboratory tests to determine moisture-density relations for the same materials, shall be made as specified. Testing shall be the responsibility of the Contractor and shall be performed by an approved independent commercial testing laboratory. Copies of all laboratory and field test reports shall be submitted to the Engineer within 24 hours of the completion of the test. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

B. Fill and Backfill Material Gradation Including Borrow Materials: One representative test per 1,000 cubic yards stockpiled or in place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM D 421 and ASTM D 422.

C. In-Place Densities: In-place density testing will be performed by the Engineer in accordance with the approved Quality Assurance and Quality Control Plan.

D. Moisture Contents: In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be made. During unstable weather, tests shall be made as dictated by local conditions, and approved moisture contents shall be tested in accordance with ASTM D 2216.

E. Optimum Moisture and Laboratory Maximum Density: Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values in accordance with ASTM D 698. One representative test shall be made for each 1,000 cubic yard of fill and backfill or when a change in material occurs that may affect the optimum moisture content or laboratory maximum density used to measure field compaction.

F. Tolerance Tests for Subgrades: Continuous checks on the degree of finish specified shall be made during construction of the subgrades.

3.10 Special Conditions

A. Construction Operations: Because of the type of soil encountered at the site, all earthwork is to be completed with a minimum disturbance of the subgrade. Construction traffic will be kept off of the completed subgrade. No attempt should be made to compact the *in situ* subgrade. Areas

to receive cover material shall be placed by end dumping with appropriate precautions to prevent damage to the installed geotextile.

B. Geotextiles: The geotextiles shall be stored, handled, and installed in accordance with the manufacturer's recommendations. All geotextiles shall be protected from sunlight until installed. The fabric shall be placed upon the prepared subgrade for all areas to receive geotextiles. All joints in the geotextile shall be made using a 2-foot overlap. Traffic shall not be permitted directly on the installed fabric. The overlying subbase or base course shall be placed by end-dumping and spreading the material in front of the advancing construction equipment.

-- END OF SECTION 02200 --

SECTION 02275

RIPRAP

PART 1 - GENERAL

1.01 Description

The work specified in this section consists of labor, equipment, tools, materials, and services needed to provide and place riprap as described herein or shown on the Contract Drawings.

A. Items included in this section:

1. Riprap requirements for shoreline protection

B. Related work specified in other sections:

1. Section 01001 - General Requirements
2. Section 01564 - Erosion Control
3. Section 02200 - Earthwork
4. Section 02421 - Geotextiles
5. Section 02727 - Drainage Piping
6. Section 02910 - Riverbank Restoration/Wetland Creation

1.02 Submittals

A. Submit the name and location of the source of stone used.

B. Submit test reports on the materials including sieve analysis.

PART 2 - PRODUCTS

2.01 General

A. Riprap shall be clean, hard, durable, angular stone as delivered from an offsite source.

B. Riprap shall be free from organic matter, trash, debris, shale, snow, ice, and other frozen or mechanically deleterious materials.

C. Riprap shall be hard enough to withstand exposure to air, water, freezing, and thawing.

D. Riprap shall have a specific gravity greater than 2.6. Shale, siltstone, shaley sandstone, or any rock type containing clay minerals will not be acceptable as riprap.

2.02 Riprap

A. Riprap shall meet the gradation requirements as follows:

Stone Weight W. (lbs)	Percent Less Than W.
600	100%
100	0-50%
10	0-10%

PART 3 - EXECUTION

A. Earth subgrade surfaces on which the riprap is to be placed shall be cut or filled, graded, compacted to the lines and grades shown on the Drawings and as necessary to provide an even surface in accordance with specification Section 02200 Earthwork. The subgrade reinforcement shall be provided by installation of geotextile fabric in accordance with specification Section 02421 Geotextiles.

B. The riprap shall be placed in a manner that will that will minimize damage to the underlying geotextile and produce a well-graded mass of stone with smaller stone fragments filing the space between the larger ones, so as to result in the minimum practicable percentage of voids.

C. The riprap shall be placed gently. The riprap for above-water and installations shall not be dropped directly onto the reinforcement geotextile from a height of more than one foot. A carefully operated backhoe bucket may be used for placement of the riprap. For under-water installations, the riprap may be lowered from water surface to the subgrade by gravity, one at a time for any riprap greater than ten inches.

D. The final section of riprap shall be in conformance with the lines, grades, and thicknesses shown on the Drawings. Riprap used for bank or channel protection shall be placed to its fill course thickness in one operation, unless otherwise directed by the Engineer or specified in the special provisions, and in such a manner that the underlying material will not be displaced or worked into the layer of stone filling.

E. Placement of stone upon finished bedding material, when used, shall be carefully controlled to avoid disruption and damage to the layer of geotextile bedding material. The stone shall be so placed and distributed that there will be no pockets of uniform size material.

F. The desired distribution of the various sizes of stone throughout the mass shall be obtained by selective loading of the material at the quarry or other source; by controlled dumping of successive loads during final placing, or by other methods of placement which will produce the specified results. Rearranging of individual stones by mechanical equipment shall be minimized to avoid excessive damages to the underlying geotextile.

G. The riprap shall be placed starting at the bottom of the placement areas and proceed to the top, or in such a manner that stone will not slide or roll down during their placement. On slopes, the largest riprap shall be placed at the bottom of the slope.

H. Geotextile shall be placed beneath riprap in accordance with Section 02421.

I. The ground surface on which riprap protection is to be placed shall be free of brush, trees, stumps, and other objectionable material and shall be dressed to a smooth surface. Do not replace riprap over frozen or spongy subgrade surfaces. Unsuitable subgrade shall be removed in accordance with Section 02081. Voids shall be filled with additional riprap.

J. Riprap shall be placed to allow the weight of the stone to be carried by the underlying material and not by the adjacent stones.

– END OF SECTION 02275 –

SECTION 02296

CUTOFF WALL

PART 1 - GENERAL

1.01 Description

Work under this Section consists of furnishing all labor, equipment, materials, testing and quality control and supervision for constructing a soil-bentonite trench or cutoff wall, hereafter referred to as the cutoff wall. The cutoff wall shall be constructed around the perimeter of the site as shown on Drawing C-2 to the alignment as specified herein and depths shown on Drawings C-3 through C-5. The cutoff wall shall consist of a mixture of bentonite slurry and select materials from designated borrow areas. The cutoff wall shall have the backfill designed for long term coefficient of permeability of 1×10^{-7} cm/sec or less and physical properties within the parameters stated herein. The work shall include, but not necessarily be limited to the following:

1. Providing bentonite slurry, including all materials, equipment (i.e. mixing, storage, pumping, and testing equipment) and maintenance of equipment and laboratory testing of materials for required physical properties.
2. Excavation of a slurry trench, maintenance of trench stability and bentonite slurry levels.
3. Providing soil-bentonite backfill, including mixing and placing of the soil-bentonite backfill.
4. Cleanup and restoration of the site and facilities, including disposal of spoil, debris and slurry onsite in areas designated by the Owner.
5. Protection and maintenance of the site during construction containing onsite contaminated soil and fluids.
6. Backfill Mix
   A. Using the backfill mix developed by Remcor Inc. (i.e., 1 percent dry bentonite by weight, 10 percent clay (minus 0.002 mm), 32 percent silt (0.002-0.075 mm), 38 percent sand (0.075-4.75 mm), and 20 percent medium to fine gravel (4.75-20 mm)) for cutoff wall backfill, performing laboratory tests on backfill samples, backfill, or
   B. Developing a backfill design mix, prior to the start of construction that includes performing laboratory permeability and compatibility tests on the backfill design mix to demonstrate that it will meet the requirements of this Specification.
   C. The Contractor shall be responsible to provide materials and quality control to meet the design parameters.
7. Developing a written Quality Control Program prior to the start of construction which will include the types and frequency of tests and measurements that the Contractor will use to verify that the work is in accordance with this Specification, and implementation/documentation of the Quality Control Program during construction of the cutoff wall.

8. Grout, seal or reconstruct cutoff wall at all points of leakage and provide a continuous cutoff wall system.

9. Clean, cover and protect the top of the cutoff wall and trench during construction for crossing of equipment and protection of final wall treatment.

1.02 Objective

The Contractor shall provide a low-permeability vertical barrier that will minimize the quantity of groundwater that leaves the site and the quantity of groundwater that enters the site. The objective will be accomplished by construction of a cutoff wall keyed three feet minimum into the specified clay stratum layer as shown on the Drawings.

1.03 Definitions

The following terms are defined as follows:

A. Cutoff Wall

A cutoff wall is a wall of specified width, excavated in the existing or backfilled soils by the slurry trench method of excavation, and backfilled with a specified material to form a vertical barrier with a design long-term coefficient of permeability equal to or less than 1 x 10^{-7} cm/sec; referred to herein as the cutoff wall.

B. Slurry Trench Method of Excavation

The slurry trench method of excavation consists of excavating a continuous trench in the existing or backfilled soils while at the same time keeping the trench filled with bentonite slurry; the basic purpose of the slurry is to provide support for the walls of the trench until the slurry is displaced by the backfill.

C. Slurry

Slurry is a colloidal thixotropic suspension of bentonite in water.

D. Bentonite

Bentonite is a natural clay whose principal mineral constituent is sodium montmorillonite.

E. Surface Water

Surface water is all water that enters the work area above the ground surface from either natural or artificial sources.

F. Work Area

The limits of the work as shown on the Drawings.

G. Groundwater

Groundwater denotes all water below the existing ground surface within the work area.

H. Working Pad

The working pad is the surface on which the equipment shall operate to excavate the cutoff wall. The elevation of this surface along the alignment of the trench shall be such that it does not cause slurry in any part of the open trench to be more than 2 feet below the top of the trench, unless specifically approved in writing by the Owner or the Engineer. The

working level of the slurry wall shall be maintained with a minimum 3 feet head differential over the groundwater level.

I. Backfill

The thoroughly blended mixture of bentonite slurry, select materials excavated from the trench and/or supplied from borrow areas, and powdered bentonite having a coefficient of permeability equal to or less than 5×10^{-8} cm/sec as determined in a laboratory flexible wall permeameter at an effective confining stress of 5 lbs/in^2 (P.S.I.) and having physical properties within the tolerances stated in Section 3.04. The required laboratory measured coefficient of permeability on the backfill (i.e., 5×10^{-8} cm/sec) is one half the design long-term *in situ* coefficient of permeability of the cutoff wall (i.e. $\leq 1 \times 10^{-7}$ cm/sec).

J. Select Materials

Materials obtained from onsite or offsite borrow sources suitable for use in the backfill to achieve the required gradation and permeability of the cutoff wall.

K. Mixing Area

The area in which all mixing and blending of soil and bentonite slurry (and dry bentonite, if necessary) shall take place. This mixing area may be along the side of the trench or elsewhere onsite. After mixing, blended materials will be transported to the slurry trench in such a manner as to preclude the segregation of backfill material and mixing with non-approved fill or work platform materials.

L. Keying Stratum

The clay stratum indicted in Drawings C-2 through C-4 into which the cutoff wall shall terminate. This clay stratum is classified as CH-soil in the borings.

1.04 References

Materials requirements and tests performed on the specified materials shall conform to the most recent issue of the following standards. In the event of a conflict between this Specification and the referenced standards, this Specification shall govern.

A. American Petroleum Institute (API)

1. API Specification 13A: "Specification for Oil Well Drilling Fluid Materials", 14th Edition, August 1, 1990.
2. API, 13B-1 Recommended Practice: "Standard Procedure for Field Testing Water-Based Drilling Fluids", 1st Edition, June 1, 1990.

B. American Society for Testing Materials (ASTM)

1. ASTM C-143: "Test for Slump of Portland Cement Concrete"
2. ASTM D-422: "Particle-Size Analysis of Soils"
3. ASTM D-1140: "Amount of Material Finer Than No. 200 Sieve
4. ASTM D-2116: "Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil Aggregate Mixtures"
5. ASTM D-4318: "Liquid Limit, Plastic Limit, and Plasticity Index of Soils"

6. ASTM D-5084: "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Well Permeameter"
7. ASTM D-4380: "Density of Bentonite Slurries"
8. ASTM D-4381: "Sand Content by Volume of Bentonite Slurries:

1.05 Qualifications

The Contractor shall submit with his bid, written evidence of experience and competence of Contractor or specialty Subcontractor in soil-bentonite cutoff wall construction as herein described. The evidence shall demonstrate the following:

1. A minimum of five years experience in soil-bentonite cutoff wall construction, including a list of four recently completed projects with the names, telephone numbers and addresses of the Owner and Engineer and responsible person to contact for verification of the information. The listed projects shall indicate experience in constructing cutoff walls to the depths and widths required by this Specification.
2. Sufficient appropriate equipment and experienced personnel to carry out the work.
3. The names and resumes of the people considered for assignment as the Project Manager and Foreman/Superintendent. These personnel shall be experienced in the type of work specified herein. If, in the opinion of the Engineer, the safety, quality, or progress of the cutoff wall work is being impaired by a shortage of Contractor's qualified personnel, the Contractor shall assign additional qualified personnel to the work that are acceptable to the Engineer, and approved by the Owner.

1.06 Submittals

The Contractor shall submit, for review and comment by the Engineer, the following items four (4) weeks prior to starting the work:

1. Work Procedures: A complete description of the procedures he intends to use to perform the work including:
   a. Material handling, transport, and storage.
   b. Submit a plan showing work areas and sequence of slurry trench excavation. Method for excavating full trench depth and clean-out of trench bottom and trench slopes during work shutdowns.
   c. Slurry mixing, storing, and transporting. Time of hydration and delivery to trench.
   d. Backfill mixing, placement and protection during construction.
   e. Disposal of excess slurry and backfill onsite, including methods to stabilize these materials before disposal.
   f. Method for measuring trench depth, thickness of sediment on trench bottom and vertical, horizontal location control for measurement.
   g. Method for protection of utilities, roadways, structures and river banks.
   h. Method for grouting, scaling or reconstruct wall at points of leakage, if any.
2. Quality Control Program: A proposed quality control program for the work in conformance with the requirements of this Specification, including proposed test data

sheets and procedures, testing frequencies, sketches and information on testing equipment, and the name of the laboratory the Contractor intends to use to perform the laboratory tests required in the accepted Quality Control Program. The program shall at a minimum, meet the requirements of Section 3.07 of this Specification.

3. Equipment Schedule: A list and quantity of equipment, by size, type, and capacity/capability which he proposes to use for the work. The list shall include excavation equipment, slurry mixing, storing, transporting and cleaning equipment, trench bottom cleaning equipment, backfill mixing and placement equipment, and other tools and appurtenances required to complete the work and facilitate its inspection by the Engineer.

4. Materials:

   Documents on the sources of soil and bentonite for use in the backfill mix. Documents certifying the properties of bentonite, mixing water, and other materials that the Contractor proposes to use for the work. At the Engineer's request, the Contractor shall furnish samples of any materials in sufficient amount for independent testing.

5. Backfill Design Mix:

   A. Use the backfill mix developed by Remcor Inc. (see description under Part 1).

   B. Develop a new backfill mix conforming to this specification.

   Results of laboratory gradation, moisture content, slump and plasticity index analyses and permeability test results on the design mix(es) the Contractor proposes to use for the work. The design mix(es) shall use the same bentonite water, and additives (if any) that the Contractor is planning to use in the field.

6. Reports and Procedures:

   A. A signed laboratory report by an independent testing agency for soil bentonite backfill materials should be submitted and include gradation, trial moisture contents, mix proportions, slump, and laboratory permeability for 4 samples of the mix using the same materials proposed for use by the Contractor.

   B. A quality control procedure for sampling, testing frequency and reporting all materials and backfill specified should be submitted. It should conform to the requirements of Section 3.07, "Inspection and Testing."

1.07 Subsurface Conditions

Contractor should examine the site, records of existing utilities and construction, and the subsurface investigation reports for the site. Detailed data on subsurface conditions at the site are contained on Drawings C-3, C-4, and C-5.

The Owner makes no warranty, expressed or implied, of the subsurface conditions stated herein.

PART 2 - PRODUCTS

2.01 Materials

A. Bentonite

Bentonites for use in trench excavation shall conform to Sections 4, 12 and 13 of A.P.I. 13A. Bentonite used in preparing the backfill mix slurry shall be "SW-101" as manufactured by WYO-BEN, Inc., or approved equal. The bentonite shall be covered to

protect it from the elements and contaminants in transit to and in storage at the site. The bentonite Manufacturer's Certification Report shall be provided by the Contractor with each shipment.

B. Water

Water used in preparing the bentonite slurry shall be potable city water or approved equal which are free from deleterious amounts of oil, salts, organic matter, or other deleterious substances such that the resulting slurry has the necessary properties to provide stability of the trench and to provide the desired backfill characteristics. The total dissolved solids shall be less than 500 ppm. The Contractor shall submit to the Engineer for comment the water quality test (pH, dissolved solids and chlorides) results and the location of the source or sources of water.

C. Additives to Slurry

No additives such as dispersants, plugging agents, and/or softeners may be added to the water or slurry so as to obtain proper workability of the slurry and efficient use of the bentonite unless the Contractor can prove by performing laboratory tests that the additives will not adversely effect the design backfill mix (i.e. increase its permeability). Additives to the slurry shall be approved by the Engineer prior to use in the slurry and shall not affect the trench stability or cleaning of the trench before backfill placement.

D. Backfill

The soil material placed as backfill in the trench shall consist of a mixture of select excavated soils and/or soils obtained from a borrow area and bentonite slurry (and dry bentonite, if required) demonstrated by laboratory design mix testing as having a permeability equal to or less than 5×10^{-8} cm/sec as determined in a flexible wall permeameter at an effective confining stress of 5 pounds pre square inch (P.S.I.). The blended backfill material shall be free of wood, roots, organic soil, trash, debris, soil clods greater than 1 inch, lumps or stones larger than three inches in diameter, frozen material of any kind, or other deleterious materials. The backfill shall be thoroughly mixed and shall not contain unmixed pockets of slurry or soil exceeding 2 inches in diameter. Dry bentonite added to the backfill mix shall be evenly distributed within the mixed materials. The physical properties of the backfill shall fall within the ranges given in Section 3.04.

2.02 Equipment

A. Slurry Mixing Plant

The Contractor's slurry plant shall include a mixer capable of producing a colloidal suspension of bentonite in water, and agitator, pumps, and necessary valves, hoses, supply lines, above ground storage tanks, and other equipment as needed to provide an adequate supply of hydrated slurry to the trench excavation. The Contractor shall provide the necessary valves, hoses, and other necessary items to bring water to the mixing area. The mixer used in preparing the slurry may be a high-speed colloidal-type mixer, or another type capable of achieving complete dispersion of bentonite, and capable of continually mixing to provide a uniform and thoroughly blended slurry. Fully mixed slurry shall be hydrated a minimum of 8 hours prior to in-trench or in-backfill use.

Hand mixing or trench mixing of the slurry shall not be allowed.

Storage of the slurry shall be in above-ground tanks only. The storage facilities shall be of sufficient size to accommodate the trench excavation rate and to allow complete hydration (minimum of 8 hours) of the bentonite before mixing with additives. The storage facilities shall be equipped with a circulation system for agitation of the slurry and shall have adequate capacity to provide fully hydrated slurry to the trench if substantial loss of slurry from the trench occurs.

B. Excavation Equipment

Equipment for excavating the slurry trench shall consist of either a backhoe or special slurry trench equipment (i.e. clam shell) or combinations of such equipment capable of continuously excavating the required alignment and width of trench to its final depth. The equipment shall be capable of excavating the minimum required width in a single pass of the excavating tool. The width of the excavating tool shall be equal to or greater than the specified width of the cutoff wall. Special chopping tools or similar equipment may be used to assist excavation in hard formations. Air lift pumps excavator bucket and slurry desanders or other cleaning buckets or appropriate tools and equipment shall be used as necessary to clean the trench bottom and/or slurry, as required. In case shall an excavator be permitted to operate over an open trench filled only with slurry.

C. Backfill Equipment

Equipment for mixing the backfill shall be suitable types of earthmoving or grading equipment, or mechanical blender that are capable of thoroughly mixing and blending the backfill materials into a relatively homogeneous mass meeting the required physical properties. Equipment for placing the backfill into the trench shall be capable of placing the backfill in a controlled manner so as to produce a uniform, continuous cutoff wall without causing segregation of the backfill components, accumulation of non-approved backfill components or trapped pockets of slurry.

D. Field Testing Equipment

the Contractor should supply an enclosed and protected laboratory. It should contain as a minimum the following equipment:

a. Slump cone and rod for backfill slump test
b. Marsh funnel sets
c. Standard API filter press
d. Mud balance - direct reading type of density
e. Slurry sampler
f. U.S. Standard Sieves and sieve shaker
g. Oven for moisture content and gradation testing
h. pH coding paper strips, or pH meters
i. Mixer
j. Storage cylinders for backfill permeability tests
k. Sand content sets
l. Sounding weights for determining depth of suspended solids falling to the trench before the start of backfilling.

PART 3 - EXECUTION

General Execution Requirements

A. Location and Dimensions

The cutoff wall shall be constructed to the lines, depths, and widths on the Drawings, unless otherwise directed by the Engineer.

1. Depth: The depth of the cutoff wall shall extend from the top of the working pad, through the site fill and natural overburden soils, and to the bottom of the cutoff wall as shown on the Drawings, penetrating a minimum of 3 feet or greater into the key stratum. The keying stratum shall be the clay layer.

   After examination of the bottom material, the Engineer shall determine the necessity for adjusting the trench depth. After the trench excavation reaches the accepted depth, the Contractor shall measure and document the actual depth of the cutoff wall.

2. Width: The minimum required width of the cutoff wall is 36 inches and shall extend for the entire depth of the cutoff wall. Contractor shall document the actual width of the cutoff wall for the entire depth the wall. Should the Contractor elect, for his own convenience, to construct a wider cutoff wall, the additional width and materials will be at no additional cost to the Owner.

3. Corners: Any abrupt corners of the bottom of the cutoff wall shall overlap a minimum of 5 feet for the entire depth of the wall as shown on the Drawings. If a backhoe excavated re-entrant corners a suitable trench slope beyond the 5 feet minimum shall be used as determined by the backfill design and trench depth.

B. Maintenance of Site

1. Working Surface: During the course of construction, the Contractor shall maintain the working surface in such a condition so as not to impair the construction operations, including excavation of the slurry trench, quality of the bentonite slurry and backfill, stability of the trench walls access to the trench for observations and measurements, and trafficability of vehicles associated with the work. Any deterioration of the working surface shall be promptly repaired by the Contractor so as not to delay the work. The Contractor shall provide a working surface a minimum 3 feet above the groundwater level.

2. Site Drainage: The Contractor shall familiarize himself with the surface water drainage patterns of the site. The Contractor shall provide and maintain a drainage system consisting of berms, ditches, sumps, and pumps as required to direct and remove surface water from the area so that is does not flow into the slurry trench or the soil bentonite backfill mixing areas. The intent is to minimize the erosion of the completed cutoff wall and spreading of slurry and contaminated materials over the work area.

   Stormwater collected in the Contractor's drainage system shall be directed into the existing drainage system. The Contractor shall provide site drainage in the areas of his work that shall include berms and swales so as to prevent drainage of surface water into the slurry trench.

3. Spillage of Slurry: The Contractor shall be responsible to contain within the work area any spillage of slurry or runoff containing bentonite. The Contractor shall promptly clean up a spillage of slurry and dispose of it onsite in accordance with the approved plan for slurry disposal (refer to 1.06-1.e).

4. Onsite Access: The Contractor shall not cause blockage of site entrance, exit, and access roads, except as approved by the Owner.

5. Dust Control: A dust control plan shall be submitted by the Contractor, approved by the Owner, and implemented by the Contractor. Adjustments and/or modifications that are deemed necessary by the Health and Safety Officer must be added at the Contractor's expense.

3.02 Bentonite Slurry

A. Method of Mixing and Storage

The bentonite slurry shall be prepared by mixing bentonite with water in an approved mixer that achieves complete dispersion of the bentonite particles.

The bentonite slurry shall be allowed to hydrate completely before its use in the trench. Hydration may be accomplished by storing the slurry in a tank or pit with a circulation system. The bentonite slurry shall meet the density, pH, sand content, viscosity and fluid loss proportions and properties. The bentonite slurry shall be stored under essentially constant-circulation until used. Circulation may cease for short periods when construction activities are not in progress (i.e. weekends, holidays).

B. Proportions and Properties

1. Proportions and Initial Properties: The bentonite slurry shall have properties, when completely hydrated, within the following limits:

Bentonite Content	5 percent or greater (by weight)
Density	1.03g/cm^3 (65 lb/ft^3) minimum
Viscosity	40 seconds minimum at 65° F (Marsh Funnel Method, API 13B-1)
Filtrate Loss	less than 20 cc in 30 min at 100 lb/in^2 pressure
pH	between 6.5 and 9

2. Properties in the Trench: The bentonite-water slurry as used for trench stabilization shall have properties in the trench within the following limits:

Density	1.03 to 1.20 g/cm^3 (65 to 75 lb/ft^3)
Viscosity	$\geq$ 40 seconds but less than 80 seconds at 65° F (Marsh Funnel Method, API 13B-1)
Sand Content	less than 12 percent (by volume) at 5 feet above bottom of trench. (Section 5 of API 13 B-1)
pH	$\geq$ 6.5, but less than 9

The Contractor shall maintain the properties of the slurry in the trench. The use of additives, recirculation, or replacement must be approved. At all times, the backfill density shall be at least 0.25 g/cm^3 (16 lb/ft^3) greater than the slurry density as measured at the bottom of the trench.

3.03 Excavation

A. Excavation Procedure: Excavation shall not start until (1) the laboratory report of the backfill design mix has been received by the Engineer and a backfill design mix has been accepted, (2) an adequate supply of fully hydrated slurry is available, (3) the backfill mixing area has been prepared, (4) site safety regulations have been fulfilled and required worker's protection has been provided, and (5) all equipment, materials, supplies and labor/supervision has been furnished.

The trench shall be excavated vertically from the ground surface through the site backfill and natural overburden soils as shown on the Drawings. Excavation of the slurry trench shall be accomplished by the equipment accepted by the Engineer. The accepted equipment shall excavate in a manner to provide a continuous cut-off wall along the alignment of the trench from the starting point to the finishing point. Pre-augering, chiseling, or other suitable methods may be used when necessary to excavate of existing materials, structures and hard materials. Use of such equipment shall not be done without the prior acceptance of the Engineer.

Bentonite slurry shall be introduced into the trench at the beginning of excavation and shall be maintained at a level no more than two feet below the top of the trench. As shown on the Drawings, the existing grade may vary as much as four feet along the alignment of the cutoff wall. The Contractor shall perform any work needed to maintain the slurry level at no more than two feet below the top of the trench. The Contractor shall maintain the stability of the excavated trench at all times (including weekends and/or holidays) for its full depth.

The soil excavated from the trench shall be hauled to an onsite disposal area within the cap limits. The excavated soil shall not be stockpiled within 20 feet from the edge of the trench or as directed by the Engineer to maintain trench stability. Provide berms or other suitable means to prevent unsuitable backfill from entering trench.

The Contractor shall allow time during the excavation cycle for inspection of the work and measurements by the Engineer. The Contractor shall provide:

1. Suitable means of access to the trench, e.g., movable trench bridge, for inspection and depth measurements.
2. Labor to assist the Engineer in measuring the depth of the trench.
3. A suitable depth measuring device with prominent markers at one-foot intervals.
4. The contractor shall provide a suitable trench tool or buckets to verify the minimum width.
5. Samples of keying stratum to the Engineer for approval of wall depth.

B. Key: Excavation shall be to the minimum depths shown on Drawings C-3, C-4, and C-5. When the design depth of trench, as shown on the drawings, has been reached, the Engineer will inspect the cuttings brought up by the excavating tools to verify that the trench is keyed into the clay layer. If the Engineer directs that additional excavation depth is required, this will be directed as a field change order, and additional compensation based on the additional area of trench/cutoff wall required will be paid.

C. Trench Bottom Cleaning: Upon completion of excavation, and prior to the backfill placement, loose material greater than 6 inches in thickness shall be removed from the bottom of the trench by suitable means. The bottom surface shall be checked for sediment by the Engineer, by means of a sounding tool with a flat weighted bottom and tape or other suitable devices, supplied by the Contractor.

D. Excavation Sounding: Sound trench a maximum spacing of every 10 feet along alignment to measure depth in the presence of the Engineer. Sound trench immediately following cleaning of trench bottom and prior to placement of backfill. Perform sounding of trench using two separate sounding tools at each location, one with an end area of 1 square inch, weighing 7 pounds, and the other with an end area of 20 square inches, also weighing 7 pounds. The sounding tools shall be a type approved by the Engineer. The difference in depth measurements between sounding tools indicates accumulated debris or sediment on the excavation bottom. If the flat weight sounding is six inches or more above the pointed weight sounding, clean trench bottom and re-sound.

3.04 Backfill

A. Mixing: The select import fill material shall be mixed with new or trench bentonite slurry to achieve a homogeneous mixture meeting the physical properties and permeability criteria specified. The addition of water will not be permitted. Mixing shall be accomplished adjacent to the trench or at a remote location by equipment proposed by the Contractor and accepted by the Engineer. Mixing should continue until the soil-bentonite backfill is a homogeneous mixture with a consistency necessary to maintain the desired backfill slopes (see paragraph B, "Placement"). The backfill shall not contain unmixed pockets of slurry or soil. The maximum size of clay lumps permitted in the backfill shall be 1 inch. Backfill mixing shall be far enough away from the trench to avoid spillage into the trench.

B. Placement: No backfill shall be placed in the trench until that portion of the trench has been accepted by the Engineer. The backfill shall be placed in such a manner so as not to trap pockets of slurry within the backfill. Placement of backfill shall begin at the point of start of trench excavation and proceed in the direction of the excavation.

Backfilling shall not start until the length of the trench is at least ten times the average depth. Placement of backfill in the first section shall be done by lowering the bucket of the excavating equipment or a tremie pipe to the bottom of the trench and discharging the backfill directly on the bottom of the trench at the starting point of excavation. This process of placement shall be continued (i.e. discharging backfill directly on top of previously placed backfill) until the level of the backfill reaches the top of the trench in the first section and the backfill has formed a uniform scope from the bottom of the trench to the top of the trench.

Free-dropping of the backfill through the slurry will not be permitted. Also, pumping of backfill shall not be permitted.

After initial backfill has been placed so that its surface rises to the top of the trench (above the slurry level), additional backfill may be placed at the top of the previously deposited backfill, by pushing additional backfill with the blade of a dozer or placing the backfill with a front-end loader, so that the backfill below the slurry level will slowly slide down the slope of the previously placed backfill. The location where the backfill is pushed into

the trench shall be a minimum of 10 feet behind the portion of the advancing surface of backfill that has risen to the top of the trench.

The consistency of the backfill shall be such that the slope of backfill is between 6 (horizontal) to 1 (vertical) and 10 (horizontal) to 1 (vertical). A distance of not less than 40 feet and not more than 100 feet shall be maintained between the toe of the advancing slope of the backfill and the portion of the trench being excavated and cleaned, unless otherwise accepted by the Engineer.

Backfill shall not be placed if the average air temperature is less than 25 degrees Fahrenheit. Frozen backfill shall not be placed.

The Contractor shall avoid excessive delays (i.e. more than two working days) in the placement of backfill once this operation begins. The Contractor shall remove all sand layers that may develop on the surface of the backfill in the trench to the satisfaction of the Engineer.

C. Proportions and Properties: The slump of the backfill shall range from 3 inches to 6 inches. This requirement may be varied by the Engineer in order to improve the slope of the backfill and integrity of the cutoff wall.

The backfill shall consist of a well graded material with 25 to 40 percent (by dry weight) passing the No. 200 sieve (U.S. size), 60 to 75 percent (by dry weight) passing the No. 4 sieve (U.S. size), and 100 percent (by dry weight) passing the 3 inch sieve (U.S. size). Stiff clays must be pulverized to perform as fines, rather than clay lumps.

The soil used in the backfill shall have plasticity index (as defined in ASTM D-4318) of two or greater. The backfill shall have an average and maximum water content of 30 percent and 40 percent, respectively.

At least 80 percent of the laboratory permeability test results on the design backfill mix shall have a permeability of less than or equal to 5×10^{-8} cm/sec with no result exceeding 1×10^{-7} cm/sec as determined in the laboratory in the flexible wall permeameter at an effective confining stress of 5 p.i.s. The hydraulic gradient shall not exceed 40 for any test.

3.05 Top of Cutoff Wall

Backfill shall be placed in the slurry trench to the grades shown on the Drawings. If, during the course of construction, the level of the backfill settles more than 6 inches below the design grades, the Contractor shall place additional backfill in the trench to the design grades. The Contractor shall pump off any free standing water that forms on top of the backfill.

The Contractor shall protect the surface of the cutoff wall to prevent desiccation cracks from forming on the backfill. The Contractor shall repair any desiccation cracks that form in the backfill to the satisfaction of the Engineer.

3.06 Cleanup and Restoration

A. Working Surface

After completion of the cutoff wall construction, the Contractor shall remove any remaining excavated material, slurry, or backfill from the working pad or areas outside of the remediation area. The removed materials shall be dewatered by gravity (as needed), solidified (as needed), and compacted under the proposed cap.

B. Working Areas and Access Roads

The Contractor shall remove from the work areas and from the access roads any excess or spilled slurry, excavation spoil, or backfill material and all equipment, temporary structures, and debris incidental to his operations. The work areas and access roads shall be restored to the satisfaction of the Owner.

C. Excess Material

Excess material excavated from the trench, excess backfill, and excess slurry shall be disposed of onsite as general fill in the proposed cap areas. The Contractor shall, however, minimize the amount of excess materials by prudent planning of material use. The excess spoils and slurry shall be stabilized by adding cement to it as it is pumped through a mixer, before it is disposed of onsite. The stabilized spoils and slurry shall be strong enough to allow placement and compaction of the site capping system above it. The Contractor shall submit detailed procedures for stabilizing the spoils and slurry to the Quality Assurance Engineer for comment, prior to performing this work. The disposal of all excess materials shall be done in a manner acceptable to the Engineer.

3.07 Inspection and Testing

A. General

Quality control of construction of the cutoff wall shall be the responsibility of the Contractor. The Contractor's quality control activities during construction shall follow the accepted Quality Control Program and measurements and tests requested by the Engineer. The Contractor must submit his Quality Control Program for approval by the Engineer and Owner before commencing work.

The Contractor shall record the results of all quality control activities on approved forms and furnish one copy daily test results taken within 2 hours or by the end of the work period to the Engineer. The results of laboratory tests within 36 hours of testing shall be in the form of a laboratory report and one copy furnished to the Engineer. Recording of all quality control activities shall be referenced by date, time, station, and depths, as appropriate.

The Engineer may make additional measurements and tests as he deems necessary to determine the acceptability of the work. The additional measurements and tests made by the Engineer do not relieve the Contractor from his obligation to perform his own quality control work.

B. Observations and Measurements During Construction

1. Keying Stratum

The Contractor shall observe the materials being excavated from the trench. When the design depth has been reached, as evidenced by depth measurements and inspection of the cuttings brought up by the excavating tools, the Contractor shall notify the Engineer for verification that the keying stratum has been reached, and shall measure the depth of the trench at that point. Such observations and measurements shall be made and recorded at intervals not exceeding 10 feet along the alignment of the trench.

2. Bottom of Trench

After the required depth of trench has been reached and the bottom cleaned, the Contractor shall sound the bottom with an appropriate tool to check for excessive sediment, as described in paragraph 3.03, to determine whether additional bottom cleaning is required. The Engineer will observe the sounding operation and indicate whether the bottom is acceptable for backfilling. Such soundings shall be made and recorded at intervals not exceeding 10 feet along the alignment of the trench. The Contractor shall also sample the bottom of the trench for sediment, to determine if additional bottom cleaning is required. The sampling device shall be acceptable to the QA Engineer. If there is more than 6-inches of sediment at the trench bottom, additional bottom cleaning will be conducted by the Contractor.

3. Depth and Width of Trench

After cleaning and acceptance of the bottom of the trench by the Engineer, the Contractor shall measure the depth of the trench to within 0.1 feet with an appropriate device. The Engineer will observe the measurement operation. Such measurements shall be made and recorded at intervals not exceeding 10 feet along the alignment of the trench. The sampling device shall be acceptable to the QA Engineer.

Width of trench shall be as specified on drawings (3 feet minimum).

4. Backfill

The bottom of the slurry-filled trench shall be cleaned of all loose material prior to the placement of backfill. Backfill shall be placed in such a manner that the backfill displaces the slurry progressively from the bottom, rising uniformly to the surface, and such that intermixing of the backfill and slurry will not occur. Free dropping of backfill through the slurry will not be permitted. Initially, the backfill shall be placed into the trench at one location only by placement at the bottom of the trench through a tremie pipe or by clamshell bucket until the backfill material emerges from the slurry. If a lead-in excavation in front of the starting location is used, then a slope no steeper than 1 vertical to 2 horizontal slope shall be used.

If the backfill placement is not continuous from the beginning of the trench in the direction of the excavation to the end of trench, or work is stopped for more than approximately 4-6 hours, the face of the backfill slope shall be sampled and (if required) cleaned prior to the placement of additional backfill.

As backfill is being placed, the Contractor shall determine the slope and uniformity of slope which the backfill forms by making depth measurements to the top of the backfill at intervals not exceeding 10 feet along the slope at least once daily. The Engineer will observe the measurement operation.

C. Sampling and Testing

1. Bentonite

A sample of delivered bentonite shall be tested for chemical composition, pH, gel strength, and fines (percent pass No. 200 sieve).

2. Slurry

The minimum slurry level shall be 3 feet above the groundwater level and within 2 feet from the top of working pad. Samples of freshly mixed slurry and samples of

slurry recirculated from the trench, taken from the storage points, shall be tested for density and viscosity at least twice daily and for filtrate loss for each batch of bentonite mixed. pH should be tested twice weekly. Samples of slurry in the trench, taken from approximately mid-depth near the point of excavation, shall be tested for density and viscosity at least two times daily. Samples of slurry taken from near the base of the trench, shall be tested for density and viscosity at least three times a week.

3. Water

   A sample of the water used for making the slurry shall be tested for pH and total dissolved solids once at the start of the work and once each time the water source is changed. The Engineer may request additional tests if slurry properties or behavior indicate the necessity for additional tests.

4. Backfill

   Samples of the backfill taken from the mixing area shall be tested for gradation, density and slump at least twice daily. Moisture content, gradation and permeability field tests are required for every 500 cubic yard of backfill or additional tests if contractor changes backfill supply or bentonite. Twice a week, the Contractor shall take a 5-pound sample for the backfill from the mixing area at the locations accepted by the Engineer and ship it to the Contractor's laboratory for permeability testing in a flexible-wall permeameter. However, for the first week of backfill placement, the Contractor shall perform a laboratory permeability test in a flexible-wall permeameter once daily. Test results shall be reported within 5 working days of sampling.

5. Keying Stratum

   Samples of the soil from the keying stratum shall be taken by means of a special sampling device attached to the end of the excavating tool or may be taken from the bucket. The samples shall be given to the Engineer for inspection and then stored in jars labeled with the station and depth of the sample. The samples shall be taken at intervals not exceeding 25 feet along the alignment of the trench.

   Moisture content, gradation and permeability field tests are required for every 500 cubic yards of backfill, with additional tests if the Contractor changes backfill supply or bentonite.

   The overall out-of-plumb tolerance for the entire cut-off wall from top to bottom shall not exceed 2.0% of the height of the cut-off wall at any point. The construction alignment of the cut-off wall shall be limited to a lateral dimension of two feet from the design location at any point. Alignment changes as necessary to bypass obstructions may be made with the approval of the Engineer. Alignment changes should be coordinated with pre-excavation for obstructions and backfill for the slurry trench working platform.

-- END OF SECTION 02296 --

SECTION 02350

PILES

PART 1 - GENERAL

1.01 Description

A. This section describes the furnishing and installation of steel H-piles at locations shown on the Drawings or as directed by the Engineer.

B. The minimum design load bearing capacity of each pile shall be 27 tons.

C. Related work specified in other sections

1. Section 03200 - Concrete Reinforcement
2. Section 03300 - Cast-in-Place Concrete

1.02 Quality Control

A. Reference specification and standards: ASTM A36.

B. Pile Installation Inspection: An Engineer will be engaged by the Owner, who shall act as the direct representative of the Owner and shall be present and exercise continuous inspection of all pile installation. He shall maintain the official driving log, and file required reports of completion of pile work. Costs for all such inspections will be paid by the Owner, except the costs of reinspection of work replacing nonconforming work, which shall be borne by the Contractor. All work shall be done in accordance with the Contract Drawings and these specifications.

1.03 Submittals

A. Chemical and physical analysis certificates of the steel used in the manufacture of steel H-piles.

B. At least 15 days prior to any pile or test pile installation, submit a detailed work plan specifying the pile driving system, the type of equipment to be used, pile length order list, and other pertinent information for Engineer's review and approval.

C. Coal tar epoxy proposed for pile coating and recommendations from the pile manufacturer and coating supplier on thickness and coverage of coating.

D. Documentation on the qualifications of the pile welder.

1.04 Qualifications

A. Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code" D1.1, Section 5, Qualification.

B. Provide certification that all welders employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within the previous 12 months. Contractor shall ensure that all certifications are kept current.

PART 2 - PRODUCTS

2.01 General

A. H-piles shall be at least HP8X36.

B. All bearing piles within a group shall be of the same type and be of equal load capacity.

2.02 H-Piles

A. Steel used for the fabrication of the H-piles shall conform to ASTM A36.

B. Steel H-piles shall be domestically produced with section size and weight as shown on Drawings S-2 and S-3.

2.03 Pile Top Plates

A. After pile is cut off, weld top plates in place square and level. The top plate size shall match the outside dimensions of the piles and be 7/16 inch thick of ASTM A-36 steel.

2.04 Ordering Lengths

A. The lengths of piles on the plans are estimated and may be varied to conform to conditions actually encountered. The Engineer will approve the lengths of piles to be ordered, basing his decision upon the best information available at the time the order is placed. Production piles shall be ordered in accordance with Section 3.02C.

2.05 Pile Coating

A. H-piles shall have a factory applied coal tar epoxy in thickness and coverage recommended by the pile manufacturer and coating supplier as approved by the Engineer. The coal tar epoxy shall be Kop-Coat Bitumastic No. 300M or equal.

PART 3 - EXECUTION

3.01 H-Pile Driving Equipment

A. General: Use pile driving equipment and systems of the type and capacity suited to the pile characteristics and the subsoil conditions.

B. Hammer: Use pile driving hammer of size and type able to deliver consistently and uniformly the dynamic energy for driving of the piles into the subsoil without damage to the piles. The driving energy shall not be less than 80 percent of the hammer energy rated by the manufacturer. The hammer shall be double acting powered by air or steam with a limiting energy of 21,000 ft-lbs. Other types of hammers may be used only if approved by the Engineer particularly with regard to the consistency of energy delivered at every stroke.

C. Leads:

1. Fixed or rigid pile driving leads shall be used that will hold the pile firmly in position and in alignment with the hammer. Extend the leads within 2 feet of the elevation at which pile enters the ground.

2. Leads shall be of sufficient length to make use of a follower unnecessary, and shall be so designed as to permit proper placing of batten piles if required. Free swinging leads shall not be used unless specifically approved by the Engineer.

D. Pile Length Markings: Mark each pile length with horizontal line at 1-foot intervals, and the number of feet from pile point at 5-foot intervals.

3.02 Driving of H-Piles

A. Pile Location Marking: All proposed pile locations shall be marked on the ground to check if there is any interference with existing foundation, such as old piles and strip footings. Any interference noticed shall be brought to the Engineer's attention and the proposed pile locations shall be adjusted to avoid this interference.

B. Production Piles: Production piles shall be procured in accordance with a pile length order list. Such list shall be submitted for Engineer's approval.

C. Pile Refusal: H-piles shall be driven to refusal as defined by a minimum driving resistance of 5 blows per 1/4 inch of penetration.

D. Pile tips shall be no higher than elevation 522'.

3.03 Splicing of H-Piles

Splices shall be 100% butt-welded.

3.04 Driving Tolerances

A. Carefully maintain the center of gravity for each group or cluster of piles to conform to the locations shown on the drawing.

B. Vertical piles shall be plumbed carefully before driving and shall be corrected against tendency to drift. Use of judgement force to get any pile into position shall not be permitted.

C. The following minimum tolerances shall be maintained:

1. Location: 3 inches from the location indicated; one inch for piles under walls.
2. Plumbness: One inch from a vertical line for 10-foot length to a maximum of 4 inches.
3. Batter piles: Maximum of one foot in 10 feet from the required angle.

D. Heaved Piles: Make survey instrument readings after completion of driving to determine if a driven pile has heaved from its original position during driving of adjacent piles. If heaving occurs, redrive the affected piles to a point elevation at least to the original position with a driving resistance equal to or better than the original resistance.

3.05 Pile Caps

Concrete for pile caps or any other concrete in direct contact with the soil shall be reinforced with epoxy coated steel in accordance with ASTM D3963.

3.06 Defective or Misdriven Piles

A. Piles which are out of specified tolerances, misdriven, or damaged shall be rejected and replaced in an approved manner at Contractor's expense. Rejected piles may be abandoned in place and cut off to approved elevations. Rejected piles shall not be extracted unless specifically approved by the Engineer. Any voids left by piles shall be filled with sand and grouted.

B. Drive additional pile or piles where the center line deviation exceeds 3 inches in plan and analysis indicates that a load on any other pile will exceed 110 percent of the design load (36 kips).

C. When additional piles are driven as replacement piles, the pile group and the pile cap shall be redesigned by the Contractor and shall be subject to Engineer's approval. The added construction cost of such redesigned work will be at Contractor's expense.

D. Piles which exhibit defects in epoxy coating from the factory or from handling in the field shall receive field applied epoxy in accordance with manufacturer's recommendations. The epoxy coating should also be applied over any pile surfaces disturbed by welding.

3.07 Driving Order

A. Pile groups shall be driven from the interior outward to preclude densification and excessively hard driving conditions on the interior.

3.08 Obstructions

A. Where obstructions make it impossible to properly install certain piles, the Contractor shall resort to all typical methods to clear the obstructions. Clearance of obstructions above elevation 580' shall be at the Contractor's expense. If the Engineer determines that obstructions should be cleared below elevation 580', the Contractor will be reimbursed for the additional work.

B. If the Engineer determines that additional piles are required in lieu of obstruction clearance, the Contractor will be reimbursed for the obstructed pile and additional pile(s).

-- END OF SECTION 02350 --

SECTION 02405

FLEXIBLE MEMBRANE LINERS

PART 1 - GENERAL

1.01 Description

A. The work specified herein consists of the furnishment and placement of 60 mil high density polyethylene (FML) flexible membrane liners (FML) on the Buffalo Color Site as shown on the Contract Drawings. Smooth and/or textured HDPE shall be used at the Buffalo Color Site depending on the cap slope as shown on Drawings. The work shall include the furnishing of all labor, supervision, equipment, materials, small tools, seaming devices, and quality control devices to install a complete and watertight FML.

B. Related work specified in other sections:

1. Section 02200 - Earthwork
2. Section 02421 - Geotextiles

1.02 Submittals

A. To be submitted prior to construction:

1. Manufacturer
   a. The name of the intended membrane manufacturer and the FML type to be supplied.
   b. The manufacturer's quality control program or descriptive documentation.
   c. Test results indicating the typical minimum average roll values of the FML which meet or exceed those listed in Table 02405-1 at the end of this section.
   d. Samples of the FML (2 @ 8" x 10").
2. Manufacturer's Quality Control Submittals:
   a. The origin and identification of the raw materials used to manufacture the FML including the supplier's name, production plant, brand name, and type.
   b. Copies of quality control certificates issued by the producer of the raw materials.
   c. Test reports for specific gravity and melt flow index, to verify the quality of the raw materials used.
   d. Copies of quality control certificates for each roll of FML identifying: a) the date of manufacture and identification number; b) that each roll was continuously inspected for uniformity, damage, imperfections, holes, cracks, thin spots, foreign materials, tears, punctures, and blisters; and c) that non-destructive seam testing was performed on all fabricated seams over their full length, if any. Include copies of test results for seam testing.
   e. Copies of destructive seam testing results performed on a minimum of two samples per blanket taken from extra material at the beginning or end of blanket seams such that the blanket is not damaged or its geometry changed. Testing is to be performed by an independent laboratory.

f. Certification that the FML has a maximum coefficient of permeability of $1x10^{-11}$ cm/s.

3. Installer

   a. The name of intended installer including the company name, field crew foreman, and seaming foreman.

   b. A list of at least ten projects completed by the intended installation company using similar membranes which total a minimum of 100 acres. For each project identify the name and purpose of the facility, location, completion date, owner, designer, installer, point of contact and phone number, total square footage, and FML type and thickness, and seaming method used.

   c. A list of at least five projects completed by the installer's field crew foreman using the same FML which total a minimum of 50 acres. For each project identify the name and purpose of the facility, location, completion date, owner, designer, installer, point of contact and phone number, total square footage, and FML type and thickness, and seaming method used.

   d. A list of at least three projects completed by the installer's seaming foreman using the same type FML used on this project which total a minimum of 50 acres. For each project identify the name and purpose of the facility, location, completion date, owner, designer, installer, point of contact and phone number, total square footage, and FML type and thickness, and seaming method used.

   e. Shop Drawings and/or Procedure Manual

      1) Layout of the FML system showing panels, seams, and vent locations as proposed for construction.

      2) Details of seaming and welding the FML material.

      3) Details of joining the FML material to concrete or other dissimilar materials as required.

      4) Details of joining the FML material to pipe penetrations as required.

      5) An installation schedule showing the sequence of operations, the objectives to be completed daily, including personnel, number of shifts, and capacity per shift, and the anticipated total duration required to complete the membrane.

      6) A description of Standard and Emergency Operational Procedures including health and safety policies.

   f. A statement that the foundation upon which the membrane is to be placed is acceptable.

4. Manufacturer's installation instructions, including repair procedures.

5. Quality control requirements and procedures.

6. Qualifications of the independent testing laboratory and its key personnel that the Contractor will retain to perform quality control testing. Submit a listing of the testing apparatus, testing standards typically performed, QA sampling and testing schedule, and a

letter stating that the testing laboratory is independent from, and has no financial interest in, the FML installer, manufacturer, or Contractor.

B. To be submitted by installer during liner installation in a timely manner:

a. Copies of seaming quality assurance records which shall include apparatus temperature, extrudate temperature, if applicable, and ambient air temperature.

b. A letter stating that the granular materials and Contractor's proposed installation methods for soil materials immediately above the FML are acceptable for FML installation.

c. Copies of quality assurance certificates and laboratory test results signed by an authorized representative of the testing firm which shall include:

1) Panel numbers and identification.

2) Quality assurance test locations, procedures and results.

3) Documentation of repairs, including location and retest results.

d. Archive samples of material from each destructive seam location. Enough material shall be submitted to allow for one complete set of destructive tests for both peel adhesion and shear strength.

C. To be submitted by installer after completion of construction:

1. Record Drawings: Submit within two (2) weeks after demobilization of the liner installer from the construction site, as-built drawings showing the following information:

a. Layout of FML system showing panels including roll identification, destructive sample locations indexed to test results and repair disposition, and any other repairs or patches.

b. Any deviation from previously submitted certified drawings.

2. Summary and log of the following information:

a. Quality assurance testing performed.

b. Ambient temperature at which seaming was performed recorded every two hours during placement and seaming.

c. FML surface temperature recorded every two hours during placement and seaming.

d. Seam wedge temperature, recorded every two hours during placement and seaming.

PART 2 - PRODUCTS

2.01 Sheet FML

The HDPE FML shall be a thickness of 60 mil containing no fillers or extenders certified by the manufacturer to meet or exceed the material properties tabulated in Table -02405-1 of this specification.

2.02 Extrusion Joining Resin

Any resin used for extrusion welding of sheets and/or sheet to penetrations shall be HDPE produced from the same material as the sheet resin. Physical properties shall also be the same as those of the resin used in manufacturing of the FML material.

PART 3 - EXECUTION

3.01 Inspection of Sheet FML At Jobsite

The Engineer will visually inspect the sheet rolls as they arrive on the jobsite for possible damage in transit. If, in the opinion of the Engineer, the roll is not suitable for repair, the roll will be rejected and removed from the jobsite. As each sheet is unrolled, the Engineer will further visually inspect the sheet surfaces. The FML surface shall be brushed, blown or washed by the installation contractor if the amount of dust or mud inhibits inspection. The Engineer shall decide if cleaning of the FML is needed to facilitate inspection. Sharp creases resulting from wrinkles in the material at the time of manufacture are not acceptable. All faulty areas will be repaired in an appropriate manner using methods that meet the approval of the Engineer. Repairs will be tested as described in 3.05-11 of this specification.

3.02 Delivery, Storage, and Handling of Materials

1. Delivery: Materials shall not be delivered to the site until the appropriate submittals of Section 1.03 of this specification have been approved by the Engineer. At such time, the manufacturer/installer may deliver the materials to the jobsite and shall unload and store materials at an area approved by the Engineer.

2. Storage and Handling: Storage and handling of the materials shall conform to the manufacturer's recommendations and shall be done in such a manner as to prevent damage or deterioration to any part of the FML. Further, the installer assumes the responsibility for proper storage and handling prior to and during installation of the FML materials. Rolls shall be stored on a prepared surface (not wooden pallets) with no protrusions greater than 1/2 inch and shall not be stacked.

   The membrane shall be protected from puncture, mechanical abrasions, dirt, grease, mud, moisture, excessive heat, light, or other damage. Any damage to protective wrapping shall be repaired immediately. The Installation Contractor shall be responsible for the onsite handling of all FML materials. No FML material shall be unloaded without the field crew foreman present.

   When using a front end loader to handle FML rolls for transport from storage to the specific installation location, the installer shall incorporate the use of nylon straps and a spreader bar assembly to lift the roll. The nylon straps are to be centered so that the roll can be lifted and remain relatively level. It will not be acceptable to drag one end of the roll during transport. A backhoe with a smooth bucket blade would be an acceptable piece of equipment for lifting the rolls using nylon straps and a spreader bar. Only with the Engineer's approval, will a fork truck be used for lifting. Under no circumstances will it be acceptable to force the fork truck tongs under a roll.

3. Equipment and tools shall not damage the membrane. No vehicular equipment shall be driven directly on the membrane. Personnel working on the membrane shall not smoke and shall wear smooth soled shoes. Shoes with uneven bottoms or protrusions which may trap stones are not allowed.

3.03 Pre-Installation Subgrade Preparation

The surface of the site to be capped with the FML shall be finish graded to the lines and grades as shown on the construction drawings. The surface for placement of the FML cap shall be rolled smooth prior to installation. The FML shall be placed on a geotextile, which in turn, shall be placed on the material to be capped. No standing water will be allowed. The

Contractor is to certify to the Engineer that the surface on which the membrane cap is to be installed is acceptable before commencing work. The contractor shall maintain these surfaces in an acceptable condition during installation of the membrane.

3.04 Pre-Installation Conference

The Contractor shall hold a pre-installation conference with the Engineer, installer, and manufacturer's representative.

3.05 Installation

1. General: The FML material shall be laid out and installed in accordance with the applicable approved shop drawings by crews experienced in the installation of the FML. Seams directly exposed to weather should be minimized in the fabrication plans. A minimum of three feet (3') of soil for wheeled vehicles and one foot (1') of soil for tracked vehicles shall be maintained over installed FMLs at all times. The FML shall not be covered until acceptable results for both non-destructive and destructive tests have been submitted to, and approved by, the Engineer. FML rolls or panels should be placed in an orderly fashion which shall minimize or prevent surface water from flowing below an in-place FML.

2. Weather Conditions: The effects of weather are critically important in obtaining a high quality installation.

   a. Field seaming is not permitted when the ambient air temperature is below 50° F (10° C) or above 100° F (38° C).

   b. Field seaming is not permitted during precipitation, fog, or in the presence of moisture.

   c. Deployment of membrane and field seaming is not permitted when winds are in excess of 20 miles per hour.

3. Lap joints will not be laid out or prepared for welding (cleaning and/or grinding) further ahead than one day. Prepared joints that have laid out overnight will be recleaned and/or ground prior to welding.

4. Field seams should be oriented parallel to the line of maximum slope, i.e. oriented along, not across the slope. In corners and irregularly shaped locations, the number of field seams should be minimized. No seam parallel to the edge should be less than five feet from the edge of the cover.

5. Slack: The FML shall be installed with an adequate amount of slack to allow future temperature shrinkage of the material to occur with no stretching and tightening of the FML due to tautness in any area. As a guideline, for every 100 ft. of surface to be covered, 3/4 inch for each 5° F of temperature differential (the difference between the installation sheet temperature and 35° F, or the average daily minimum winter temperature for the installation site, whichever is lower) should be added to the 100 ft. dimension to compensate for shrinkage. Using this approach, a FML installation at a sheet temperature of 75° F would provide for six inches (6") of FML for every 100 linear feet of surface to be covered. Excessively large wrinkles in the FML, so large that the wrinkle could fold over and cause a sharp crease in the material under overburden pressure, shall be removed.

   Cover materials shall be carefully placed over the liner to avoid stretching and folding of the FML.

6. Tenting: There will be no tenting of the FML at the toes of slopes or in corners at a sheet temperature of 35° F or higher. Tenting is the formation of air space beneath the FML that results from temperature changes and/or improper installation. It will not be an acceptable practice to "free roll" the FML rolls down the slopes. The roll will be controlled as it is unrolled down slopes.

7. Extrusion Welded Field Joints: Extrusion welded field joints shall be made by overlapping adjacent sheets by five inches (5") (minimum) and extruding a ribbon of hot extrusion resin along seams to ensure a complete weld of the joined materials. Prior to extrusion welding of the seams, all areas which are to become seam interfaces shall be cleaned of dust, dirt and moisture. The slick surfaces of the FML sheet which are to become seam interfaces shall be roughened with a wire brush, fine grain sanding disk, or other acceptable means before extrudate is placed between, or at the edge of, the overlapped sheets. Sufficient extrudate shall be used to assure that a weld bead is visible at the edge of the sheet overlap. Joints between the FML sheets shall be field welded using the particular manufacturer's extrusion joining apparatus and technique under suitable ambient conditions. Any joining procedure utilized shall properly prepare the surfaces and heat the FML materials sufficiently with the addition of a molten bead to ensure a homogeneous and consistently fused seam. A moveable protective layer shall be used below each overlap of FML during field seaming to prevent the buildup of moisture between the sheets.

8. Hot Shoe Seamed Field Joints: Hot shoe seaming joints shall be made by overlapping adjacent sheets by five inches (5") (minimum) and running a hot metal shoe wedge between the overlapped area. The controlled heating is followed by pressure/nip rollers which uniformly fuse the materials together. Prior to seaming all areas which are to become seams, interfaces shall be cleaned of dirt, dust and moisture. Depending upon the type of wedge used, a single fusion seam or a double fusion seam may be produced. HDPE FML shall be double fusion seamed. In the case of the single fusion seam, testing will be conducted in the same manner as with the extrusion welded seam system. If a split wedge is used, the resulting double seam shall also be subjected to testing by air pressure as set out in Section 4 of this specification. A moveable protective layer shall be used below each overlap of FML during field seaming to prevent the buildup of moisture between the sheets.

9. Welder Certification and Testing: Each welder will certify his welding equipment at the beginning of each work shift and after an extended break of more than 30 minutes, such as a meal, by running a sample weld on extra material and testing for peel adhesion and seam strength on at least three specimens from the weld. All specimens must pass before production welding will be allowed. Acceptable welds are when elongation occurs in the FML sheeting before there is more than 1/16 inch of peel failure of the weld.

10. FML Penetrations: Penetrations through the FML for monitoring wells, piping, support structure, inlet/outlet structures, pump pits, etc., shall be sealed using factory fabricated or installer prefabricated seals. The liner installer may submit alternate connection systems or methods which will be given full consideration by the Engineer.

    A FML reinforcement overlay of thickness equal to the FML shall be placed around any penetration opening. The opening in the overlay shall be of the same size and configuration as the opening in the FML. The overall minimum dimensions of the overlay shall be related to the FML opening as follows:

Penetration Opening Dimension	Reinforcement Overlay Overall Dimension (min)	Reinforcement Overlay Outside Corner Radius
< 6"	3'	6"
6" to 1'	4.5'	9"
1' to 2'	7'	1.25'
2' to 3'	10'	1.75'
3' to 4'	12.5'	2.25'
4' to 5'	15.5'	2.75'
5' to 6'	18'	3'
6' to 7'	21'	3.5'
> 7'	Opening size plus 14'	3.5'

The outside edge of the overlay shall be welded to the FML.

The prefabricated seals shall not be installed until after placement of the drainage geonet composite layer for 50' in all directions around each penetration to allow for shifting of the FML. The area immediately surrounding each penetration shall be left open until the seal is installed and tested.

11. Repairs in FML Material: Immediately upon discovery or inspection of the installed FML, all defects and damage shall be repaired in accordance with standard practices as approved by the Engineer.

    Repairs of holes and test sample cutouts will be patched with a square or circular shaped precut FML piece. A minimum lap of six inches (6") is required from all cut edges or repairs. If the patch is square or rectangular shaped, the corners of the piece shall be rounded off with a minimum three inch (3") radius of curvature. Cutting out of patch pieces from a piece of FML laid directly on an already installed FML sheet will not be allowed. Patches are to be cut out from pieces laid either on the ground outside the site area or upon a backup board or scrap material laid over the installed FML.

    Weld seams designated for repair shall be done by capping the seam.

    Defective seams shall be rewelded, overlaid, or cut out and replaced as the conditions may dictate. All repairs shall be tested as described in Part 4 and documented as per Sections 1.02 B and C. Exact location of all repairs shall be measured and included in the as-built drawings.

12. Temporary Anchoring: Sandbags or rubber tires may be used as required to hold the membrane in place during installation. Tires shall not have exposed steel cords or other sharp edges which may snag or cut the membrane. At the end of each day the membrane shall be sufficiently anchored to prevent displacement and/or tenting.

13. Final Review: After completion of installation and testing, and prior to construction of subsequent cover layers, all field test results shall be reviewed and a final inspection performed by the Engineer.

PART 4 QUALITY ASSURANCE AND CONTROL

4.01 Reference Standards

Where applicable, the provisions and recommendations of the designated standards adopted by the American Society for Testing Materials (ASTM) shall be used as the basis for the material requirements, unless otherwise specified.

4.02 Testing

The Contractor shall perform quality assurance sampling and testing after the installation of each roll or panel to verify that a satisfactory seam has been obtained. Non-destructive testing shall be performed by the Contractor for the entire length of all seams using one of the methods described in Part 4.03. Destructive testing as described in Part 4.04 shall be performed randomly at an interval of one per 500 feet (average) of seam welding, after every two hours of continuous welding, or if welding is stopped less than 500 feet, for that section of seam completed. Both peel adhesion and shear strength tests shall be performed at each destructive testing interval. All testing shall be performed in the presence of the Engineer.

A. During the FML installation process, the Installation Contractor shall record the following information on record drawings and make notation on the membrane in a distinctive color to identify test sites and successfully tested seams.

1. The location and identification number of each imperfection, the date found, the date repaired and the result of non-destructive testing on the seam (acceptable/unacceptable).
2. The location, date, sample number and test result (acceptable/unacceptable) of each destructive test series.
3. The location, identification number and date of each non-destructive air pressure seam test, the length of the tested seam, and the result of the test (acceptable/unacceptable), if applicable.
4. The location, date and lengths of nondestructive vacuum box seam testing performed on a daily basis.

4.03 Non-Destructive Tests

All seams shall be tested by one of the following non-destructive methods for their entire length:

A. Seam Pressure Testing: In the case of split wedge fusion seams, vacuum testing can be eliminated provided that it passes the seam pressure test.

The seam pressure test shall be conducted as follows:

1. Seal and clamp both ends of the flow channel to assure an air tight seal. During the test, apply soapy water to the clamp area to test the air tightness at the clamps.
2. Take the pressure test device, which consists of an inflation needle and pressure gauge mounted on a "T" fitting, and insert the needle into the flow channel. Connect a pump to the test device (a small bicycle pump will suffice) and inflate the flow channel to the desired pressure of 25 P.S.I. Allow one (1) minute for the seam to stabilize as indicated by a possible slight drop in the initial pressure reading due to the seam expanding slightly under pressure.
3. Re-inflate to the desired pressure and test for a period of two (2) minutes.

4. At the end of the test period, if the pressure has not dropped more than two (2) P.S.I. (a small pressure drop would be the result of some air seeping around the inflation needle), the test is considered a pass and the following procedure is implemented.

   a. Remove the test device and clamps.
   b. Make any repairs, if necessary, to the area where the flow channel was clamped or inflated.
   c. Record the test results, mark the seam as passing and proceed to the next seam.

5. If the pressure drops below the two (2) P.S.I. allowance, the test is considered a failure, and further testing will be conducted on the seam including vacuum testing until the leak is found and repaired.

B. Air Lance Testing: Air lance testing shall be performed for seams where the vacuum box or seam pressure tests cannot be used. The testing equipment shall consist of a portable air pump, an air lance with a 3/16-inch diameter orifice capable of delivering 50 psi of continuous air, associated hose and fittings, and a mounting cushion to protect the membrane from damage.

Testing is performed by placing the orifice of the air lance at the underside of the upper FML panel of the seam at a slightly upward angle. Air of approximately 50 psi (±5 psi) is blown onto the seam being tested. Defective seams are located when the air jet causes the membrane to inflate, flutter, or otherwise behave dissimilarly to properly seamed areas.

C. Vacuum Box Testing: Vacuum box testing shall be performed on all extrusion welded seams in the presence of the Engineer to detect any voids, leaks, breaks, or other deficiencies. Such testing shall be accomplished with an open bottom vacuum box placed over a soap film coated section of seam. The box shall be capable of producing a partial vacuum at a constant ten (10) PSIG or higher for a minimum duration of at least thirty (30) seconds to confirm a leakproof weld. This full test load will be performed on all material thicker than 40 mil. For materials 40 mil and lighter, the test loading will be no less than five (5) PSIG for a duration of at least fifteen (15) seconds. During the test loading, no bubbles should appear in the vacuum box for a properly sealed membrane seam. Any defects if noted shall be identified and corrected by rewelding or additional patching as approved by the Engineer. The patched area shall then be tested as described above to assure that the repairs are leakproof.

4.04 Destructive Tests

Destructive tests, both peel adhesion and shear strength, shall be performed for every 500 feet of seam, after every two hours of continuous welding, or, if welding is stopped less than 500 feet, for that section of seam completed.

A. Peel Adhesion Testing: Peel adhesion testing shall be performed in accordance with ASTM Method D-4545. The Contractor's approved testing laboratory may perform this test in the field or laboratory provided proper equipment is used. Acceptance limits are for greater than 60% of stress at 300% elongation.

B. Shear Strength Testing: Shear strength testing shall be performed in accordance with ASTM Method D-4545. The Contractor's approved testing laboratory may perform this test in the field or laboratory provided proper equipment is used. Acceptance limits are for greater than 80% of stress at 300% elongation.

C. Enough material from each destructive seam test location shall be taken to perform three (3) complete sets of destructive tests for both peel adhesion and shear strength. Enough material for one set of destructive tests shall be submitted to the Engineer for archiving.

D. A test sample will be removed and tested for peel adhesion and seam strength after every 500 feet of seam welding after every two hours of continuous welding. If the sample fails, then a sample will be taken every ten feet (10') back along the previously welded seam until acceptable production welding is located. If welding is stopped and the production seam is less than 500 feet, a sample will be tested to represent that footage of seam completed. FML sheets shall be placed to lay smooth and be allowed time to relax and smooth out prior to seam welding. Welding a wrinkled or rough sheet to a smooth sheet will not be an acceptable practice, nor will the welding together of two wrinkled sheets be accepted.

PART 5 WARRANTY AND GUARANTEE

Prior to acceptance, the manufacturer/installer shall provide evidence in writing of all testing made to ensure joint integrity and to verify conformance to the specifications. The manufacturer/installer shall warrant that materials and workmanship supplied conform to the contract documents.

A. Guarantee of Materials: The lining material shall be guaranteed in writing by the manufacturer on a pro rata basis for a period of 20 years. The guarantee shall be against manufacturing defects of workmanship and against deterioration due to ozone, ultraviolet, or other normal weather aging. The guarantee shall be limited to replacement of defective material only and shall not cover vandalism, acts of animals, earthquakes, other acts of God.

TABLE 02405-1
HDPE FML MATERIAL PROPERTIES
TESTING SPECIFICATIONS

Property	Designated Test Method	Designated Values: Smooth HDPE	Designated Values: Textured HDPE	Units
Density	ASTM D1505 Method A	0.940 (min)	0.940 (min)	g/cm^3
Tensile Strength @ Break	ASTM D638 Type IV (2"/min)	200	120	lb/in width
Elongation @ Break	ASTM D635 Type IV	600	300	% (Avg.)
Thickness	ASTM D1593	60 ± 10%	60 ± 10%	Mil
Tear Resistance	ASTM D1004 Die C	40	40	lbs
Environmental Stress Crack Resistance	ASTM D1693 (as modified in NSF 54 Appendix A, Condition C at 100° C)	>2000 (min)	>2000 (min)	Hours
Dimensional Stability	ASTM D1204	±2	±2	%
Low Temperature Brittleness	ASTM D746 "B"	<-94	<-94	°F
Puncture Resistance	FTMS 101 C2065	65	65	lbs
Melt Index	ASTM D1238 Method A	≤1.0 (max)	≤1.0 (max)	g/10 min
Carbon Black content	ASTM D1603	2 - 3	2 - 3	%
Field Seam Property				
Shear Strength	ASTM 4437 (modified NSF 54-1.991)	44 (min)	30 (min.)	lbs/in.
Peel Strength	ASTM 4437 (modified NSF 54-1.991)	40 (min)	20 (min.)	lbs/in.

– END OF SECTION 02405 –

SECTION 02421

GEOTEXTILES AND GEONET

PART 1 - GENERAL

1.01 Section Includes

A. Separation and Cushion (Nonwoven) Geotextile.

B. Reinforcement (Woven) Geotextile

C. Drainage Geonet

1.02 Related Sections

A. Section 02200 - Earthwork

B. Section 02275 - Rip-Rap

C. Section 02405 - Flexible Membrane Liners

D. Section 02501 - Gravel Maintenance Road

1.03 References

A. Documents

1. Task Force #25, AASHTO-ABC-ARTBA Joint Committee, "Specifications for Geotextiles." July 1986.

B. Quality Control Testing Standards

1. ASTM D3776 - Mass Per Unit Area of Woven Fabric.
2. ASTM D3786 - Hydraulic Bursting Strength of Knitted Goods and Non-Woven Fabrics.
3. ASTM D4354 - Sampling of Geosynthetics for Testing.
4. ASTM D4491 - Water Permeability of Geotextiles by Permittivity.
5. ASTM D4594 - Effects of Temperature on Stability of Geotextiles.
6. ASTM D4595 - Tensile Properties of Geotextiles by the Wide Width Strip Method.
7. ASTM D4632 - Breaking Load and Elongation of Geotextiles (Grab Method).
8. ASTM D4751 - Determining Apparent Opening Size of a Geotextile.
9. ASTM D4833 - Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
10. ASTM D4873 - Identification, Storage and Handling of Geotextiles.
11. ASTM D5188 - Nominal Thickness of Geotextiles and Geomembranes.

1.04 Submittals

A. Submit a 1-foot square sample of each geotextile and geonet proposed for use on this project.

B. Certification that each geotextile meets the criteria listed in Table 02421-1 at the end of this section.

C. Certification that each geonet meets the criteria listed in Table 02421-2 at the end of this section.

1.05 Delivery, Storage, and Handling

A. Store geotextiles and geonet out of the elements and protect from abrasion or tearing or exposure to sunlight.

B. Clearly mark rolls showing the type of fabric and manufacturer.

C. Handling of the geotextile and geonet rolls shall be based on the manufacturer's recommendations.

D. The requirements for identification, storage and handling of geotextiles in ASTM D4873 shall be followed as a minimum.

PART 2 - MATERIALS AND PRODUCTS

2.01 Materials

A. Separation and Cushion Geotextile (Underdrain and Geomembrane)

1. Shall be heat-bonded (non-woven) geotextile specifically designed for drainage and separation applications.
2. Shall be composed of polyester and/or polypropylene polymers.
3. Shall meet the criteria listed in Table 02421-1.

B. Reinforcement Geotextile (Road Riprap Bed Reinforcement)

1. Shall be a woven geotextile specifically designed for reinforcement applications.
2. Shall be composed of polyester and/or polypropylene polymers.
3. Shall meet the criteria listed in Table 02421-1.

C. Drainage Geonet (cap drainage)

1. Shall be composed of high density polyethylene polymers.
2. Shall meet the criteria in Table 02421-2.

PART 3 - EXECUTION

3.01 Inspection

A. The Contractor shall inspect all geotextiles and geonet upon delivery and verify that the proper materials and quantities have been supplied.

B. The Contractor shall inspect the subgrade for protrusions or other unacceptable conditions prior to installation of geotextiles.

C. The Contractor shall continuously inspect needle-punched geotextiles during deployment for broken needles remaining from needle-punching operations.

3.02 Preparation

A. The subgrade shall be prepared as indicated in the specifications.

3.03 Protection

A. Protect all geotextile and geonet materials from damage due to exposure to sunlight, dirt, dust and other hazards.

B. Maintain the protective wrapping on geotextile and geonet rolls at all times prior to actual deployment.

C. The geotextiles and geonet shall be covered within 10 days after installation.

D. During spreading operations of backfill, a minimum depth of 12 inches of aggregate shall be maintained by construction equipment passing over the geotextiles and geonet unless a lesser thickness is specifically authorized by the Engineer. Construction equipment shall not operate directly on the geotextile and geonet.

3.04 Placement

A. Geotextile and geonet rolls shall be positioned as required and unrolled.

B. When placed on prepared subgrades, geotextiles and geonet shall be overlapped a minimum of 1.0 feet on all edges.

C. When geotextile is placed on unstable subgrades or slopes steeper than 1V:5H, horizontal overlaps shall be sewn.

D. When geotextile is placed on slopes steeper than 1V:5H, longitudinal seams shall be sewn or overlapped a minimum of 5 feet.

E. Sewing requirement:

1. The thread color shall contrast with that of the geotextile.
2. Sewing operations shall employ a thread tension which secures the geotextile rolls without cutting the material.
3. Sewing operation shall use a "J" seam secured with a minimum of one row of four-stitch per inch two thread main stitch.

F. When geotextile is placed in trenches, the material shall be overlapped a minimum of 1 foot over the top of the trench. Longitudinal seams between adjacent rolls of material shall be overlapped a minimum of 2 feet.

G. When geotextile is placed under water, the lower edge of the geotextile shall be secured in-place, e.g., with a weight during placement of riprap.

H. Geotextile and geonet rolls shall be cut and laid flat such that buckling of the roll does not occur.

I. If geotextiles are damaged during any phase of construction or installation, a new piece of the same type shall be cut and placed over the damaged area with a 2-foot minimum overlap and sewn.

J. Cover material shall be spread in the direction of overlap wherever possible.

TABLE 02421-1

MINIMUM ACCEPTANCE CRITERIA GEOTEXTILE

Test Description	Test Method	Criteria
Separation		
Mass per unit area	ASTM D-3776	$\geq$6 oz/SY
Apparent opening size (AOS)	ASTM D-4751	<No. 70 sieve
Puncture resistance	ASTM D-4833	$\geq$60 lb.*
Grab strength	ASTM D-4632	$\geq$ 150 lb.*
Tensile strength	ASTM D-4595	$\geq$75 lb.*
Permittivity	ASTM D-4491	$\geq 1.5\ sec^{-1}$*
Burst strength	ASTM D-3786	>200 psi*
Reinforcement		
Mass per unit area	ASTM D-3776	>8 oz/SY
Puncture resistance	ASTM D-4833	> 150 lb.
Grab strength	ASTM D-4632	>400 lb.
Tensile strength	ASTM D-4595	>200 lb./in.
Burst strength	ASTM D-3786	>800 psi

Minimum strength criteria shall apply to both the machine direction (MD) and the cross machine direction (XMD).

* Minimum Average Roll Values (MARV)

TABLE 02421-2

MINIMUM ACCEPTANCE CRITERIA GEONET

Test Description	Test Method	Criteria
Specific Gravity	ASTM D-1505	$\geq 0.94\ g/cm^3$
Melt Flow Index	ASTM D-1238 Condition E	<0.3 8/10 minutes
Thickness	ASTM D-374	>5 mm
Percent Carbon Black	ASTM D-1603	>2%
Transmissivity	ASTM D-4716 (10,000 pst pressure and 0.25 gradient)	>10 g/min./ft. or $2 \times 10^{-3}\ m^2/sec.$

-- END OF SECTION 02421 --

SECTION 02501

GRAVEL MAINTENANCE ROAD

PART 1 - GENERAL

1.01 Description

A. The work herein consists of the furnishing and placement of maintenance road at the Buffalo Color site.

B. Section Includes:

1. Subgrade preparation.
2. Furnishing natural soils.
3. Furnishing select borrow material.
4. Furnishing granular access/maintenance road material.
5. Temporary drainage.
6. Compaction.
7. Proof rolling.
8. Removal and replacement of unacceptable materials.
9. Grading.
10. Installation of geotextile fabric.

1.02 Related Sections

A. Section 01510 - Temporary Construction Facilities

B. Section 01564 - Erosion Control

C. Section 02200 - Earthwork

D. Section 02421 - Geotextiles and Geomet

1.03 References

A. ASTM D698 - Moisture/density relations of soil/aggregate mixtures using 5.5 lb. rammer and 12 in. drop.

1.04 Definitions

A. "Subgrade" shall be defined as the foundation layer of natural soils or select borrow material that supports the gravel pavement layer.

1.05 Performance Requirements

A. Compaction of subgrade shall meet the requirements for compaction as stated in Section 02200.

1. Compaction curves shall be developed for each type of subgrade material when "In-Place Density" tests are required by the Engineer.
2. The cost of failed compaction tests will be reimbursed by the Contractor.

B. Proof rolling with 8 - 10-ton pneumatic tire compactors to locate areas of inadequate compaction or soft or rutting areas or other defects in the subgrade surface.

1.06 Submittals

A. Geotextile Fabric - Refer to Section 02421.

1.07 Environmental Requirements

A. Provide erosion and sediment controls (refer to Section 01564) to prevent debris, stones and silt from entering drainage systems.

1.08 Field Measurements

A. Prior to start of construction, verify by field measurements that existing conditions are as shown on Drawings. Notify the Engineer of specific differences.

1.09 Coordination

A. Coordinate field work under provisions of Section 01040, including maintenance of traffic and emergency vehicle access.

B. Coordinate work with local utility companies (private and municipal) for location of existing utilities and protection thereof.

1.10 Test Requirements

A. Refer to Article 1.05 above.

PART 2 - PRODUCTS

2.01 Materials

A. Granular access/maintenance road material shall be crushed aggregate as specified in Section 02200.

B. The type, size and quantity of granular material shall be that required to prepare a compacted subgrade approved by the Engineer.

C. Geotextile fabric shall be as specified for a separation geotextile in Section 02421.

PART 3 - EXECUTION

3.01 Examination

A. See Section 02200.

B. All underground utility installations, including culverts, shall be completed, backfilled and compacted prior to completion of subgrade.

C. Verify that traffic controls and erosion and sediment controls are in place.

3.02 Preparation

A. See Section 02200.

B. Temporary erosion and sediment controls shall be installed prior to construction of subgrade. See Section 01564.

C. Temporary drains and ditches shall be constructed as necessary to remove water from the subgrade area.

1. Temporary drainage openings in existing catch basins may be made in a manner acceptable to the Engineer. Such openings to be repaired to the satisfaction of the Engineer.

2. Contractor shall prevent debris, stones and silt from entering drainage systems, including the use of hay bales, screens and other desilting methods.

D. Backfilled areas shall be retested at the discretion of the Engineer.

3.03 Installation

A. Construct the subgrade by cutting existing grades or by filling with clean offsite fill.

1. The final subgrade surface shall be fine graded, rolled and compacted to form a smooth, even surface.

B. The subgrade in fill sections shall be placed in maximum 12-inch layers before compaction, and compacted before the next layer is spread.

C. The subgrade surface shall drain to the road edges, be free from holes, bumps, wheel ruts and of standing water, snow, frozen material and organic materials prior to the placement of the next course.

1. Soft or otherwise unacceptable subgrade materials shall be removed and replaced with select onsite material acceptable to the Engineer.

2. Where no suitable onsite fill is available, granular materials shall be installed and compacted.

3.04 Field Quality Control

A. For compaction requirements, refer to Section 02200.

B. Tolerances - Refer to Section 02200.

C. Proof Roll - Prior to the placement of the geotextile fabric, the subgrade surface shall be proof rolled to locate areas of inadequate compaction, deflection, or soft or rutting areas requiring undercutting, with 8 - 10-ton pneumatic tire compactors.

1. Areas of inadequate compaction will be recompacted.

2. If additional rolling does not correct an area of unstable conditions, the unstable area shall be removed and replaced with select onsite material and compacted.

3. Areas inaccessible to rollers are to be compacted by other mechanical methods.

3.05 Protection

A. No vehicular traffic will be allowed on the newly-placed fabric until covered with the granular layer.

3.06 Dust Control

A. Dust Control shall be accomplished by using water, brooming and cleaning methods.

1. Dust control shall be carried out on a daily basis including weekends and holidays.

-- END OF SECTION 02501 --

SECTION 02671

MONITORING WELLS

PART 1 - GENERAL

1.01 Work Specified

A. The Contractor shall provide all labor, materials, equipment, and incidentals as required by this specification to complete the work as described.

B. Six groundwater monitoring wells will be installed outside the cutoff wall and six groundwater wells will be installed inside the cutoff wall at locations shown on the Drawings. The wells will be constructed using the appropriate equipment to advance the borehole to its completion depth and install a monitoring well. The drilling equipment and well materials include: an appropriate drill rig to drill 12-inch boreholes (interior wells) and 6.25-inch boreholes (exterior wells), protective casing, stainless steel well screen and riser, and concrete surface seal/precast concrete manholes.

1.02 Submittals

A. Product Data: The product data for each component to be used in construction of the monitoring wells, including well screen, filter pack, cement and bentonite must be submitted to the Engineer. Product data, including manufacturers name and material source, must be submitted at least two weeks prior to use.

B. Installer: The name and address of the proposed well driller and a list of at least five completed projects of similar construction must also be submitted to the Engineer.

1.03 Reference Standards

Title 6, New York Code of Rules and Regulations, Part 360.

PART 2 - PRODUCTS

All well materials shall be new and composed of materials that will not alter the quality of water samples.

2.01 Protection

A. Protective Casing: Protective casing shall be installed, in accordance with the drawings, for all 12 groundwater monitoring wells. The casings shall be 6-inch diameter (or 6-inch square, for exterior wells) and 12-inch diameter (or 12-inch square, for interior wells) carbon steel pipe with a vented, hinged locking cap and lock. All locks are to be keyed alike to match existing locks on site.

2.02 Riser

A. Exterior Wells: The monitoring well riser pipe for the exterior wells shall be 2-inch ID, flush joint, threaded, schedule 40, type 304 stainless steel pipe.

B. Interior Wells: The monitoring well riser pipe for the interior wells shall be 6-inch ID, flush joint, threaded, schedule 40, type 304 stainless steel pipe.

2.03 Well Screen

A. Exterior Wells: The well screen for exterior wells will be 2-inch ID, flush joint, threaded, schedule 40 stainless steel pipe with a threaded stainless steel bottom plug. The screen sections will be ten feet in length with a machined slot size of 0.02 inches (10-slot).

B. Interior Wells: The well screen for interior wells will be 6-inch ID, flush joint, threaded, schedule 40 stainless steel pipe with a threaded stainless steel bottom plug. The screen sections will be ten feet in length with a machined slot size of 0.02 inches (10-slot).

2.04 Vent Caps

A. Exterior Wells: A 2-inch stainless steel vent cap shall be provided for the stainless steel riser.

B. Interior Wells: A 6-inch stainless steel vent cap shall be provided for the stainless steel riser.

2.05 Sand Pack

A. The sand pack surrounding the well screen shall be a clean, inert, and siliceous material. Sand back will be composed of fine sand with over 98 percent of the grains passing the No. 30 sieve and less than two percent of the grains passing the No. 70 sieve (Jessie-Morie #00 or equivalent).

2.06 Bentonite Seal

A. The seal will consist of 3/8-inch diameter sodium bentonite pellets. In unsaturated conditions, the bentonite pellets will be hydrated with potable water. The bentonite pellets will be allowed to hydrate a minimum of 30 minutes after installation.

2.07 Grout Mixture

A. The grout mixture shall be a mixture of Type I, Portland Cement (1-94 lb. bag), minus No. 200 sieve bentonite powder (3 lbs.), and potable water (7 gallons) in appropriate quantity to fill the borehole.

2.08 Concrete Surface Seal

Interior Wells: The concrete surface seal must be a minimum of six inches in thickness and three feet in diameter. The surface seal will contain Type I Portland Cement with processed aggregates containing no deleterious materials. The cement will be mixed with clean, potable water to obtain a mix strength of 3,000 psi at a minimum. The cement mix will be placed in a 3 foot diameter form or 3 x 3 foot form around the base of the protective casing at ground surface. The cement surface seal will be reinforced with either welded wire fabric or grade 60 reinforcing bars. The surface seal must also be constructed to prevent ponding around the well and surface water from entering the well.

PART 3 - EXECUTION

3.01 Monitoring Well Installation

A. Installations shall be recorded by the Field Geologist/Engineer in a field log book.

B. Monitoring wells shall be installed in the subsurface to specified depths using air rotary or other approved appropriate hollow stem auger drilling techniques. The wells will be screened

adjacent to the upper portion of the confining layer. All cuttings and drilling fluids will be collected in 55-gallon drums for disposal within the confines of the cutoff wall. Drilling equipment shall be decontaminated prior to drilling, between boreholes, and before leaving the site, as outlined in this specification.

C. Following the completion of drilling, a 2-inch stainless steel well for exterior locations and a 6-inch stainless steel well for interior locations will be constructed. Each well will be constructed with threaded flush joint, schedule 40 stainless steel risers with 10 feet of 0.010-inch slotted, schedule 40, stainless steel well screen. Appropriate centraliters shall be used for installation of the screen and riser. The annulus around the outside of the well screen will be backfilled with a properly sized clean, inert, silica sand that extends from six inches below the bottom of the well screen to 2 feet or 20 percent of the length of the well screen (whichever is greater) above the top of the well screen. The sand pack will be placed using methods that avoid bridging and ensure accurate placement of filter materials. A minimum three foot thick bentonite pellet seal will be placed above the sandpack, hydrated, if necessary, and allowed to swell a minimum of 30 minutes. After allowing the bentonite seal to swell, cement/bentonite grout will be installed above the bentonite seal to within three to five feet of ground surface. The grout will be placed ensuring that it is not diluted by formation water and that any water in the annular space is displaced.

D. Each well shall have a vented cap. The interior wells will have a steel casing with a hinged locking cap placed over the monitoring well. The protective casing shall extend at least two feet above the ground surface and be cemented and sealed in place with a concrete surface seal. A permanent measuring point shall be marked on the stainless steel riser.

E. Concrete surface seals shall be installed on interior wells, consisting of steel reinforced concrete pads conforming to the following dimensions: 3 feet wide by 3 feet long (or 3 feet in diameter) by the depth obtained by the bottom of the protective casing. The surface of the concrete pad shall be sloped away from the well casing and be flush with the ground surface at its outside edge.

   A drum type batch machine mixer, or other capable means of mixing concrete must be used to create the concrete mix. The concrete will be protected from physical damage or reduced strength due to weather extremes during mixing, placement, and curing. All concrete will be solid, compact and smooth, free of laitance, cracks, and cold joints. A non-slip broom surface will be applied. The formed surface will be cured by use of moisture-retaining cover or membrane-forming curing compound.

F. After wells are completed, they will be labeled with paint or other permanent markings to identify the wells.

3.02 Well Development

The Contractor shall perform well development after the grout seal has set for a minimum of 24 hours. The static water level and total well depth from the top of casing shall be measured initially. The monitoring wells shall be pumped to remove sediment from the well screen and sand pack. Well evacuation shall be accomplished using a positive displacement pump and dedicated polyethylene tubing equipped with a foot valve, or a submersible pump. Dedicated tubing shall be used to eliminate the need for decontamination and reduce the risk of cross contamination. The Contractor shall develop the wells for at least five well volumes and attempt

to achieve stabilized pH, conductivity, and temperature readings, and turbidity readings of 50 NTU or less.

The well development water shall be screened using a PID by the Engineer/Geologist. Physical characteristics such as color, odor, turbidity, the presence of separate phases, and odors shall be noted throughout well development operations. The duration of different development methods (i.e., time spent bailing or pumping) and estimated quantities of water removed, shall also be noted. Recovery times for wells which are pumped or bailed dry shall also be noted. Upon completion of well development, the development water shall be disposed onsite within the confines of the cutoff wall.

3.03 Acceptance

A. If at any time during the installation of a monitoring well the Engineer/Geologist determines that the well has not been properly installed, the Contractor shall abandon the hole and slurry grout its full depth as directed by the Engineer/Geologist and initiate construction of a new well at a location determined by the Engineer/Geologist at no cost to the Owner.

B. Upon completion of a well, the Contractor shall demonstrate to the Engineer/Geologist that the full depth of the monitoring well is free from any obstructions and clear of any formation materials, or the well shall be deemed unacceptable and shall be abandoned and re-drilled at no cost to the Owner.

3.04 Drilling Records

A. The Engineer/Geologist will record all drilling activities in a well log. The well log will contain the following information:

1. A record of the soil materials penetrated and the depth to which they were encountered in accordance with 6 NYCRR 360-2.11(a)(10).

2. A record showing lengths of each diameter of casing and screen used and the location of packers, plugs and seals.

3. Static groundwater level, in the new well and the levels at which water was encountered during drilling.

3.05 Surveying

A. Vertical and horizontal coordinates of newly installed wells shall be determined by a state licensed land surveyor. Each well shall be surveyed from the permanent measuring point scribed onto the well riser. Vertical measurements (elevations) shall be measured to within +/- 0.01 feet and horizontal measurements within 0.1 feet. Measurements shall be tied into the horizontal and vertical control established for the site.

B. Surveying shall be provided by the Contractor.

3.06 Decontamination

A. The Contractor will not use, reuse, or remove any equipment, materials, samples, or other goods at or from the site until it is certified to be uncontaminated. Decontamination will consist of washing and steam cleaning all equipment and materials that may be required as specified above or at the request of the Engineer/Geologist. The drilling crew will undertake the decontamination of the given equipment or materials under the Engineer/Geologists' supervision. The Contractor shall comply with all request and procedures of the onsite

Engineer/Geologist regarding decontamination during the course of the work, close of the workday, and upon completion of the project. Anticipated requests and procedures for decontamination are outlined as follows:

B. General Decontamination Procedures and Requirements

1. All drilling equipment shall be inspected for integrity of hydraulic and oil fluid handling systems and general overall cleanliness. Leaking hoses, tanks, hydraulic lines, etc., shall be replaced or repaired prior to beginning work.

2. All well casing, screens, and other construction materials must be in new condition. Used materials shall not be permitted in well construction.

C. Initial Cleaning

1. All drilling equipment and associated tools shall be steam cleaned, upon arrival at the Site. Equipment will include at a minimum, but not be limited to:

   - drilling rods, bits;
   - augers (clips, pins, and associated hardware);
   - samplers (i.e. split spoon, hydropunch);
   - casing materials (both temporary and permanent);
   - wrenches;
   - hammers;
   - other hand tools and tool boxes;
   - hoses, tanks;
   - cable clamps and other holding devices in direct contact with drilling rods; and
   - drill rig and undercarriage, wheel wells, chassis.

2. During and following cleaning, equipment shall be handled only with clean gloves. A new set of gloves will be utilized between each location.

3. Cleaned materials shall be protected from contamination by such means as the supervising Geologist deems necessary.

D. Onsite Cleaning

1. Following use, all equipment with the exception of the carrier truck and undercarriage, shall be steam-cleaned between borings.

2. Down hole sampling equipment must be washed in laboratory grade detergent and water, and rinsed in clean, clean potable municipal water between consecutive samples and/or each boring, as appropriate.

3. If immiscible products are encountered during drilling, the drilling and sampling equipment must be cleaned.

– END OF SECTION 02671 --

SECTION 02672

EXTRACTION WELLS

PART 1 - GENERAL

1.01 Description

A. Work included in this section: The Contractor shall provide all labor, materials, equipment, and incidentals as required by this specification to complete the work as described.

B. Groundwater recovery wells will be installed at locations shown on the Drawings. The wells will be constructed using the appropriate equipment to advance the borehole to its completion depth and install well materials. The drilling equipment and well materials include: an appropriate drill rig to drill 12-inch boreholes, 6-inch stainless steel well screen and riser, properly sized sand filter pack, bentonite, cement/bentonite grout, and a precast concrete protective vault.

C. Related work specified in other section:

1. Section 02200 - Earthwork
2. Section 02673 - Well Pumping Equipment
3. Section 03400 - Precast Concrete Manholes and Vaults

1.02 Submittals

A. Product Data: The product data for each component to be used in construction of the extraction well; including well screen, filter pack, cement and bentonite must be submitted by the Contractor. Product data must include manufacturer's name and the source of the material and be submitted prior to use in extraction well construction.

B. Installer: The name and address of the proposed well driller and a list of at least five completed projects of similar construction must be submitted by the Contractor.

1.03 Reference Standards

A. Title 6, New York Code of Rules and Regulations, Part 360 and Part 373.

PART 2 - PRODUCTS

2.01 Protection

A. Protective Vault: The protective vault shall be a precast concrete unit of the dimensions indicated on the Drawings. The protective vault will include a precast concrete cover with an aluminum hatch and integrated lock system. All lock mechanisms shall be keyed alike.

2.02 Riser and Sump

A. The well riser and sump pipe will be 6-inch ID, flush joint, threaded, Schedule 40, type 304 stainless steel.

2.03 Well Screen

A. The well screen will be 6-inch wire wound, type 304 stainless steel with flush threaded joints. The screen section will be comprised of two sections; the bottom five feet with a slot size of 0.025 inches (corresponding with the sand and gravel layer) and ten feet of 0.005 slot size above this section (corresponding with the alluvium layer).

2.04 Well Cap

A. The well cap will consist of 0.25-inch stainless steel flange welded to the well riser. The flange will be mated to 0.25-inch carbon steel cover plate fitted with a 6-inch cast iron well seal.

2.05 Standpipe

A one-inch, type 304 stainless steel, with flush threaded joints standpipe shall be installed adjacent to the extraction well risers and screen systems (within the sand pack) to allow for water level measurement. A five foot, screen section shall straddle the lower five foot section of the recovery well screen system. The standpipe well screen will be have a 0.025 inch slot size.

2.06 Sand Pack

A. The sand pack surrounding the 0.025 inch slot size screen will be Best 620 or equivalent. The sand pack will be a clean, inert, and siliceous material.

B. The sand pack surrounding the 0.005 inch slot size screen will be Best 550 or equivalent. The sand pack will be a clean, inert, and siliceous material.

2.07 Bentonite Seal

A. The seal will consist of 3/8-inch diameter sodium bentonite pellets. In unsaturated conditions, the bentonite pellets will be hydrated with potable water. The bentonite pellets will be allowed to hydrate a minimum of 30 minutes after installation.

2.08 Grout Mixture

A. The grout mixture shall be a mixture of Type I, Portland Cement (one 94 lb. bag), minus No. 200 sieve bentonite powder (3 lbs.), and potable water (7 gallons) in appropriate quantity to fill the borehole.

PART 3 - EXECUTION

3.01 Groundwater Extraction Well Installation

A. Installation of the groundwater Extraction well shall be recorded by the Engineer/Geologist in a field log book.

B. Extraction wells shall be installed to specified depths using air rotary, hollow stem auger, or other approved appropriate drilling techniques. Each extraction well will be drilled from the ground surface. The extraction wells will be screened from the elevations noted in the Drawings. All cuttings and drilling fluids will be disposed of in an area designated by the Engineer/Geologist. Drilling equipment shall be decontaminated prior to drilling, between boreholes, and before leaving the site.

C. The borehole shall be drilled to the required depth using appropriate drilling techniques. Upon reaching the required depth, the groundwater extraction well will be constructed in the borehole. Each groundwater extraction well will be constructed with the appropriate length of slotted well

screen and solid well riser. Appropriate centraliters shall be used to install the screen and riser. The borehole annulus around the outside of the screen will be backfilled with the specified sand packs extending from six inches below the bottom of the sump section to 2 feet, or 20 percent, of the length of the well screen (whichever is greater) above the top of the screen. Both sand packs will be placed using methods that avoid bridging and ensure accurate placement of filter materials. A minimum three foot thick bentonite pellet seal will be placed above the sandpack, hydrated, if necessary, and allowed to swell a minimum of 30 minutes. After allowing the bentonite seal to swell, cement/bentonite ground will be installed above the bentonite seal to the bottom of the surface vault. The grout will be placed ensuring that it is not diluted by formation water and that any water in the annular space is displaced.

3.02 Well Development

A. The Contractor shall perform well development after the grout seal has set for a minimum of 24 hours. The static water level and total well depth from the top of casing shall be measured initially. The extraction wells shall be pumped to remove sediment from the well screen and sand pack. Well evacuation shall be accomplished using a positive displacement pump and dedicated polyethylene tubing equipped with a foot valve, or a submersible pump. Dedicated tubing shall be used to eliminate the need for decontamination and reduce the risk of cross contamination. The Contractor shall develop the wells for at least five well volumes and attempt to achieve stabilized pH, conductivity, and temperature readings, and turbidity readings of 50 NUT or less.

The well development water shall be screened using a PID by the Engineer/Geologist. Physical characteristics such as color, odor, turbidity, the presence of separate phases, and odors shall be noted throughout well development operations. The duration of different development methods (i.e., time spent bailing or pumping) and estimated quantities of water removed, shall also be noted. Recovery times for wells which are pumped or bailed dry shall also be noted. Upon completion of well development, the development water shall be disposed onsite within the confines of the cutoff wall.

3.03 Acceptance

A. If at any time during the installation of a groundwater extraction well the Engineer/Geologist determines that the well has not been properly installed, the Driller shall abandon the hole and slurry grout its full depth as directed by the Engineer/Geologist and initiate construction of a new groundwater recovery well at a location determined by the Engineer/Geologist, at no cost to the Owner.

B. Upon completion of a groundwater extraction well, the Driller shall demonstrate to the Engineer/Geologist that the full depth of the well is free from any obstructions and clear of any formation materials, or the groundwater extraction well shall be deemed unacceptable and shall be abandoned and re-drilled at no cost to the Owner.

3.04 Drilling Records

A. The Engineer/Geologist will record all drilling activities in a well log. The well log will contain the following information:

1. A record of the soil materials penetrated and the depth to which they were encountered in accordance with 6 NYCRR 360-2.11(a)(10).

2. A record showing the measurements of casing and screen used and the location of packers, plugs and seals.

3. Static groundwater level and the levels at which water was encountered during drilling.

3.05 Surveying

A. Vertical and horizontal coordinates of newly installed groundwater recovery wells will be determined by a state licensed land surveyor. Each well shall be surveyed from the permanent measuring point scribed onto the well riser. Vertical measurements (elevations) will be measured to within +/-0.01 feet and horizontal measurements within 0.1 feet. Measurements will be tied into the horizontal and vertical control established for the site.

B. Surveying shall be provided by the Contractor.

3.06 Decontamination

A. The contractor will not use, reuse, or remove any equipment, materials, samples, or other goods at or from the site until it is certified to be uncontaminated. Decontamination will consist of washing and steam cleaning all equipment and materials that may be required as specified above or at the request of the Geologist. The drilling crew will undertake the decontamination of the given equipment or materials under the field Engineer/Geologist supervision. The Contractor shall comply with all requests and procedures of the Engineer/Geologist regarding decontamination during the course of the work, close of the workday, and upon completion of the project. Anticipated requests and procedures for decontamination are outlined below.

B. General Decontamination Procedures and Requirements Surveying

1. All drilling equipment shall be inspected for integrity of hydraulic and oil fluid handling systems and general overall cleanliness. Leaking hoses, tanks, hydraulic lines, etc., shall be replaced or repaired prior to beginning work.

2. All well casing, screens, and other construction materials must be in new condition. Used materials shall not be permitted in well construction.

C. Initial Cleaning

1. All drilling equipment and associated tools shall be steam cleaned upon arrival at the Site. Equipment will include at a minimum, but not be limited to:

- drilling rods and bits;
- augers (clips, pins, and associated hardware);
- samplers (i.e. split spoon, hydropunch);
- casing materials (both temporary and permanent);
- wrenches;
- hammers;
- other hand tools and tool boxes;
- hoses and tanks;
- cable clamps and other holding devices in direct contact with drilling rods; and
- drill rig and undercarriage, wheel wells, chassis.

2. During and following cleaning, equipment shall be handled only with clean gloves. A new set of gloves will be utilized between each location.

3. Cleaned materials shall be protected from contamination by such means as the Supervising Geologist deems necessary.

D. Onsite Cleaning

1. Following use, all equipment with the exception of the carrier truck and undercarriage, shall be steam-cleaned between borings.

2. Down hole sampling equipment must be washed in laboratory grade detergent and water, and rinsed in clean, clean potable municipal water between consecutive samples and/or each boring, as appropriate.

3. If immiscible products are encountered during drilling, the drilling and sampling equipment must be cleaned.

-- END OF SECTION 02672--

SECTION 02727

DRAINAGE AND PIPING

PART 1 - GENERAL

1.01 Section Includes

A. Furnishing and installation of corrugated high density polyethylene (HDPE) pipe for use as underground drainage.

B. Piping, manhole risers, frames, end sections, and fittings.

C. Miscellaneous appurtenances.

D. Requirements.

E. Installation.

F. Pipe Schedule.

1.02 Related Sections

A. Section 01001 - General Requirements

B. Section 01510 - Temporary Construction Facilities

C. Section 01564 - Erosion Control

D. Section 01700 - Project Closeout

E. Section 02200 - Earthwork

F. Section 02421 - Geotextiles

G. Section 02990 - Finish Grading, Topsoil, and Seeding

1.03 References

A. The drainage piping and accessories shall meet the applicable requirements of the following specifications:

1. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
2. ASTM D883 - Terms Relating to Plastics
3. ASTM D1248 - Polyethylene Plastics Molding and Extrusion Materials.
4. ASTM D1693 - Environmental Stress Cracking of Ethylene Plastics.
5. ASTM D2122 - Determining Dimensions of Thermoplastic Pipe and Fittings.
6. ASTM D2412 - Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
7. ASTM D2444 - Tests for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a TUP (Falling Weight).

1.04 Submittals

A. Submit under provisions of Section 01300.

B. Shop Drawings - Provide data, indicating conformance to ATSM/AWWA codes, pipe material, sizes, class, dimension, joint type and accessories.

C. Manufacturer's Certification - Certify that products meet or exceed specified requirements.

1.05 Project Record Documents

A. Submit documents under provisions of Section 01001 and 01300.

B. Submit marked up record plans including record location of pipe connections, valves, cleanouts, bends, tees, manholes, and rim and invert elevations. Invert elevations to be of pipe invert at a point where the pipe enters or exits a structure.

C. Identify and locate on record drawings during construction, the discovery of exposed uncharted existing utilities and services.

1.06 Regulatory Requirements

A. Conform to applicable codes for materials and installation of the work of this section.

B. All sheeting and bracing including the use of mobile shields shall conform to Public Law 91-596 (Williams Steiger Act). Occupational Safety and Health Administration Act (OSHA) of 1970 and its amendments and regulations or to the New York State Industrial Code Rule 23, entitled "Protection in Construction, Demolition and Excavation Operations" as issued by New York State Department of Labor, Board of Standards and Appeals, whichever is the most stringent.

C. Conform to New York State Industrial Code Rule 53, entitled "Construction, Excavation and Demolition Operations at or Near Underground Facilities" as issued by the State of New York Department of Labor, Board of Standard and Appeals.

1.07 Field Measurements

A. Prior to start of construction, verify that the elevations of existing conditions are as shown on drawings. Notify Engineer of specific differences.

1.08 Test Requirements

None

1.09 Coordination

A. Coordinate work under provisions of Section 01040.

PART 2 - PRODUCTS

2.01 General

A. All products included in this section shall conform to the requirements of the standard specifications referenced herein.

B. Pipe material, pipe class and pipe sizes shall be furnished and installed as listed herein, in the pipe schedule, or as shown on the Drawings.

C. All fittings, if required, shall be provided.

2.02 Pipe Materials

A. Underdrain Piping

1. Pipe and fittings shall be made of virgin PE compounds which conform with the requirements of Type III, Category 4 or 5, Grade P34, Class C - ASTM D1248.

2. Manufacturers or equal

   a. ADS

   b. Hancor

3. Perforations shall consist of slots whose widths shall not exceed 1/8-inch. The length of the slots shall not exceed 10 percent of the pipes inside nominal circumference. Slots shall be centered in the valleys of the corrugations.

4. Couplings shall be corrugated to match the pipe corrugations and shall provide sufficient longitudinal strength to preserve pipe alignment and prevent separation at the joints. Couplings shall be bell and spigot. split collar or screw on collar.

2.03 Identification

A. Each pipe length and fitting shall be clearly marked with:

1. Manufacturer's name and trademark.

2. Nominal pipe size and class.

3. Material designation.

PART 3 - EXECUTION

3.01 Examination

A. Verify that trench cut, excavated base and pipe bedding material are ready to receive pipe and that excavations and pipe bedding dimensions and elevations are as shown on Drawings.

B. All pipe or fittings which have been damaged in transit or which are obviously deformed or refinished in any way shall be rejected, marked, and removed from the site of the work.

1. Any pipe or fitting which the Engineer suspects is improper for the job shall be temporarily rejected, marked, and set aside for subsequent investigation to determine its conformity with the specifications.

2. All pipe fittings and specials shall be carefully inspected in the field before lowering into the trench. Cracked, broken, warped, out-of-round, damaged pipe joints including damaged pipe lining or coatings or specials, as determined by the Engineer, shall be culled out and not installed.

   a. Such rejected pipe shall be clearly tagged in such manner as not to deface or damage it, and the pipe shall then be removed from the job site by the Contractor at his own expense.

3.02 Preparation

A. The Contractor shall have on the job site with each pipe laying crew, all the proper tools, gauges, pipe cutters, lubricants, etc. to handle, cut and join the pipe.

B. Flat-bottom trenches of required width shall be excavated to the necessary depth as required and maintained in accordance with Section 02200.

C. Prior to installing the pipe foundation material, trenches shall have all water removed and all work performed in a dry trench.

D. All pipes, fittings and specials which are to be installed in the open trench excavation shall be properly bedded in, and uniformly supported on pipe foundations of the type specified in Section 02200 and shown on the Drawings. In particular, stones 2 inches and larger in diameter shall be removed from the bearing surface of the pipe foundations.

E. Pipe foundation bedding material shall be spread in maximum 8-inch layers and each layer shall be compacted up to the spring line of the pipe.

F. Compaction methods include hand tamping with T-bars, flat heads, level slicing as well as mechanical compactors.

G. The Contractor shall perform his bedding operations with care to maintain line and grades.

H. Suitable holes or depressions shall be provided in the pipe bedding to permit adequate bedding of bells, couplings, or similar pipe projections.

3.03 Lines and Grades

A. The Contractor shall furnish all labor, materials, surveying instruments, and tools to establish and maintain all lines and grades. The Contractor shall have personnel on duty or on standby call, at all times, who are qualified to check line and grade of pipe lines as they are installed.

B. Control points and lines necessary for locating the work are as shown on the Drawings and as described in Section 01040.

C. During construction, the Contractor shall provide the Owner at his request, all reasonable and necessary materials, opportunities, and assistance for setting stakes and making measurements, including the furnishing or one or two rodmen or chainmen as needed at the intermittent times.

D. The Contractor shall carefully preserve bench marks, reference points and stakes established by the Owner, and in case of willful or careless destruction by his own operations he will be charged with the resulting expense to reestablish such destroyed control data and shall be responsible for any mistakes or delay that may be caused by the unnecessary loss or disturbance of such control data.

E. The Contractor may use laser equipment to assist in setting the pipe.

F. The use of string levels, hand levels, carpenter's levels or similar equipment for transferring grade or setting pipe are not to be permitted.

3.04 Tolerances

A. Pipes shall be laid to the lines, grades, and inverts shown on the Drawings. Maintain a minimum grade as shown on the Drawings.

B. Minimum depth of cover shall be maintained as shown on the Drawings or as described herein.

3.05 Installation

A. The Contractor shall furnish slings, straps and/or approved devices to provide satisfactory support of the pipe when it is lifted. Transportation from storage areas to the trench shall be restricted to operations which can cause no damage to the pipe.

B. The pipe shall not be dropped from trucks onto the ground or into the trench.

C. Pipe laying shall proceed upgrade.

D. Each pipe section shall be placed into position in the trench on the pipe bedding in such manner and by such means required to cause no injury to the pipe, persons or to any property.

E. Pipe laying procedures shall be as recommended by the manufacturer and approved by the Engineer to control thermal expansion and contraction, both during and after installation.

F. Pipes, fittings, and specials shall be firmly bedded in the pipe foundation and shall have full bearing throughout their entire length, which shall be accomplished by combination of shaping the bedding and adequately combating the pipe bedding and backfill under and around the pipe to the spring line of the pipe. The remaining backfill placed in 12-inch lifts to 1-foot above the crown of the pipe in accordance with Section 02200.

G. Pipe laid in normal trench excavation shall not be laid on wood blocking.

H. Backfill material within 12 inches of the pipe shall be free of stones greater than 2 inches in any dimension.

I. Pipe deflection shall be according to the recommendations of the manufacturer.

3.06 Pipe Schedule

Description	Size (Inches)	Type of Pipe	Schedule or Class Carrier Pipe	Joints	Testing Procedures
Perimeter Drain Outlet	6"	Solid HDPE	AASHTO Designation M294-90 Type S	Split couplings	None
Underdrain Piping	6"	Corrugated Perforated HDPE	AASHTO Designation M252-90 Type CP	Split couplings	None

-- END OF SECTION 02727 --

SECTION 02910

RIVERBANK RESTORATION/WETLAND CREATION

PART 1 - GENERAL

1.01 Description

The work specified herein includes the material, equipment, and labor necessary to place soil, fertilizer, seed, plant materials, and mulch, as described herein and shown on Drawings.

A. Work included in this section:

1. Soil preparation at all planted areas including placing, loosening, conditioning, and fertilizing the soil.
2. Furnishing and installing plant materials, including trees, shrubs, and herbaceous plantings.
3. Staking and guying of trees.
4. Cleanup of all project areas.
5. Maintenance for 60 days.

B. Related work not included in this section:

1. Section 02200 - Earthwork; and
2. Section 02275 - Riprap.

1.02 Submittals

A. Soil Source: The Contractor shall submit for approval by the Engineer a written statement giving location of soil source and test results for pH, organic content, and sieve analysis.

B. Grass Seed Vendors Certificate: The Contractor shall submit the seed vendor's certified statement for the grass seed mixture required, stating common name, percentage by weight, and percentages of purity and germination rates for the grasses and sedges used for seeding.

C. Plant Materials: The Contractor shall submit a schedule of planting describing all installation milestones with proposed dates of commencement and completion for each milestone, within 10 days of receiving award of contract and 5 days prior to beginning work.

D. Fertilizer: The Contractor shall submit for approval by the Engineer, the manufacturer's literature concerning chemical composition, chemical make-up, application rates, and application procedures.

E. Hydroseeders: The Contractor shall submit for approval by the Engineer all data concerning hydroseeding equipment including all material application rates.

F. Erosion Control Fabrics: The Contractor shall submit for approval by the Engineer, the erosion control fabric manufacturer's literature, sample and specifications.

1.03 Quality Assurance

A. All plants shall conform to or surpass minimum quality standards as defined by the American Association of Nurserymen. All plant materials must be clearly labeled with genus, species, and common name. These plants may be inspected for conditions of root ball, disease, insects, or injury. All rejected plant materials must be removed immediately from the job site and must be replaced by the Contractor at no cost to the Owner within 5 working days. The Engineer has the right to inspect and reject plant materials up to the final acceptance.

B. Certificates. In addition to any other certificates specified, the Contractor shall furnish a certificate with each delivery of material, in containers or bulk, the analysis of the material, together with the date of delivery. All certificates shall be delivered to the Engineer, who will inspect the materials prior to its use.

C. Seeding. Seed shall be labeled in accordance with USDA Rules and Regulations under the Federal Seed Act and applicable State seed laws. Seed shall be furnished in sealed bags or containers bearing the date of the last germination which shall be within a period of six (6) months prior to commencement of planting operations. Seeding material shall be inspected upon arrival at the job site, and unacceptable material shall be removed from the job site. Seed shall be from same or previous year's crop; each variety of seed shall have a purity of not less than 85%, a percentage of germination not less than 90%, shall have a weed content of not more than 1% and contain no noxious weeds.

PART 2 - PRODUCTS

2.01 Substrate Soil

A. Substrate soil for upland, riparian, and wetland plantings shall be friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and reasonably free from subsoil, roots, heavy or stiff clay, stones larger than 2" in greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter. Substrate soil as delivered to the site or stockpiled shall meet the requirements for topsoil as specified under Section 02990.

B. Fertilizer

All soil placed for riverbank restoration and wetland creation shall be amended with fertilizer. Fertilizer shall be a starter fertilizer of commercial stock, of neutral character, with elements derived from organic sources. It shall be a complete, prepared and packaged material and shall contain a minimum of 8% nitrogen, 20% phosphoric acid and 10% potash. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

2.02 Wooded Shoreline Plant Materials

A. Plant Material

1. Woody Materials

Bare root and dormant cutting materials will be planted within the riprap shoreline protection. Woody materials shall be plated in locations and in patterns as indicated on the Drawing. The woody plant materials shall be installed in the spring before cuttings break dormancy. Planting holes shall be secured in the rip rap by the placement of sections of PVC tubing (or equivalent) within the riprap matrix at the time of riprap placement. Tubing shall be located in a grid pattern as indicated on the Drawing. Tubing shall be 8 inches or 10 inches in diameter depending on the species to be planted. The tubing will be

3 feet in length. This will allow the tubing to extend through the 30 inches of riprap and still allow for 6 inches to extend out of the riprap to facilitate locating the tubing later. A U-shaped length of rebar will be used to secure the section of tubing in place while the riprap is being placed around it. The U-shaped length of rebar will be used to secure the section of tubing in place while the riprap is being placed around it. The U-shaped rebar can then be removed and reused. The tubing will remain inplace until the time of dormant cutting planting. A hole shall be augered into the substrate, using the PVC tubing as a means of accessing the substrate, to a minimum depth of 10 inches and the dormant cutting will be inserted into hole. Woody materials shall consist of the following species and sizes in the following proportions or approved equivalent.

2. Dormant Cuttings

   Cuttings are sections of dormant stems at least 4 feet in length and 1/4 to 3/4 inch in diameter. Cuttings are planted in a grid and should be driven into the substrate to a minimum of 10 inches. The cuttings are sharpened at the bottom end and forced vertically into the earth into the prepared holes. Holes for the dormant cuttings will be made by placing sections of PVC tubing 8 inches in diameter into the riprap while simultaneously placing the riprap. The tubing will remain in place until the time of dormant cutting planting. A hole shall be augered into the substrate and the dormant cutting will be inserted into hole remaining using the PVC tubing as a means of accessing the substrate.

3. Bare Root Plants

   Bare root plants shall be planted into larger holes. To maintain an opening in the riprap from the time of placing the riprap until the installation of bare root plant material a length of PVC tubing shall be used. As the riprap is being placed lengths of PVC tubing shall be placed in bare root planting locations and shall be filled around with the riprap. The PVC tubing shall be 10 inches in diameter and 3 feet in length. When planting is to occur a soil auger shall be used to dig a hole in the soil 18 inches deep. The auger will allow the soil to be removed from the PVC tubing. The bare root plant shall then be placed in the hole and the soil can be replaced and tamped down around the new planting.

4. Posts

   Post treatment is the placement of dormant cuttings of larger diameter and lengths of branches. Each post shall be 3 inches or larger in diameter and 5 feet or more in length. Posts are driven into the soil using specially adapted heavy equipment consisting of a backhoe or trackhoe fitted with a hydraulic drill. Access through the riprap is provided by

   The following plant species and quantities shall be supplied:

Common	*Scientific*	Growth	Availability	Quantity
red-osier dogwood	*Cornus sericea*	shrub	dormant cutting	600
streamco willow	*Salix purpurea streamco*	shrub	dormant cutting	600
bankers willow	*Salix cottetti*	shrub	dormant cutting	600
gray dogwood	*Cornus foemina*	shrub	dormant cutting	1225
silky dogwood	*Cornus amomum*	shrub	dormant cutting	875
speckled alder	*Alnus rugosa*	sm. Tree	bare root	250
buttonbush	*Cephalanthis occidentalis*	shrub	dormant cutting	160
black willow	*Salix nigra*	tree	post	120

B. Product and Manufacturer: Provide plant materials as supplied by:

1. Southern Tier Consulting, Inc., West Clarksville, NY 719-968-3120
2. New England Wetland Plants, Inc., Amherst, MA 413-256-1752
3. Bestmann Green Systems, Inc., Salem, MA 508-741-1166
4. Miller Nurseries, Canandaigua, NY
5. or equal

C. Submit requests for plant substitutions in writing within 5 days after Award of Contract. Submit a minimum of three possible substitutions for each species. Plant substitutions should be similar in character and environmental requirements of the original plant.

D. Tree and shrub plant materials will be planted in the perimeter shoreline habitat areas as designated on the Drawings.

2.03 Create Wetland

A. Plant Material - Submergent

1. Wild celery (*Vallisneria spiralis*) shall be planted and established in the submergent trough zone of the created wetland habitat as designated on the Drawing. Winter buds of celery shall be used as planting materials for establishing new stands of this species. Winter buds shall be inspected upon arrival at the job site and unacceptable materials shall be immediately removed from the job site.
2. Minimum planting density shall be 2 foot squares. Each planting location shall consist of a minimum of 3 winter buds.

B. Plant Material - Emergent Zone and Wet Meadow Zone

The following species shall be planted and established in the emergent and wet meadow zones:

Planting Zone	**Common Name**	***Scientific Name***
Wet meadow	Dark green bulrush	*Scirpus atrovirens*
Wet meadow	Fox Sedge	*Carex vulpinoidea*
Wet meadow	Lurid Sedge	*Carex crinita*
Wet meadow	Soft rush	*Juncus effusus*
Wet meadow	Woolgrass	*Scirpus cyperinus*
Wet meadow	Blueflag iris	*Iris versicolor*
Emergent	Softstem bulrush	*Scirpus validus*
Emergent	Sweetflag	*Acorus calamus*
Emergent	Burreed	*Sparganium eurycarpum*
Emergent	Arrow arrum	*Peltandra virginica*
Submergent	Wild Celery	*Vallisneria spiralis*
Emergent	Pickerel weed	*Pontedaria cordata*
Emergent	Narrow-leaved Cattail	*Typha angustifolia*
Emergent	Broad-leaved Cattail	*Typha latifolia*

Plant Plugs are mature plants with a two inch diameter root ball with a coconut fiber substrate that can be planted directly into the substrate. Plugs that utilize coconut fiber as a plant

substrate work exceptionally well and if plant plugs are to be used the herbaceous wetland plants shall be planted one plug 3 feet on center. Plant Plugs as supplied by Bestmann Green Systems, Inc. or equivalent.

If **bare root** plants are to be used, the minimum planting density shall be 2 foot on center.

If **root stock** is to be used, the minimum planting density shall be 2 foot on center and each planting location shall consist of a minimum of 3 root stocks.

C. Product and Manufacturer: Provide plant materials as supplied by:

1. Southern Tier Consulting, Inc., West Clarksville, NY 719-968-3120
2. New England Wetland Plants, Inc., Amherst, MA 413-256-1752
3. Bestmann Green Systems, Inc., Salem, MA 508-741-1166
4. Miller Nurseries, Canandaigua, NY
5. or equal

D. If a variety of specified rootstock winterbuds and other plant materials are not available at the time of planting, substitutes must be approved by the Engineer. To obtain approval for substitutes, submit signed statements from 3 recognized vendors that the specified rootstock of the required species is not available.

2.04 Additional Seeding

A. Overseed emergent and wet meadow zones after planting with herbaceous planting. A wetland seed mix shall be spread in the wetland at a rate of 3.25 lbs/acre. Seeds shall be supplied by Southern Tier Consulting, Inc., or equivalent.

Wetland Native Wildflower Mix

Panic grass	*Panicum dichotomiflorum*
Smartweed	*Polygnum pennsylvanicum*
Minor components	
Nodding beggars tick	*Bidens cernua*
Boneset	*Eupatorium perfoliatum*
Blue vervain	*Verbena hastata*
Joe pye weed	*Eupatorium maculatum*
Canada goldenrod	*Solidago canadensis*
Ironweed	*Vernonia noveboracensis*
Additional species (as available)	
Swamp milkweed	*Asclepias incarnata*
Marsh marigold	*Caltha palustris*
Blueflag	*Iris versicolor*
New England aster	*Aster novae-angliae*
Grassleaf goldenrod	*Euthamia graminifolia*

Wetland hummock seed mix shall be used to vegetate upland hummocks within the wetland. The seed mix shall be applied at a rate of 3.25 lbs/acre. Seeds shall be supplied by Southern Tier Consulting, Inc., or equivalent.

Wetland Hummock Mix

Fox sedge	*Carex vulpinoidea*
Rice cut grass	*Leersia oryzoides*
Sedge	*Carex lurida/C. crinita*
Soft rush	*Juncus effusus*
Bulrush	*Scirpus atrovirens/S. cyperinus*
Sedge	*Carex comosa/C. intumescens*

If a variety of specified seed is not available at the time of seeding, substitutes will be approved by the Engineer. To obtain approval for substitutes, submit signed statements from 3 recognized seed vendors that the specified seed of the required species is not available. Replacement seeds will be of equal or greater dollar value.

Moldy or damaged seed will not be accepted.

2.05 Erosion Control Fabric

The erosion control fabric shall be as specified under Section 02990.

PART 3 - EXECUTION

3.01 General

A. The Contractor shall coordinate all work with riprap placement and cap system construction.

3.02 Installing Substrate Soil

A. Substrate soil

1. Substrate soil shall be placed in respective shoreline systems as shown on Drawings, to a depth sufficiently greater than required so that after natural settlement and light rolling, the complete work shall conform to the lines, grades, and elevations indicated on the Drawings. No substrate soil shall be spread while frozen or muddy.

2. The substrate soil shall then be rolled or compacted with a cultipacker weighing not more than 100 pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional topsoil, and the surface shall be regraded and rolled until a smooth and even finished grade is created.

B. Fertilizer

1. The fertilizer shall be applied with a mechanical spreader at a minimum rate of 200 lbs/acre or in accordance with the manufacturer's suggested rate.

2. After substrate soil has been spread and the fertilizer applied, it shall be carefully prepared by scarifying or harrowing to a depth of 2 inches and left in a roughened condition for seeding. All stiff clods, lumps, roots, litter and other foreign material shall be removed from the area and disposed of by the contractor. The areas shall also be free of smaller stones, in excessive quantities, as determined by the Engineer.

3.03 Installing Created Wetland and Riprap Shoreline Plant Materials

A. Planting pits for container stock should be hand dug with vertical sides. Control any adverse compaction in the soil conditions.

B. Wild celery winter buds shall be planted in the spring at a depth not to exceed 1 inch in the submerged sediment. Cattail rootstocks shall be planted in the spring at a depth not to exceed 6 inches in the submerged sediment.

C. Mix individual plant species within the planting areas to provide diversity. One plant species should not be clumped together in one area.

D. If plant materials arrive before sufficient areas are prepared, provide temporary storage areas and proper care for plant materials in storage. Proper storage areas include areas sheltered from wind, wildlife, vandalism, theft, and adverse weather. Replacement of plant materials that die during storage is the responsibility of the Contractor at no additional expense to the Engineer.

E. Dormant cuttings shall be inserted into substrate soil before winter dormancy is broken.

3.04 Installing Additional Seeding

A. Seeding

1. The seed mixture shall be applied uniformly upon the prepared surface with a hydroseeder at a minimum rate as specified immediately following the application of fertilizer.

2. If seed materials arrive before sufficient areas are prepared, provide temporary storage areas that are sheltered from wildlife, vandalism, theft, and adverse weather.

3.05 Maintenance

A. The Contractor shall begin a maintenance period immediately after planting of landscape materials.

B. Seeding establishment period is for one year. If in the judgment of the Engineer coverage has not been met, the Contractor must reseed those areas lacking acceptable coverage. Upon reseeding, the seeded areas shall be reinspected after establishment.

3.06 Warranty

A. The warranty period shall be one year from the date of substantial completion or correction period as specified in General Conditions. Areas of erosion shall be immediately repaired, re-seeded, and maintained until an acceptable grass stand is established.

B. Failed plant materials exhibiting conditions that are determined by the Engineer as being unacceptable due to workmanship shall be replaced by the Contractor at no additional cost to the Owner or Engineer. Replacement plant materials must match the size of adjacent specimens of the same species.

-- END OF SECTION 02910 --

SECTION 02990

FINISH GRADING, TOPSOIL, AND SEEDING

PART 1 - GENERAL

1.01 Description

The work specified herein includes the material, equipment, and labor necessary to provide finish grading and to place topsoil, fertilizer, seed, mulch, and erosion control fabric.

A. Work included in this section:

1. Finish grading
2. Placement of topsoil, seeding, and mulch
3. Installation of erosion control fabric
4. Maintenance of landscaped surfaces

B. Related work specified in other sections:

1. Section 01001 - General Requirements
2. Section 02200 - Earthwork

1.02 Submittals

1. Topsoil Source: The Contractor shall submit for approval by the Engineer, a written statement giving location of topsoil source. If soil amendments are proposed, submit amendment types, quantities, mixes, and test results.
2. Grass Seed Vendors Certificate: The Contractor shall submit the seed vendor's certified statement for the grass seed mixture required, stating common name, percentage by weight, and percentages of purity and germination.
3. Fertilizer: Submit manufacturer's product data showing contents and test results.
4. Hydroseeders: The Contractor shall submit for approval by the Engineer, all data concerning hydroseeding equipment (if used) including all material application rates.
5. Erosion Control Fabrics: The Contractor shall submit for approval by the Engineer, the erosion control fabric manufacturer's literature, samples, and specifications.

PART 2 - PRODUCTS

2.01 Topsoil

Topsoil shall be natural, friable, fertile soil of loamy character, capable of sustaining healthy plant life, and reasonably free from subsoil, roots, heavy or stiff clay, stones larger than 2 inches in greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter. Topsoil as delivered to the site or stockpiled shall have pH between 6.0 and 7.5; shall contain not less than 3 percent organic matter nor more than 20 percent as determined by loss of ignition of moisture-free samples dried at 100° to 110° Celsius; and shall have less than 20 percent by

weight passing the #200 sieve, less than 15 percent by weight clay, and less than 10 percent by weight gravel. Topsoil shall not be delivered to the site or used while in a frozen or muddy condition.

2.02 Grass Seed

Seed shall be labeled in accordance with USDA Rules and Regulations under the Federal Seed Act and applicable State seed laws. Seed shall be furnished in sealed bags or containers bearing the date of the last germination, which date shall be within a period of six (6) months prior to commencement of planting operations. Seeding material shall be inspected upon arrival at the job site, and unacceptable material shall be removed from the job site. Seed shall be from same or previous year's crop; each variety of seed shall have a purity of not less than 85 percent, a percentage of germination not less than 90 percent, shall have a weed content of not more than 1 percent and contain no noxious weeds. The seed mixture shall consist of the following proportions or approved equal.

Common Name	Variety	% By Weight
Tall Fescue	KY-31	40
Perennial Ryegrass	Polly	25
Creeping Red Fescue	Ensylva	20
Orchard Grass	Pennlate	15
Bird-Foot Trefoil	Viking	4

2.03 Fertilizer

Fertilizer shall be of commercial stock, of neutral character, with elements derived from organic sources. It shall be a complete, prepared, and packaged material and shall contain a minimum of 10 percent nitrogen, 10 percent phosphoric acid, and 10 percent potash. Other fertilizer mixes may be acceptable provided the application rate is adjusted to provide equal quantities. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

2.04 Mulch

Mulch shall be comprised of threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold, or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10 inches or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

2.05 Erosion Control Fabric

The erosion control fabric shall be a machine-produced mat of 100 percent biodegradable straw and netting. The material shall contain straw at 0.5 pounds per square yard with netting on one side only. The material shall be North American Green type S75 or equal.

2.06 Wire Staples

The wire staples for securing erosion control fabrics shall be U-shaped and formed of 11-guage plain iron wire with dimensions of 6-inch minimum length and 2-inch minimum width.

PART 3 - EXECUTION

A. Final grading shall be finished to a smooth and compact surface in accordance with the lines, grades, elevations, and sections shown on the final grading plan.

The surfaces of embankments or subgrades upon which roads, pavements, or structures are to be placed shall not vary more than .10 foot from the established grade. The surface of other areas shall be within .10 foot of the grades and elevations indicated. Gutters and drainage channels shall be finished in such a manner that will result in effective drainage. Surface of areas to be turfed shall be finished to a smoothness suitable for application of turfing materials.

B. All final grade surfaces outside the cover limits that have been disturbed or damaged during execution of the work shall be restored in accordance with this specification section.

C. The Contractor shall place erosion control fabric on all disturbed or constructed slopes:

3.01 Application Procedures

A. Topsoil

1. The Contractor shall place a minimum of six (6) inches of compacted topsoil over excavated areas, the cover area, and the disturbed areas as directed by the Engineer.

2. The underlying soil shall be tilled to a depth of 2 inches by disking or harrowing before topsoil placement. Tillage shall be parallel to contours, and shall not be performed when the cover is frozen or excessively wet.

3. Topsoil shall be placed to a depth sufficiently greater than required so that after compaction, the complete work will conform to the lines, grades, and elevations indicated on the Drawings and the six (6) inch minimum requirement. No topsoil shall be spread in water or while frozen or muddy.

4. The topsoil shall then be rolled or compacted with a cultipacker weighing not more than 100 pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional topsoil, and the surface shall be regraded and rolled until a smooth and even finished grade is created.

B. Fertilizer

1. The fertilizer shall be applied with a mechanical spreader at a minimum rate of 900 lbs/acre.

2. After topsoil has been spread and the fertilizer applied, it shall be carefully prepared by scarifying or harrowing to a depth of 2 inches and left in a roughened condition for seeding. All stiff clods, lumps, roots, litter, and other foreign material shall be removed from the area and disposed of by the Contractor.

C. Seeding

1. The seed mixture shall be applied uniformly upon the prepared surface with a hand or mechanical spreader at a minimum rate of 200 lbs/acre. The seed shall be raked lightly into the surface and rolled. Seeding shall be conducted from April 1 to May 15 or from August 15 to October 1.

D. Mulch and Erosion Control Fabric

1. Mulch or erosion control fabric shall be placed immediately after the application of fertilizer and seed.

2. Areas that have been seeded and have a slope less than or equal to 15 percent shall be protected from erosion by the placement of straw mulch. The mulch shall be applied with a mulch blower at a uniform rate of 1500 lbs/acre and anchored by use of a tackifier.

3. Erosion control fabrics shall be installed in lieu of the straw mulch in areas that have a slope greater than 10 percent or as indicated on the Drawings.

E. Watering

1. Following applications of the mulch or erosion control fabric, the seed bed shall be moistened. A muddy soil condition will not be acceptable. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory growth. Watering shall be done in such a manner to prevent washing out of seed.

2. The stand of grass resulting from the seeding shall not be considered satisfactory until accepted by the Owner. If areas are determined to be unacceptable, the remaining mulch or erosion control fabric will be removed and all areas shall be re-seeded, re-fertilized and re-mulched, and erosion control fabric replaced as per the above application procedures at the Contractor's expense.

3.02 Maintenance

A. The Contractor shall begin a maintenance period immediately after planting of grass and landscape materials.

B. The Contractor shall maintain grass areas, for the period required to establish an acceptable growth, but not less than 60 days, after seeding. If seeded in the fall and not given a full 60 days of maintenance, or if not considered acceptable by the Owner and the Engineer at that time, continue maintenance during following spring until acceptable grass stand is established.

C. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory sod growth. Watering shall be in such a manner as to prevent washing out of seed.

3.03 Warranty

A. The warranty period shall be one year from the date of substantial completion or correction period. Areas of erosion shall be immediately repaired, re-seeded, re-mulched, and maintained until an acceptable grass stand is established. Areas to be repaired shall also include areas failing to produce a full, uniform strand of grass.

-- END OF SECTION 02990 --

SECTION 03100

FORMWORK

PART 1 GENERAL

1.01 Description

A. Contractor is referred to the Owner's Construction Contract and will consider same as a part of these Specifications as if repeated herein.

B. Contractor shall review all other Sections of these Specifications for instructions related to work under this Section.

C. Furnish all labor, material and equipment to install all formwork for cast-in-place concrete, including hardware and appurtenances.

1.02 Quality Assurance

A. Formwork design shall conform to American Concrete Institute's (ACI) Recommended Practice for Concrete Formwork, ACI 347, Latest Edition.

B. Plywood form design shall conform to American Plywood Association's (APA) Plywood for Concrete Forming, Form V345, Latest Edition.

1.03 Product Delivery, Storage and Handling

A. On delivery to job site, place materials in area protected from weather.

B. Store materials aboveground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Handle materials to prevent damage.

PART 2 PRODUCTS

2.01 Materials

A. Conform with ACI 347, Chapter 3, Materials and Formwork, Latest Edition.

B. Lumber:

1. Softwood framing lumber shall conform to Product Standard's (PS) American Softwood Lumber, Standard PS 20, Latest Edition.

2. Boards less than 1-1/2" thick and 2" wide, used for basic forms and form liners shall be kiln dried.

3. Lumber shall be grade marked by grading rules agency approved by American Lumber Standards Committee.

4. Light framing or studs for board or plywood forms, 2" to 4" in width and thickness shall be construction standard grade.

5. Boards for basic forms or form liners shall be construction standard grade.

6. Board surface shall be smooth.

C. Plywood:

1. Exterior type softwood plywood shall conform to Softwood Plywood - Construction and Industrial, PSI, Latest Edition.

2. Each panel shall be stamped or branded indicating veneer grades, species, type and identification.

3. Overlay plywood for non-architectural concrete surfaces shall have panel veneer Grade B with mill-oiled sides and mill-sealed edges.

D. Chamfer strips shall be wood, of uniform width, straight, and dressed.

E. Ties shall be carbon steel taper rod, snap-off steel form ties or approved equal. Minimum breakback shall be 1-1/2".

F. Form coatings shall be non-staining mineral oil or other approved material.

G. Sealant shall be one part silicone sealant.

PART 3 EXECUTION

3.01 General

A. Conform to ACI 347, Chapter 2, Construction, Latest Edition.

B. Framing, bracing and plywood form liners shall conform to APA Form V 345, Latest Edition.

C. Provide temporary openings in formwork for concrete placement and to permit thorough cleaning prior to concrete placement.

D. Forms shall be built mortar-tight and true to line and grade with substantial bracing. Form lumber for exposed surfaces shall be dressed. Plywood forms, or forms face-lined with plywood may be used provided they are substantial, of uniform thickness, and are mortar-tight when in position. Exposed corners will have 3/4" x 45 degree chamfer. Use only form ties; no wire ties.

E. Vertical formwork on exposed surfaces shall be removed as soon as practical, but not earlier than 24 hours after concrete is placed, to facilitate finishing. Horizontal formwork shall not be removed until at least 14 days after placing concrete. All removal of forms shall proceed with care to avoid damage to surfaces which have not fully hardened.

F. Pipes, conduits, anchors, castings, bolts, plates, inserts, and other appurtenances which are necessary to be placed in the concrete of a structure, whether indicated on the Drawings or not, shall be placed by the Contractor during construction. No additional compensation will be allowed for placing such items.

G. The location of all construction joints not shown on the Drawings and required by the Contractor in performance of this work shall be subject to the approval of the Owner.

– END OF SECTION 03100 –

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 Description

A. Contractor is referred to the Owner's Construction Contract and will consider same as a part of these Specifications as if repeated herein.

B. Contractor shall review all other Sections of these Specifications for instructions related to work under this Section.

C. Furnish labor and material as required for furnishing and installing all reinforcing steel for cast-in-place concrete as shown on the Drawings and as specified herein.

1.02 Quality Assurance

A. Acceptable Manufacturers: Regularly engaged in manufacture of steel bar and welded wire fabric reinforcing.

B. All reinforcement shall conform to the American Concrete Institute's (ACI) Manual of Standard Practice for Detailing Reinforced Concrete Structure (ACI 315), Latest Edition, and Building Code Requirements for Reinforced Concrete (ACI 318), Latest Edition.

C. All fabrication of welded wire fabric shall conform to ASTM-A185.

1.03 Submittals

A. Submit shop drawings indicating bar sizes and dimensions for fabrication and placing of reinforcing steel bars; supports; bar schedules; stirrup spacing; and diagrams of bent bars.

B. Submit copies of certificates of mill tests covering all bars, wire fabric and wire used, or copies of test reports made by an independent testing laboratory acceptable to the Owner showing conformance of the materials with these Specifications.

1.04 Product Delivery, Storage and Handling

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.

B. Handle and store materials to prevent contamination and damage.

PART 2 PRODUCTS

2.01 Materials

A. Reinforcing steel shall have a minimum yield strength of 60,000 psi and conform to ASTM A615.

B. Welded wire mesh shall conform to ASTM A185.

C. The wire shall conform to ASTM A82, double annealed.

PART 3 EXECUTION

3.01 Installation

A. Reinforcing shall be placed in accordance with CRSI's Manual of Standard Practice and ACI 318.

B. All splices, ties, corner bars, etc., shall conform to ACI 315.

C. Wire Fabric:

1. Install in longest practicable length.
2. Lap adjoining pieces not less than 12 inches, and tie splices with 16 gauge wire.
3. Do not make end laps midway between supporting beams or directly over beams of continuous structures.
4. Offset end laps in adjacent widths to prevent continuous laps.

D. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete.

E. Protection During Concreting: Keep reinforcing steel in proper position during concrete placement.

-- END OF SECTION 03200 --

SECTION 03300

CONCRETE

PART 1 GENERAL

1.01 Description

A. Contractor is referred to the Owner's Construction Contract and will consider same as a part of these Specifications as if repeated herein.

B. Contractor shall review all other Sections of these Specifications for instructions related to work under this Section.

C. Furnish all labor, material and equipment to complete all site-placed concrete shown on Drawings, including installation of anchor bolts and embedded steel furnished in other Sections of these Specifications.

1.02 Quality Assurance

A. All work shall conform to American Concrete Institute's (ACI) Specifications for Structural Concrete for Buildings, ACI 301.

B. Submit test reports of concrete compression, air content and slump tests.

C. Submit Manufacturer's certification that materials meet Specification requirements.

D. Submit material content per cubic yard of each class of concrete furnished:

1. Dry weight of cement.
2. Saturated surface-dried weights of fine and coarse aggregate.
3. Quantities, type, and name of admixtures.
4. Weight of water.

E. Submit ready-mix delivery tickets conforming to ASTM C94.

F. Design of the concrete mix required to meet the strength specified shall be the responsibility of the concrete supplier. The Owner shall approve the design mixture before any concrete is placed. No changes or additions, particularly water, shall be made to the supplier's mix without the Owner's approval. Water to cement ratio allowed for concrete proportioned is in ACI 318, Table 4.5.

PART 2 PRODUCTS

2.01 Concrete Properties

A. All concrete shall attain a minimum compressive strength of 4000 psi at 28 days. Slump shall not exceed 4". Concrete shall have a total air content of 4% to 8% for concrete exposed to freezing and thawing. All other concrete shall have a total air content of 2% to 4%.

B. Do not use calcium chloride in concrete unless authorized in writing by the Engineer. Do not use admixtures containing calcium chloride.

2.02 Cement

A. Portland Cement shall conform to ASTM C150, Type I.

2.03 Aggregate

A. Coarse aggregate shall be crushed slag or crushed stone conforming to ASTM C33. Size shall be No. 57.

B. Fine aggregate shall be natural sand, manufactured sand or a combination thereof.

2.04 Admixtures

A. Air-Entraining Admixtures shall conform to the requirements of AASHTO M154, except that the tests for bleeding, bond strength and volume change will not be required.

B. Plasticizer shall conform to the requirements of ASTM C494. The quantity of plasticizer will depend on the concrete mix and shall be determined by trial batches. Plasticizer shall be Eucon 37 by Euclid Chemical Company or approved equal.

2.05 Bonding Agent

A. Bonding agent for new concrete to existing concrete shall be "Sikadur-Hi-Mod" as manufactured by Sika Chemical Corporation, Lyndhurst, New Jersey, or other approved. Application as recommended by the manufacturer.

2.06 Grout

A. Grout shall be Masterflow 713 as manufactured by Master Builders, Cleveland, Ohio, or other approved.

2.07 Expansion Joint Material

A. Expansion joint material shall be non-extruding and resilient filler, conforming to ASTM D1751. Filler may be composed of either cellular fibers or granulated cork with asphalt binder. Acceptable fillers: "Elastite" by Phillip Carey Co.; "Flexcell" by Celotex Corp.; or "Corkfill" or "Fibre Joint" by W.R. Meadows.

2.08 Waterstops

A. Waterstops shall be polyvinylchloride (PVC) waterstops as manufactured by Greensteak, Inc., P.O. Box 7139, St. Louis, Missouri 63177. Splices and joints shall be heat fused.

2.09 Sealant

A. Sealant shall be W.R. Meadows Poly-Jet JFR or equal.

PART 3 EXECUTION

3.01 Inspection

A. Assure that excavations and formwork are completed, and that ice and excess water are removed.

B. Check that reinforcement is secured in place.

C. Verify that expansion joint material, anchors and other embedded items are secured in position.

D. All anchor bolts on the Drawings shall be set using a template and to the following tolerances:

Bolt Projection: Plus 1/4" minus 0"

Bolt Location: Plus or minus 1/16"

All templates used in setting of anchor bolts shall be of adequate construction and sufficiently secured to insure that the bolts will not be displaced during the placement of concrete. All templates shall be set at the approximate elevation of the baseplates of the equipment or columns which are to be secured by the bolts. The construction of templates and method of placing templates shall be approved by the Owner.

3.02 Installation: General

A. Unless other arrangements acceptable to the Owner are specifically entered into by the Contractors concerned, all sleeve, pipes, inserts, conduits, hangers, ties, etc., required to be set or built into the forms for the work of others, shall be installed as part of the work of such other Contractors with whom this Contractor shall cooperate.

B. No concrete shall be placed, except when the Owner is present, unless this requirement is specifically waived by the Owner.

C. Water shall be free of organic material and of potable quality.

D. Admixtures for plasticizing, densifying, air entrainment, retarding or accelerating of set may be used in the concrete, provided that acceptable documentary evidence must be presented with the material submitted for approval showing that the concrete strength will not be impaired and that the desired qualities will be obtained. The Owner's approval must be had for all admixtures used in the concrete. Salts, chemicals, and other foreign materials shall not be mixed with the concrete for the purpose of preventing freezing.

E. Concrete transported in a truck mixer shall meet the "Standard Specifications for Ready-Mix Concrete", ASTM C94. Concrete which is held in the mixer for more than one hour after charging water to the mix, or which is otherwise unsuitable for placing, shall be returned to the supplier.

G. No job mixed concrete will be permitted.

3.03 Placing Of Concrete

A. Remove debris and water from forms. Avoid segregation due to handling. Concrete shall be deposited in the forms in a manner that will avoid segregation of the materials and shall not be permitted to drop freely more than 3 feet. To avoid an excessive drop, concrete shall be deposited through drop chutes or through openings placed in the side of forms. Concrete shall be deposited as nearly as practicable in its final position. In general, it shall be placed in horizontal layers of uniform thickness and shall be compacted before placing the next layer.

B. Work concrete thoroughly around reinforcement, embedded fixtures and into corners of forms. All concrete shall be compacted with internal vibrators. Vibrators shall be applied at point of deposit and shall not be used to move concrete into its final position.

C. Placing of concrete in weather below 40°F. shall be permitted only upon approval of the Owner.

D. If the forms show any bulges or settlement, they shall be corrected, with the concrete being removed, if necessary.

E. While pouring, lift welded wire fabric up so that it is completely surrounded with concrete and not less than 2" above bottom of ground, 1/2" above formwork.

F. Notify the Owner and all interested trades 48 hours in advance before placing concrete.

G. All concrete placed under these Specifications shall be so protected that the temperature at the surface will not fall below 50°F. Before placing the concrete, the forms and/or subgrade shall be free from frost and ice, and after the concrete is placed it shall be protected on all exposed sides by straw, tarpaulins or other approved means. The methods of heating the material and protecting the concrete shall be approved by the Owner. Salts, chemicals and other foreign materials shall not be mixed with the concrete for the purpose of preventing freezing. Temperature of concrete shall not exceed 90°F.

3.04 Finishing Of Concrete

A. Vertical surfaces exposed to view shall be dressed by neatly removing fins and other projections and carefully smoothing the surface. Filling of voids, or honeycomb areas, will be done by using a mortar of cement and fine aggregate mixed in the proportions of the concrete being finished and the repaired surface finished with a wood float to free it of all imperfections and discoloration. Exposed surface shall mean those surfaces of structures against which backfill will not be placed. Exposed concrete surface shall be true and even, free from rough areas, depressions, or projections. Exposed surfaces which are not satisfactory to the Owner's Representative as to color, texture and smoothness, or because of excessive patching and/or other corrective work, shall be grout cleaned as required by the Owner's Representative. Other contiguous exposed surfaces on the structure shall be finished in a similar manner to the extent required to produce a uniform appearance.

B. Concrete surfaces, not exposed to view, shall require no finish, but all voids and honeycomb shall be filled with patching mortar applied after wetting the area to be patched.

C. All slabs, equipment pads and sidewalls are to be finished to a hard smooth surface with a steel trowel. Slabs are to be perfectly level unless shown pitched to drains, etc. Any humps or dips in the slab will be corrected to the satisfaction of the Owner at this Contractor's expense.

3.05 Curing Of Concrete

A. All concrete shall be cured for a period of not less than 7 days by one of the approved methods listed below. During the curing period, no part of the concrete shall be permitted to become dry. The curing medium shall be applied so as to prevent the checking and cracking of the surface of the concrete immediately after placing and it shall be maintained so as to prevent loss of water from the concrete for the duration of the entire curing period.

B. Water Curing - Concrete shall be kept wet by mechanical sprinklers or by any other approved method which will keep the surface continuously wet.

C. Curing Compounds - Curing compounds of the surface membrane type conforming to ASTM C309 shall be used if approved by the Owner. Curing compounds shall be agitated thoroughly by mechanical means continuously during the use, and shall be sprayed or brushed uniformly in a single coat on all surfaces at a rate not to exceed the requirements of ASTM C309. Application shall be made immediately following the final finishing operation.

D. The Recommended Practice for Cold Weather Concreting, ACI 306, and/or the Recommended Practice for Hot Weather Concreting, ACI 305, shall be followed when placing all concrete.

E. Apply EUCO Surfhard, Sonneburn Lapidolith, or equal after curing to all exterior concrete slabs.

3.06 Testing

A. Make at least one (1) cylinder to be tested at 28 days and one (1) cylinder to be tested at 7 days for each 100 cubic yards of concrete or fraction thereof according to ASTM C31. At least two (2) cylinders required for each day's placement, except for small batches or non-structural concrete. Testing shall be by a recognized lab in accordance with ASTM C39. Furnish two (2) copies of report to the Owner. The EXACT LOCATION of the concrete in the work represented by each set of cylinders MUST BE recorded and shown on test reports. The Owner may order additional test cylinders made at anytime during progress of work.

B. In the event that the concrete fails to meet the requirements of these Specifications, in any respect, the Owner may require:

1. A revised concrete mix.
2. Core samples be drilled in that portion of the structure represented by low strength cylinders and tested in accordance with ASTM C42.
3. Load tests made by an approved testing lab on the portion of the structure represented by low strength cylinders.

C. The Owner shall have the right to require strengthening or removal and replacement of that portion of the structure failing to pass the load test, or tests made on the core samples. Any testing, replacement or strengthening so ordered shall be made at the Contractor's expense and no extra compensation will be allowed.

3.07 Grouting

A. Grout all steel bearing plates, sleeves, equipment bases, columns and other structural parts set to structural hardened concrete using approved premixed grout, adding only water. Use driest practical mix and pack into place or, where necessary, use a flowable mix poured into form. Prepare and install in accordance with the manufacturer's written recommendations. Unless noted otherwise, use a minimum of 1" thickness of grout.

3.08 Slabs On Grade

A. Install all concrete slabs in exact accordance with the requirements of the Drawings as to thickness, reinforcing, slopes, etc., and as hereinafter specified.

B. Where floor drains occur, pitch slabs uniformly toward drains as directed.

C. Reinforce all slabs, unless other reinforcing is indicated on the Drawings, throughout with standard 6 x 6 x 6/6 welded wire fabric.

Hold fabric back 2" from expansion joints. Lap adjacent sheets at least 12" and securely wire or clip together on not over 48" centers. Position fabric in approximately the center of the slab thickness as concrete is placed.

D. Provide expansion joints of width noted on Drawings at all junctions of slabs with walls and between adjacent slabs where called for on the Drawings. Utilize expansion joints (continued across openings) as construction joints if needed; allow at least 12 hours of elapsed time before making adjacent pour.

3.09 Non-Conforming Work

A. All concrete not meeting the requirements of these Specifications will be corrected or replaced if required in accordance with the Owner's decision at no expense to the Owner.

-- END OF SECTION 03300 --

SECTION 03410

PRECAST CONCRETE HOLLOW CORE SLABS

PART 1 - GENERAL

1.01 Description

A. Work of Other Sections:

1. Concrete Reinforcement: Section 03200
2. Concrete: Section 03300
3. Insulation: Section 07211
4. Sealants: Section 07900
5. Core Drilling Holes: Responsibility of Respective Trades.

1.02 Quality Assurance

A. Manufacturer: The manufacturer shall be Spancrete Northeast, Inc., or equal, having a proven background of experience and record of performance required for this project, and shall be certified by the Prestressed Concrete Institute Plank Certification Program.

B. Requirements of Regulatory Agencies: Design, construction and installation shall meet requirements of state and local building codes.

C. Allowable Tolerances:

1. Length of precast units shall be $\pm$ 1/2 inch of the length indicated on the approved shop drawing.
2. Width of precast concrete units: $\pm$ 1/4 inch.
3. Thickness of precast concrete units: $\pm$ 1/4 inch.
4. Location of inserts within units: $\pm$ 1 inch.
5. Differential camber between adjacent units of the same design: $\pm$ 1/4 inch per 10 ft., but not greater than 1/2 inch.
6. Squareness of ends (vertical and horizontal alignment): $\pm$1/4 inch.

D. Source Quality Control: Cylinder test of concrete quality shall be made by manufacturer in accordance with ASTM C 192, for each mix design, for each day of production, or for each 100 cubic yards of concrete.

1.03 Submittals

A. Shop Drawings:

1. Submit 2 copies of shop drawings for approval prior to fabrication.

2. Drawings shall show position, span, dimensions, reinforcement, location of anchor plates or clips, and as required, openings, hanger spacing and anchoring details.

1.04 Design

A. Computer load tables, design calculations, and shop drawings shall be prepared under the supervision of a Registered Engineer. Submittals are not normally stamped by the supervising P.E. unless specifically requested in project specifications.

B. The hollow core slabs shall be designed for the dead loads shown on the drawings and the maximum of either the live stated on the drawings or the minimum live load required by the governing building code for the proposed occupancy.

C. The design shall properly account for load distribution of concentrated and live loads and for the effect of openings.

1.05 Product Delivery, Storage and Handling

A. Transport and handle precast concrete slabs with proper equipment to protect units from dirt and damage.

B. Store precast concrete slabs to protect units from contact with soil or ground. Store units on firm surfaces to avoid warping and cracking.

PART 2 - PRODUCTS

2.01 Materials

A. Concrete:

1. Portland cement shall conform to AST C 150.
2. Normal weight aggregate shall conform to ASTM C 33, for fine to course graduation.
3. Chemical admixtures shall conform to ASTM C 494. Calcium chloride shall not be used.
4. Water shall be free from foreign materials in amounts harmful to concrete.

B. Prestressing strands shall be uncoated 7 wire strands conforming to ASTM A 416, Grade 250 or 270.

C. Weld inserts, anchor plates, etc. shall be shown on drawings if required for anchoring slabs to supports or bracing steel framing.

D. Headers required to safely carry design loads shall be fabricated of steel and be painted with one coat of red primer after fabrication. Determination of header requirements shall be by manufacturers' engineer.

2.02 Mixes

A. Mix design shall be in accordance with the latest edition of ACI Committee 211 with reference to ACI Subcommittee 2 report "Recommended Practice for Selecting Proportions for No-Slump Concrete."

B. Measurements of concrete mix shall be within the following limits:

1. Cement: ± 1 percent

2. Water: $\pm$1 percent

3. Fine Aggregate: $\pm$2 percent

4. Course Aggregate: $\pm$2 percent

5. Admixtures: $\pm$3 percent

2.03 Fabrication and Manufacture

A. Precast concrete slabs shall be hollow core slabs with pretensioned, prestress strands as manufactured by Spancrete Northeast, Inc. under the trade name of "Spancrete", or equal.

B. Fabrication and Design:

1. Design of precast concrete slabs shall be in accordance with the latest edition of ACI 318.

2. Concrete shall have a minimum compressive strength of 4,000 psi at 28 days.

3. Precast concrete slabs shall be designed and reinforced for all superimposed dead and live loads as shown on architectural and structural plans.

4. Prestressing strands shall be pretensioned by either a dead weight system or a single strand jacking system. Strands shall be marked for slippage, and if slippage occurs, strand shall be detensioned and restressed. Tension of strand shall be checked to insure accurate results.

5. Prestressing strands will be released when concrete reaches a strength of 3,000 psi or greater as required by design.

6. Precast concrete slabs shall be air or steam cured and shall be clean, smooth, and straight without fins, broken edges, or structural defects prior to delivery.

PART 3 - EXECUTION

3.01 Inspection

A. All bearing surfaces including lintels to be installed by others prior to slab erection. Where masonry walls are used as bearing surfaces, the top course shall be (filled) solid.

B. Weld angles, anchor inserts in bearing surfaces, and supporting structures shall be installed plumb to line and grade by others prior to erection of slabs. Precast concrete slab contractor will verify that structure and anchorage inserts are within allowable tolerances.

C. No broken, cracked, spalled, warped, or otherwise defective units shall be erected, unless they are judged structurally adequate, and are capable of cosmetic repair with proper patching.

D. Where masonry walls are used as bearing surfaces, the top course shall be solid filled U-block or other solid, smooth, level surface.

3.02 Preparation

A. General contractor shall coordinate delivery and erection of precast concrete slabs, provide clear site, provide and maintain firm and level access roads to allow crane and trucks to reach work area under their own power.

B. Care shall be taken to protect the work and material of other trades during installation of slabs.

3.03 Installation

A. Precast concrete slabs shall be installed according to approved shop drawings and details by mechanics experienced in precast concrete slab erection.

B. Units shall be erected tight and at right angles to bearing surfaces unless shown otherwise. Minimum bearing shall be 2 1/2 inches on steel, 3 inches on concrete and 3 1/2 inches on masonry. Align and level precast concrete slabs using shims, bolts, or jacks.

C. Where weld inserts are shown, precast concrete slab contractor shall weld inserts in slabs to bearing surfaces.

D. Grouting Joints:

1. Clean joints before grouting.
2. Grout for joints shall be 1 part portland cement, 3 parts and, and water.
3. Fill longitudinal keyways between units with grout. This does not include grouting butt joints or joints between plank and other materials.
4. Remove grout that seeped through to ceiling below before grout hardens.

E. Openings greater than 10 inches square to be saw cut in field. Openings 10 inches or less will be done by trades requiring same. However, if more than two openings occur in any individual slab, approval of the precaster must be obtained prior to making any cuts. (A number of closely spaced small openings could effectively cut all prestressing strands and destroy the structural strength of the slab.)

F. All openings require in the precast slabs shall be indicated on the structural plans.

3.04 Adjust and Clean

A. Plank that are broken, cracked, or chipped shall be repaired or replaced.

B. After erection and grouting is completed, the general contractor will be responsible for the protection of the slabs.

C. Remove rubbish and debris resulting from precast concrete slab work from premises upon completion. Protect work of this section from fabrication to installation.

-- END OF SECTION 03410 --

SECTION 03480

PRECAST CONCRETE MANHOLES AND VAULTS

PART 1 - GENERAL

1.1 Description

A. Scope: Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all precast concrete manholes and vaults.

B. General:

1. Manholes and vaults shall conform in shape, size, dimensions, material, and other respects to the details shown or as ordered by ENGINEER.
2. Cast-iron frames, grates, and covers shall be the standard frame and grate or cover unless otherwise shown and shall be as specified.
3. Manhole steps and/or ladders shall be as specified in Section 05500.
4. Concrete for inverts in precast manholes shall be Class A and shall conform to the requirements specified under Section 03300.

C. Related Sections:

1. Division 2 Sections on Earthwork.
2. Section 03300, Cast-In-Place Concrete.
3. Section 05500, Miscellaneous Metal Fabrication.
4. Division 15 Section on Piping.

1.2 Quality Assurance

A. Reference Standards:

1. ASTM C 478, Specification for Precast Reinforced Concrete Manhole Sections.
2. ASTM A48, Gray Iron Castings.
3. ANSI A14.3, Safety Requirements for Fixed Ladders.

1.3 Submittals

A. Shop Drawings: Submit for approval the following:

1. Drawings showing design and construction details of all precast concrete manholes and vaults including details of joints between the manhole bases and riser sections and stubs or openings for the connection of piping.
2. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor diagrams, and installation instructions for products to be used for miscellaneous metals works and casting assemblies.

PART 2 - PRODUCTS

2.1 Precast Concrete Manholes

A. Precast manholes and vaults shall conform to the details shown.

B. Except where otherwise specified, precast components shall consist of reinforced concrete sections especially designed for manhole construction and manufactured in accordance with ASTM C 478 except as modified herein.

C. Precast, reinforced concrete manhole and vault bases, riser section, flat slabs, and other components shall be manufactured by wet cast methods only, using forms which will provide smooth surfaces free from irregularities, honeycombing or other imperfections.

D. Joints between precast components shall be the tongue and groove type employing a single, continuous rubber O-ring gasket and shall conform to AWWA C302. The circumferential and longitudinal steel reenforcement shall extend into the bell and spigot ends of the joint without breaking the continuity of the steel. Joints between the base section, riser sections, and top slabs of manholes 72 inches in diameter and less shall be rubber and concrete joints. Joints for manhole components greater than 72 inches in diameter shall be provided with steel bell and spigot rings.

E. All precast components shall be of approved design and of sufficient strength to withstand the loads imposed upon them. They shall be designed for a minimum earth cover loading of 1340 pounds per cubic foot, an H-20 wheel loading, and an allowance of 30 percent in roadways and 15 percent in rights-of-way for impact. Component bases shall have two cages of reinforcing steel in their walls, each of the area equal to that required in the riser section. Wall thickness shall not be less than 5 inches. Concrete top slabs shall not be less than 8-inches thick.

F. Lifting holes, if used in components, shall be tapered, and no more than two shall be cast in each section. Tapered, solid rubber plugs shall be furnished to seal the lifting holes. The lifting holes shall be made to be sealed by lugs driven from the outside face of the section only.

G. Mark date of manufacture and name or trademark of manufacturer on inside of component.

H. The barrel/riser of the manhole vault shall be constructed of various lengths of riser pipe section manufactured in increments of one foot to provide the correct height with the fewest joints. Openings in the barrel riser of the manholes/vaults will not be permitted closer than one foot from the nearest joint. Special manhole/vault base or riser sections shall be furnished as necessary to meet this requirement.

I. A precast or precast eccentric cone, as shown or approved, shall be provided at the top of manhole barrels to receive the cast iron frames and covers.

J. Manhole sections shall contain manhole steps, 12-inches on centers, accurately positioned and embedded in the concrete. Steps are specified under Section 05500.

2.2 Miscellaneous Metals

A. Metal frames, covers, steps, toe pockets, and similar required items shall be provided as shown in accordance with Division 5 Sections on Metal Fabrications.

PART 3 - EXECUTION

3.1 Manhole/Vault Bases

A. Precast bases shall be set on a crushed stone or crushed gravel foundation as show. Precast bases shall be set at the proper grade and carefully labeled and aligned.

3.2 Precast Component Sections

A. Set sections vertical with steps and sections in true alignment. The base of the bell or groove end at joints between components shall be buttered with 1:2 cement-sand mortar to provide a uniform bearing between components. All joints shall be sealed with cement mortar inside and out and troweled smooth to the contour of the wall surface. Raised or rough joint finishes will not be accepted.

B. Install sections, joints, and gaskets in accordance with manufacturer's recommendations.

C. Lifting holes shall be sealed tight with a solid rubber plug driven into the hole from the outside of the barrel and the remaining void filled with 1 to 2 cement-sand mortar.

3.3 Manhole Channels

A. All invert channels through manholes shall be constructed of Class A concrete. Channels shall be properly formed to the sizes, cross section, grades, and shapes shown on the drawings or as ordered. Benches shall be built up to the heights shown or as ordered and given a uniform wood float finish. Care shall be taken to slope all benches for proper drainage to the invert channel.

3.4 Grading Rings

A. Grading rings shall be used for all precast manholes and vaults where required. Stacks or grade rings shall be a maximum of 12 inches in height, constructed in the roof slab or cone section on which the manhole frame and cover shall be placed. The height of the stack or grade rings shall be such as is necessary to bring the manhole frame to the proper grade.

3.5 Grading at Manholes/Vault Boxes

A. All manholes/vault boxes in unpaved areas shall be built as shown or directed to an elevation higher than the original ground. The ground surface shall be graded to drain away from the manhole/vault box as specified in the drawings. Fill shall be placed around manholes/vault boxes to the level of the upper rim of the frame, and the surface evenly graded on a 1 to 5 slope to the existing surrounding ground unless otherwise shown. The slope shall be covered with 6 inches of topsoil, seeded, and maintained until a satisfactory growth of grass is obtained for manholes/vaults outside fenced areas and covered with 6 inches of crushed stone/gravel inside fenced areas.

B. CONTRACTOR shall be solely responsible for the proper height of all manholes necessary to reach the final grade at all locations. CONTRACTOR is cautioned that ENGINEER's review of Shop Drawings for manhole components will be general in nature and CONTRACTOR shall provide an adequate supply of random length precast manhole riser sections to adjust any manhole height to meet field conditions for final grading.

3.6 Manhole/Vault Boxes Watertightness

A. All manholes/vault boxes shall be free of visible leakage. Each manhole shall be tested for leaks and inspected, and all leaks shall be repaired in a manner subject to ENGINEER's approval.

3.7 Flexible Pipe Joint at Manhole/Vault Base

A. An approved flexible joint shall be provided between each pipe entering and exiting the manhole vault. This shall be accomplished by using link seals as furnished by Thunderline Corp., Link Seal; gasketed joints as furnished by A-LOK; or a flexible boot as furnished by Cor-N-Seal; or equal. The joint into the manhole base shall be completely watertight.

3.8 Connection - Existing Pipes to New Manholes

A. Not used.

3.9 Abandon Existing Manholes

A. Not used.

-- END OF SECTION 03480 --

SECTION 04200

MASONRY

PART 1 GENERAL

1.01 Description

A. Contractor shall review all other Sections of these Specifications for instructions related to work under this Section.

B. Furnish all labor, material, and equipment to perform all masonry work as shown or indicated on the Drawings, including all concrete block, grouting, cutting and patching, and final cleaning. Work includes the following items:

1. Concrete wall masonry unit walls and partitions.
2. Joint reinforcing, control joint gaskets and caulking.
3. Build metal door frames into masonry furnished under other Divisions.
4. Build in anchors, metal flashing, loose lintels, expansion joint members, equipment anchorage, furnished under other Divisions.
5. Grout hollow metal frames in masonry walls and partitions.
6. Submittals.

1.02 Product Delivery, Storage And Handling

A. Store masonry units above ground on level platforms which allow air circulation under stacked units. Cover with tarpaulins or other suitable protection from weather.

B. Cover and protect against wetting prior to use.

C. Handle units on pallets or flat bed barrows.

D. Do not permit free discharge from conveyor units or transporting in mortar trays.

E. Deliver and store manufactured products in original unopened containers. Concrete masonry units shall be delivered dry and free from ice, frost, snow, dirt, etc.

F. Store cementitious ingredients in weather-tight enclosures and protect against contamination and warehouse set.

G. Stockpile and handle aggregates to prevent contamination from foreign materials.

H. Store admixtures to prevent contamination or damage from excessive temperature changes.

I. Keep water free of harmful materials.

1.03 Submittals

A. Submit samples of joint reinforcing, cavity wall ties, dovetail anchors, weld-on adjustable anchors, and control joint gaskets.

B. Submit product data, test reports and certifications for cement, lime, sand, mortar, grout, concrete masonry units, joint reinforcing, and miscellaneous items.

PART 2 PRODUCTS

2.01 Cement

A. Portland Cement - ASTM C150, Type I.

B. Masonry Cement - ASTM C91.

2.02 Lime

A. Hydrated Lime - ASTM C207, Type S, special hydrate.

2.03 Water

A. Water shall be clean, potable, free of alkalies, acids, salts, oils and organic materials or other substances detrimental to the masonry.

2.04 Sand

A. Mason's Sand - Natural sand, ASTM C144 with clean, sharp, uncoated grains, free from loam, clay, organic impurities, or frozen material. Not over 10 percent to pass the No. 100 sieve.

2.05 Mortar

A. Mortar shall be Type S per ASTM C270; mortar color to match block color.

2.06 Grout

A. Grout shall conform with ASTM C476.

2.07 Concrete Masonry Units

A. Concrete Masonry Units - Shall conform to ASTM Specifications as listed below:

1. Loadbearing Hollow Block - ASTM C90, Grade N, Type 1.
2. Non-Loadbearing Hollow Block - ASTM C129, Grade N, Type 1.
3. Solid Block - ASTM C455, Grade N, Type 1.

B. Block shall be made from Portland cement and approved crushed stone aggregate conforming to ASTM C 33, providing a fine dense textured face with clean, sharp arises and uniform size and color and modular, 7-5/8" x 15-5/8", thickness as indicated.

C. Provide special blocks for corners, jambs, bond beams and lintels as required. Provide 1" bullnose corners for all external corners, unless shown otherwise on Drawings. Provide solid sills. Interior masonry to be standard smooth faced.

D. High temperature steam cured at atmospheric pressure with steaming cycle not less than 24 hours followed by yard curing of not less than 28 days, or high temperature steam cured in autoclave at approximately 150 psi pressure and 365 degrees F for not less than 8 hours.

2.08 Joint Reinforcing

A. Joint reinforcing, formed of cold drawn steel wire, ASTM A 82, galvanized finish, conforming to ASTM A 116, Class 3.

1. Side rods, deformed, 3/16" diameter; diagonal cross rods No. 9 gauge, butt welded to side rods in same plane, not over 16" in center.
2. Reinforcing of proper width for walls and partitions.
3. Provide preformed covers and tees.

B. All masonry walls shall be reinforced as follows:

1. Bond beam courses at top and bottom and every 40 inches on center.
2. Horizontal steel in bond beam shall be two #4 bars.
3. Vertical steel shall be one #5 bar in grouted cell every 36 inches on center, continuous from bottom to top courses.
4. Intersections and corners shall receive one vertical #5 bar in grouted cell and #5 horizontal corner bars, having 40 bar diameters length in each direction, spaced every third joint. At intersections every other horizontal corner bar shall be turned in opposite direction.
5. All openings shall receive bond beam courses directly above them extending a full block length in each direction beyond the opening.
6. All openings shall receive vertical #5 bar in grouted cell adjacent to opening and extending for the full wall height.

2.09 Miscellaneous Materials

A. Dovetail anchors to fit slots provided in concrete work, of proper length for anchorage, of masonry, formed of 15 gauge galvanized steel or zinc, minimum 1" wide, of same manufacturer as dovetail slots.

PART 3 EXECUTION

3.01 Proportioning Of Materials

A. Mortar for concrete masonry units shall two parts Portland cement, one part lime, and nine parts sand, by volume.

3.02 Batching - Mixing

A. Use methods of measuring such that specified proportioning can be accurately controlled and maintained.

B. Except as otherwise approved for small batches, all mortar shall be machine-mixed in a mechanically-operated drum-type mixer in which the quantity of water can be accurately controlled and care taken in adding final water to mix to avoid over-wetting. Mixing shall continue for not less than 5 minutes after all materials are in the mixer. Mixer to be completely empty and cleaned before it is recharged.

C. When weather is such as to cause drying out of the mortar, batch size shall be such that all material will be used within two (2) hours.

D. Mortar on the board shall be kept well tempered with water so long as its cementing material has not started to set, so that it will be soft and workable when placed in the wall.

E. Mortar shall not be retempered in the mortar box or mixer at any time, and retempering of mortar on the board shall be avoided if "initial set" of cementing, material has been reached or mortar has stiffened greatly. No antifreeze additives, either liquid or powder, shall be incorporated in the mix to lower the freezing point of the mortar.

3.03 Construction And Workmanship

A. Masonry shall be plumb, true to lie, with level courses accurately spaced and built to the thickness and bond pattern indicated or specified. Where no pattern is indicated, masonry shall be laid in running bond pattern. Each unit shall be adjusted to final position while mortar is still soft and plastic. Any unit disturbed after mortar has stiffened shall be removed and relaid with fresh mortar. Vertical cells to be filled with grout shall be aligned to provide a continuous unobstructed opening of the dimensions shown. Chases shall be built in and not cut in. Chases shall be plumb and shall be minimum one-unit length from jambs of openings. Chases and raked-out joints shall be kept free from mortar or debris. Spaces around metal door frames and other built-in items shall be solidly filled with mortar as each course is laid. Cavity insulation, flashings, anchors, wall plugs, accessories, and other items to be built in shall be installed as the masonry work progresses. All cutting and fitting of masonry, including that required to accommodate the work of other sections shall be done by masonry mechanics with masonry saws.

3.04 Cleaning And Pointing

A. All surplus mortar, splatter, drippings, etc., shall be removed from all masonry exterior and interior, as the work progresses. Clean and point at end of each working day all work that is exposed. Masonry walls shall be dry brushed at the end of each day's work and also after final pointing.

B. Remove adhering mortar with a powered "Wheel" type, 1/2" or 2" face, rather than disc-type abrasive grinding.

C. Clean all exposed surfaces with water and fiber brushes, without acid, at the completion of the work. Other cleaning methods may be allowed upon approved examination of documentation of method and material.

D. Remove all stains, cut out all defective mortar joints, fill solidly with mortar and tool to match adjacent work. Any cracks in masonry shall be repaired.

3.05 Protection

A. Protect all masonry from hazards until completion of work. Cover all walls with waterproof protection at end of each day's work, weekends, and during precipitation.

3.06 Moisture Content And Protection

A. Only block properly cured to the specified moisture content, (40 percent of maximum absorption), shall be delivered to the job. Blocks shall be tested and shipment rejected if the average moisture content of five (5) standard units, selected from shipment at random by the Owner, is found to exceed specification limits.

B. Block delivered to the job shall be stacked in a dry place, off the ground on a prepared platform, and in a manner to promote circulation of air through and around the block and protected by a shed, roof, or tarpaulins arranged to allow for circulation of air around and above block.

C. Block of moisture content exceeding specification requirements shall not be built into the work.

The Owner may at any time require a recheck on moisture content, and a block containing excess moisture shall be dried down to acceptable maximum, either by further air drying or the use of heat, before being used. No extension of time for completion will be allowed due to delay caused by failure of the Contractor to maintain stored block at the acceptable moisture content.

Damaged Block - All units must be carefully handled at all times. Units with chipped edges, spalls, or other damage to the appearance which would show in finished wall, shall not be built into the Work.

3.07 Built-in Work

A. Consult other trades in advance and make provisions for installation of their work in order to avoid cutting and patching.

B. Build-in loose structural shapes and anchor bolts in accordance with details on Drawings. Provide solid bearing as indicated and specified. Lintels shall have minimum bearing of 1 inch per foot of opening but not less than 6 inches each side of opening.

C. Adjust shelf angles as required to keep the masonry level at proper elevation. Pressure-relieving joints shall be provided by placement of a continuous elastic pad under the angle and sealing the joint with sealant.

D. Flexible Sheet Flashing:

1. General: Install flexible sheet flashings into masonry where indicated as work progresses. Grout solid under flashing and provide weep holes, 2'-0" o.c., directly above flashing. Installation shall be in accordance with manufacturer's recommendations, applied without wrinkles or buckles and no portion hanging beyond wall surface.

2. Length: Flashing shall extend full length of wall opening, in one piece, and minimum of 4" beyond jambs and 2" beyond ends of lintels, each side.

E. Construct control joints in masonry walls where located on the Drawings as per details and as herein specified. Joints to be continuous vertically from top to bottom of wall. Install #15 asphalt saturated felt on one side of joint area only. Horizontal wall reinforcement to terminate at joints. Rake joints out to be a depth of 3/4" for sealant to be supplied and installed. Install joint filler material as specified.

3.08 Bracing, Forming, Shoring And Scaffolding

A. Provide all scaffolding, staging, ladders, etc., necessary for this work and comply with all laws or codes governing them. All walls or other parts shall be securely braced and protected against storm and wind during construction. Such bracing shall be maintained in place until permanent walls are installed and it is no longer necessary for the safety and stability of the walls.

3.09 Reinforcing

A. All reinforcement shall be accurately cut to length and bent by such methods as will prevent injury to the material. All kinks or bends in the bars caused by handling incident to delivery shall be straightened out without injury to the material before placing it in the masonry.

B. Masonry joint reinforcement shall be placed so that longitudinal wires are located over face-shell mortar beds and are fully embedded in mortar for their entire length with minimum mortar cover of 5/8 inch on exterior side of walls and 1/2 inch at other locations. Reinforcement at openings shall extend not less than 24 inches beyond the end of sills or lintels or to the end of the panel if the distance to the end of the panel is less than 24 inches. In the first and second block joint above lintels and below sills, install additional lengths of reinforcing above and below all openings, centered on the opening and extended not less than 2'-0" beyond the opening, each way. Reinforcement shall not be continuous through a control joint or an expansion joint. Reinforcement shall be lapped 6 inches or more. Factory-fabricated sections shall be installed at corners and wall intersections.

C. Placing Reinforcement:

1. Minimum Bar Spacing: The minimum clear distance between parallel bars except in columns shall be equal to the nominal diameter of the bar.

2. Splices in Reinforcement: Splices may be made only at such points and in such manner that the structural strength of the member will not be reduced. Lapped splices shall provide sufficient lap to transfer the working stress of the reinforcement by bond and shear. Minimum lap shall be 30-bar diameters. Welded or mechanical connections shall develop the strength of the reinforcement.

3. All bars shall be completely embedded in mortar or grout. All reinforcement shall have a coverage of masonry not less than the following:

   a. 2-inch on vertical members where masonry is exposed to action or weather or soil for bars larger than 5/8 inch and 1-1/2 inches for bars 5/8 inch or less.

   b. 1-1/2 inch for all reinforcement in columns.

   c. 1-1/2 inches on the bottom and sides of beams or girders.

   d. 3/4 inch from the faces of all walls not exposed to action of weather or soil.

   e. 1-bar diameter over all bars, but not less than 3/4 inch at the upper faces on any member, except where exposed to weather or soil in which cases the minimum coverage shall be 2 inches or 3 inches, respectively.

   f. Reinforcement consisting of bars or wire 1/4 inch or less in diameter embedded in the horizontal mortar joints shall have not less than 5/8 inch mortar coverage at exposed face of wall.

   g. The thickness of grout or mortar between masonry units and reinforcement shall be not less than 1/4 inch except that 1/4 inch bars may be laid in 1/2 inch horizontal mortar joints, and No. 6 gage or smaller wires may be laid in 3/8 inch horizontal and vertical reinforcement shall be not less than 1/2 inch larger than the sum of the diameters of the horizontal and vertical reinforcement contained therein.

3.10 Grouting

A. Grout for pouring shall be of fluid consistency and mixed in the ratio by volumes, 1 part Portland Cement, 2-1/4 parts minimum to 3 parts maximum damp loose sand where grout space is less than 3 inches in its least dimension.

B. Grout for pumping shall be of fluid consistency and shall have not less than seven sacks of cement in each cubic yard of grout. The mix design shall be approved by Owner.

C. Fluid consistency shall mean that consistency as fluid as possible for placing without segregation of the constituent part.

D. Reinforcing steel shall be secured in place and inspected before grouting starts.

E. All grout shall be puddled or vibrated in place.

F. Vertical cells to be filled shall have vertical alignment to maintain a continuous unobstructed cell area not less than 2 inch by 3 inch.

G. Cells containing reinforcement shall be solidly filled with grout and pours shall be stopped 1-1/2" below the top of a course to form a key at pour joints.

H. All bolts, anchors, etc., inserted in the wall shall be solidly grouted in place.

3.11 Mortar Bedding And Joints

A. Hollow units shall be laid with full mortar coverage on horizontal and vertical face shells, except that webs shall also be bedded in all courses of piers, columns, and pilasters, and in the starting course on footings and solid foundation walls, and where adjacent to cells or cavities to be reinforced and/or filled with grout or concrete.

B. Horizontal and vertical face joints shall be 3/8-inch thick unless otherwise indicated. Vertical joints shall be shoved tight. Mortar joints in exposed or painted exterior surfaces shall be tooled when thumbprint hard with a round jointer. Joints in exposed or painted interior surfaces shall be similarly tooled unless otherwise indicated. Joints in unparged masonry below grade shall be pointed tight with a trowel. Mortar joints in surfaces to be plastered, or covered with other masonry shall be cut flush. Mortar protrusions extending into cells or cavities to be reinforced and filled shall be removed. Horizontal joints between top of masonry partitions and underside of concrete slabs or beams shall be filled with mortar unless otherwise indicated.

C. Raked joints for sealing shall be provided on the exterior face at control joints and at such other locations where sealed joints are indicated. Such joints shall be raked and tooled smooth to a uniform depth of 3/4 inch.

3.12 Cold Weather Requirements

A. Block shall be protected against freezing by weathertight coverings and shall be heated to a minimum of 50°F before laying. No unit shall be heated above 140°F unless adequate protection is provided. No masonry shall be laid when the temperature of the ambient air is 40°F or below, or when the temperature is likely to fall below that figure in the following twenty-four (24) hours. When working at temperatures of 40°F or below, mortar shall have a temperature from 50°F to 80°F by heating mixing water and, if necessary, mortar sand. Masonry shall be protected from freezing for at least forty-eight (48) hours after laying by heat enclosures and other methods as required. No antifreeze will be allowed to be used in the mortar. Any frozen work shall be replaced.

3.13 Bonding

A. The facing and backing (adjacent wythes) of masonry walls shall be bonded with prefabricated joint reinforcement. There shall be one cross wire serving as a tie for not more than each two

square feet of wall face area. The vertical spacing of the reinforcement shall not exceed 16 inches. The longitudinal wires shall be thoroughly embedded in the mortar.

3.14 Anchorage

A. All structural elements depending upon one another for continuity or support shall be securely anchored to resist all forces which might tend to separate the structural elements.

B. Intersecting Walls and Partitions: Masonry walls and partitions shall be securely anchored or bonded at points where they meet or intersect by one of the following methods:

1. Bonding: Walls may be bonded by laying at least 50 percent of the units at the intersection in a masonry bond with alternate units having a bearing of not less than 3 inches upon the unit below.

2. Interior Non-Loadbearing Walls: Interior non-loadbearing walls shall be anchored at their intersection, at vertical intervals of not more than two feet on centers, with metal ties extending at least 4 inches into the masonry, or with other ties which provide an equivalent method of anchorage.

3. Walls Carried Up Separately: Where the courses of meeting or intersecting walls are carried up separately, corner intersections shall be made by regularly toothing or blocking with 8-inch maximum offsets and the joint provided with rigid steel anchors. Maximum vertical spacing of such anchors shall be 4 feet. Other metal ties, joint reinforcement or anchors, if used, shall be spaced to provide equivalent anchorage at the intersection to that required by this section. Other intersections shall be similarly bonded except that the masonry bond may be omitted.

B. Walls Adjoining or Intersecting Structural Framing: Walls dependent upon the structural frame for lateral support shall be anchored to the structural members with flexible metal anchors or otherwise keyed to the structural members.

3.15 Final Cleanup

A. At the conclusion of masonry work, remove all scaffolding and equipment used in the work, clean up all debris and refuse and surplus material and remove same from premises.

– END OF SECTION 04200 –

SECTION 05500

MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 Description

Provide miscellaneous metals work, complete as indicated, specified and required. Requirements specified in Conditions of the Contract and Division 1 form a part of this Section.

A. Work Included in this Section. Principal items are:

1. Shop/erection drawings and samples.
2. Bar grating assemblies.
3. Steel channel and/or angle frames and thresholds with anchors.
4. Lift eyes, steel and stainless steel frames and supports with anchors.
5. Pipe supports with saddles, hangers, bracing and attachments as detailed and required, except as provided by other trades.
6. Miscellaneous iron and steel items indicated, specified, or required for completion of the Contract, unless included under other Sections of the Specification.
7. Miscellaneous connections, anchors, bolts, clips, spacers, nuts, washers, shapes and inserts, as required.
8. Galvanizing, shop primer finishes for work of this Section as specified or required, including field touchups of same.

B. Related Work Not Included in This Section.

1. Steel reinforcement.
2. Cast iron manhole covers and frames for precast concrete manholes as specified in pertinent Sections of Division 3.
3. Field applied paint and protective coatings except touchups of damaged shop coats.
4. Steel supports, hangers, brackets and other miscellaneous items accessory to the plumbing, mechanical and electrical installations and indicated or detailed on the Contract Drawings.

1.02 Quality Assurance

Unless otherwise specified all work specified herein and shown on the Drawings shall conform to the applicable requirements of the following specifications and codes:

A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified:

1. ASTM A36, Standard Specification for Structural Steel.

2. ASTM A123, Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.

3. ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

4. ASTM A320, Standard Specifications for Alloy Steel Bolting Material for Low Temperature Service.

5. ASTM 569

6. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

7. ASTM B211, Standard Specification for Aluminum and Aluminum-Alloy Bars, Rods, and Wire.

8. ASTM B221, Standard Specification for Aluminum an Aluminum-Alloy Extruded Bars, Rods, Wires, Shapes, and Tubes.

9. ANSI A14.3, Safety Requirements for Fixed Ladders.

10. AWS D1.1, Structural Welding Code.

B. Field Measurements:

1. Take field measurements where required prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.

C. Shop Assembly:

1. Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.03 Submittals

Prior to fabrication or delivery, submit the following and obtain Owner's approvals:

A. Shop Drawings and Erection Drawings. Show materials and specification list, construction and fabrication details, layout and erection diagrams and method of anchorage to adjacent construction. Give location, type, size and extent of welding and bolted connections and clearly distinguish between shop and field connections. Prior to submittal, coordinate shop drawings with related trades to insure proper mating of assemblies. Conform work to approved shop drawings.

1. Catalog work sheets showing illustrated cuts of item to be furnished, scale details and dimensions may be submitted for standard manufactured items.

2. Where items must fit and coordinate with finished surfaces and/or constructed spaces, take measurements at site and not from Drawings. Where concrete, masonry or other materials must be set to exact locations to receive work, furnish assistance and direction necessary to permit other trades to properly locate their work. Where welded connectors, concrete, or masonry inserts are required to receive work, shop drawings shall show exact locations required, and all such drawings shall be furnished to the trades responsible for installing the connectors or inserts.

B. Test Reports.

1. Furnish certified physical and chemical mill test reports for material used for major structural members. Perform all tests in accordance with applicable ASTM Standards.

C. Shop Painting Data. In coordinated manner with requirements for Painting and Protective Coatings specified in pertinent Section(s) of Division 9, Contractor shall submit product list with product data sheets of intended shop coats which for compatibility shall be the same products and manufacturer as those of deferred field-applied systems intended to be used in work of Division 9.

PART 2 - PRODUCTS

2.01 Materials - General

Materials shall be new, sound and shall conform to the following:

A. Steel. Rolled shapes, plates, and bars shall conform to the latest edition of the AISC "Manual of Steel Construction" and shall also conform to current ASTM Designation A 36.

1. Stainless Steel. Unless otherwise designated or approved, use stainless steel alloy types as follows which conform to ASTM A-167 and ASTM A-276:

a. Stainless steel plates and bars shall be Type 316 or Type 317 unless otherwise noted.

b. Stainless steel anchor bolts shall be Type 316.

c. Stainless steel bolts, nuts and washers shall be Type 316 where connecting or bearing on aluminum.

2. Pipe. Conform to ASTM A 53, Grade B seamless galvanized as required, Schedule 40 except as otherwise shown on Drawings, and form designated galvanized steel rail and railing assemblies of standard weight steel pipe conforming to ASTM A120.

B. Cast Iron. Conform to ASTM A-48, except as otherwise designated.

C. Ductile Iron. Conform to ASTM A 536 using grade 60-40-18 or better, except as specifically designated otherwise.

D. Aluminum. All aluminum plate, pipe and structural shapes shall be new and shall conform to applicable Federal Specification for 6061-T6 alloy, unless otherwise noted.

1. Aluminum Pipe of sizes designated shall be of Schedule 40 or greater weight.

E. Checkered Plate. Conform to Fed. Spec. QQ-F461, and use thickness not less than that shown on Drawings. Raised lugs shall be diamond shaped and have an angled and opposed pattern. Use 6061-T6 alloy aluminum, except where steel is specifically shown. Steel shall be of ASTM A 36 carbon steel, hot dip galvanized after fabrication.

F. Common Bolts. Except as otherwise designated or specified, use standard commercial quality steel units conforming to ASTM A-307, galvanize where used with galvanized work.

G. Expansion Shield Fasteners may be used in lieu of anchor bolts only where specifically noted or detailed, shall be installed in accordance with current I.C.B.O. Research Report Approval, and shall consist of the following:

1. For Interior Dry Locations anchorages provide snap-off or flush shell concrete anchors produced by Phillips Self-Drilling Concrete Anchors, Star Selfdril Shields or equal. All anchors shall be zinc coated.

2. For Exterior or Wet Locations anchorages shall consist of all stainless steel, Type 316, Molly Parabond Capsule Anchors, Molly Parabolt Concrete Anchors, Phillips Wedge Anchors, or equal.

3. Expansion shield fasteners will not be acceptable for anchorage of any vibrating machinery or equipment.

4. Powder driven "pin" and "stud" type fasteners will not be permitted.

H. Galvanizing.

1. Iron and Steel. ASTM A123, with average weight per square foot of 2.0 ounces and not less than 1.8 ounces per sq. ft.

2. Ferrous Metal Hardware Items. ASTM A153 with average coating weight of 1.3 ounces per sq. ft.

3. Touch-up Material for Galvanized Coatings. Galvanized coatings marred or damaged during erection or fabrication shall be repaired by use of DRYGALV as manufactured by the American Solder and Flux Company, Galvalloy, Galvion, Rust-Oleum 7085 Cold Galvanizing Compound, or equal, applied in accordance with the manufacturer's instructions.

I. Welding Electrodes.

1. Steel Electrodes. Welding electrodes shall conform with AWS D1.1, except E7024 rods or electrodes shall not be used.

2. Aluminum Electrodes. Contingent upon alloys being welded, use aluminum alloy welding rods of AWS classification conforming to applicable AWS A5 Series of Filler Metal Specification as recommended by parent aluminum manufacturer.

3. Stainless Steel Electrodes. Perform welding of stainless steel with electrodes and techniques as contained in pertinent AWS A5 Series Specification, and as recommended in Welded Austenitic Chromium-Nickel Stainless Steel Techniques and Properties as published by the International Nickel Company, Inc., New York, New York.

J. Shop Prime Paint. To assure compatibility with deferred field applied paint or coating systems, for ferrous metals other than stainless steel, galvanized steel and cast iron, use shop prime paint product and manufacturer as painting or protective coating system intended for field application specified in pertinent Section(s) of Division 9. Portions of work immediately adjacent to intended field welds shall not be shop primed, nor shall portions intended for embedment.

2.02 Pipe Racks

A. Fabricate to sizes and configurations as shown.

2.03 Pipe Bollards

A. Fabricated 6" round by 7' long pipe bollards from Schedule 40 steel pipe. Cap bollards with 1/4 inch minimum thickness steel base plate.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4 inch thick steel plate welded to bottom of sleeve.

C. Concrete Fill for Bollards

1. Concrete Materials and Properties. Comply with requirements of Division 3 for normal weight, ready-mix concrete with minimum 28-day compressive strength of 2,500 psi, 440 lb cement per cu. ft. minimum, and W/C ratio of 0.65 maximum, unless higher strengths indicated.

2.04 Steel Stairs

A. Steel Stairs. Fabricate true to size and detail, provide complete with all attachments, steel pipe rails and handrails, checkerplate-nosed grating type treads and landings. Submit shop and setting drawings. Hot dip galvanize after fabrication. Steel stair treads will match the bar grating described under "Grated Platforms".

2.05 Grated Platforms

A. Grating. Grated platforms 36 inches wide by lengths, as indicated on the Drawings, will be constructed of welded rectangular design, galvanized steel grating with bearing bars measuring 1 x1/8 (spaced 1 3/16 inches center to center) with bar size No. 3, welded at right angles to the bearing bars, spaced at 4 inch centers. No notching or cutting of bearing bars before welding is permitted. Deflection will not exceed 0.17 inches when subjected to a uniform load of 305 pounds. Steel grating to be Type WB as manufactured by IKG Industries of Clark, New Jersey; or approved equal.

B. Platform. Steel platform shall be constructed to safely carry live and dead loadings. The platform will be constructed of welded steel structural shapes. The platform will support steel bar grating at 36-inch maximum spans. Bar grating will be attached to the platform with threaded fasteners. Safety railing will be provided integral with the platform on all sides and adjacent to the stairway. Railings will comply with OSHA requirements. Platform feet will bear upon plate steel pieces to distribute the platform loading to the concrete floor surface.

2.06 Miscellaneous Framing and Supports.

A. Provide miscellaneous metal framing and supports which are not a apart of the structural steel framework and are required to complete the Work.

B. Fabricate miscellaneous units to the sizes, shapes, and profiles shown, or if not shown, of the required dimensions to receive adjacent grating, plates, tanks, doors, or other work to be retained by the framing. Except as otherwise shown, fabricate from structural shapes, plates, and bars, of all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection. Cut, drill, and tap units to receive hardware and similar items to be anchored to the Work.

C. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

1. Except as otherwise shown, space anchors, 24 inches on centers, and provide units the equivalent of 1-1/4 x 1/4 x 8-inch strips.

2. Galvanize exterior miscellaneous frames and supports.

3. Galvanize miscellaneous frames and supports where indicated.

2.07 Pipe and Conduit Supports and Bracing

A. Pipe and Conduit Supports and Bracing. Fabricate and install units detailed on Structural Drawings in fully coordinated manner with work of other trades. Where shown, hot dip galvanize after fabrication, and touch-up abraded or burned galvanizing using herein before specified materials. Otherwise members shall be shop primed with rust-inhibitive primer conforming with requirements of pertinent Section of Division 9.

2.08 Steel Framing for Roof Openings

A. Frame openings for ventilators and other opening in roofs as detailed and required for opening sizes. Angles shall be 4" x 4" x 1/4", galvanized, unless indicated otherwise. Consult with project Engineer for applicability.

1. Joints in framing shall be welded and connections shall be welded to steel roof supports.

2.09 Steel Framing for Masonry Openings

A. Frame openings as detailed and required for opening sizes. Angles shall be 4" x 4" x 3/8", galvanized unless indicated otherwise.

2.10 Access Ladders

A. Fabricate ladders of flat steel bar stringers of size shown, abrasive surfaced rungs, sized as shown on drawings, similar and equal to "Mebac" surfaced Ladder Rungs as manufactured by IKG Borden. Provide clips, bolts and anchors required to secure ladders rigidly in place. All steel shall be galvanized.

2.11 Warning Signs

A. Contractor shall furnish and install warning signs in the locations specified below. Units shall be not less than designated sizes. Signs shall be porcelain enamel safety blanks with red lettering on a white background. Fabricate of 18 ga vitreous enameling steel (ASTM A424-Type II). Equip each with six (6) eyeletted holes for #10 fastener. Provide fused porcelain enamel, both sides, suitable for exterior or industrial end use by experienced fabricators in strict conformance with pertinent requirements as published by Porcelain Enamel Institute, Inc.

1. A 7" x 10" sign shall be attached to the interior side of all exterior doors which provide egress to the outside and the sign shall read: EXIT.
2. A 7" by 10" sign: CAUTION - ACID.
3. A 7" by 10" sign: CAUTION - CAUSTIC.
4. A 7" by 10" sign: SAFETY SHOWER AND EYE WASH

2.12 Tank Platform

Tank Platform. Provide one wheeled steel platform for use in accessing the top of the process tanks. Platform shall be not more than 4'0" nor less than 3'6" below the top of the tallest process tank. Provide platform as distributed by McMaster-Carr. Mobile platform shall meet OSHA 1910.29 standards and shall be equipped with grip strut safety grating, handrail, and step lock.

PART 3 - EXECUTION

3.01 General Fabrication and Installation Requirements

A. Standards. Ferrous metals shall be thoroughly cleaned of all loose scale and rust before being fabricated. Finished members shall be free of twists, bends or open joints, and shall present a neat workmanlike appearance when completed. Steel work shall conform to the best practices set forth in the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, latest edition. Aluminum work shall conform to the applicable requirements of "Specifications for Aluminum Structures, Aluminum Construction Manual" of the Aluminum Association, latest edition.

B. Welding. All welding shall be done in accordance with the "Structural Welding Code-Steel", AWS D1.1 and current revisions, except where Gas Metal Arc Welding (GMAW) process issued, the short circuited mode shall be used only for light gage material (12 gage and lighter). Welders shall be qualified by tests in accordance with AWS B3.0.

1. Welding of aluminum shall conform to the general requirements of AWS D1.0 and to the detail requirements of "Welding Aluminum" by the American Welding Society and the Aluminum Association.

C. General Fabrication and Installation. Using specified new stock of standard sizes specified or detailed, fabricate in shop producing high grade metal work. Form and fabricate to meet required conditions. Include clips, straps, bolts, screws, and other fastenings necessary to secure the work. Conform applicable work to latest edition of Referenced Standards. Accurately make and tightly fit joining and intersections in true planes with adequate secure fastenings. All metal work shall be erected plumb, true on line and in its designated location. Field welds on exposed surface shall be ground and finished smooth. Connections shall be bolted or welded as indicated on drawings. After installation, all work shall be left in a neat and clean condition, ready for field painting or coating.

1. Coordinate work of this Section with related trades. Particular attention is required for items to be embedded in concrete work. Provide all punchings and drillings indicated or required for attachment of other work to that of this Section.

2. Compliance with Safety Requirements. Dimensions required for the fabrication and installation of handrails, ladders, grating, plate, pipe hangers and etc. which are not shown on the drawings, shall conform to the applicable requirements of OSHA Occupational Safety and Health Standards.

D. Protection. Provide and be responsible for protection and repair of adjacent surfaces and areas which may become damaged as a result of work of this Section. Protect work performed hereunder until completion and final acceptance of project by Owner. Repair or replace all damaged or defective work to original specified condition, at no additional cost to the Owner.

1. Protect finished floor surfaces and adjacent work from damage. Concrete floors shall not be overloaded. Mobile equipment used in placing steel shall have pneumatic tires. Steel members shall not be placed directly on floors; use pads of timber or other material for cushioning.

2. Where welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks, spatter, or tramp metal.

E. Painting.

1. All ferrous metals, except cast-iron, ductile iron, stainless steel and galvanized metals, shall be given one or more shop coats of paint. Before priming, surfaces shall be thoroughly cleaned. Shop coats shall be allowed to dry before materials are loaded for delivery to the job site. After erection, all areas where the shop coats have been rubbed off or omitted, and all field bolting and welding shall be painted as specified for shop priming. See Pertinent Sections of Division 9 of these Specifications for surface preparation, prime coatings, finish painting and coatings.

2. Aluminum members shall be isolated from contact with dissimilar metals, concrete and masonry to provide protection from electrolytic deterioration. Use non-absorptive tape or gaskets, heavy brush coat of approved zinc chromate primer made with a synthetic resin vehicle; or apply a heavy coat of approved alkali-resistant bituminous paint.

--END OF SECTION 05500--

SECTION 05521

PIPE AND TUBE RAILINGS

PART I - GENERAL

1.01 Related Documents

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 Summary

A. This Section includes the following:

1. Steel pipe and tube handrails and railing systems.

1.03 Definitions

A. Definitions in ASTM E 985 for railing-related terms apply to this section.

1.04 System Performance Requirements

A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. For cold-formed structural steel: AISI "Specification for Design of Cold-Formed Steel Structural Members."

B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.

1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 240 lbf applied at any point and in any direction.

b. Concentrated load need not be assumed to act concurrently with uniform loads.

2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 240 lbf applied at any point and in any direction.

b. Concentrated and uniform loads need not be assumed to act concurrently.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Thermal Movements: Allow for thermal movement resulting from change in ambient temperature in the design, fabrication, and installation of handrails and railings to prevent

buckling, opening up of joints, overstressing of components, connections and other detrimental effects.

1.05 Submittals

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop drawings showing fabrication and installation of handrails and railings including plans, elevations, sections, details of components, and attachments to other units of Work.

1. 6-inch-long sections of each distinctly different linear railing member including handrails, top rails, posts, and balusters.

2. Fittings and brackets.

3. Welded connections.

1.06 Quality Assurance

A. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.

1.07 Storage

A. Store handrails and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind. Cover with waterproof paper, tarpaulin, or polyethylene sheeting; allow for air circulation inside the covering.

1.08 Project Conditions

A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1.09 Sequencing and Scheduling

A. Sequence and coordinate installation of wall handrails as follows:

1. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.

PART 2 - PRODUCTS

2.01 Manufacturers

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering handrails and railing systems that may be incorporated in the Work include but are not limited to the following:

1. Steel Pipe and Tube Railing Systems:

a. Humane Equipment Co.

b. Wagner: R & B Wagner, Inc.

2.02 Metals

A. General: Provide metal forms and types that comply with requirements of referenced standards and that are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

B. Steel Pipe: ASTM A 53.

C. Steel Plates, Shapes, and Bars: ASTM A 36.

1. Prime galvanized metal.

2.03 Priming and Painting

A. Zinc Chromate Primer: FS TT-P-645.

1. Prime galvanized metal surfaces with one of the following:

a. Devoe: 13201 Mirrolac Galvanized Metal Primer.

b. Fuller: 621-05 Blox-Rust Latex Metal Primer.

c. Glidden:5229 Glid-Guard All-Purpse Metal Primer.

d. Moore: IronClad Galvanized Metal Latex Primer #155.

e. PPG: 6-215/216 Speedhide Galvanized Steel Primer.

f. P & L: P & L Interior Trim Primer.

g. S-W: Galvite B50W3.

B. Paint:

1. Paint galvanized metal after priming with:

a. One coat Tnemec 135 Chembild

b. Followed by one coat Tnemec 71 EnduraShield.

2.04 Welding Materials, Fasteners, and Anchors

A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.

2.05 Fabrication

A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than those required to support structural loads.

B. Preassemble railing systems in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Form changes in direction of railing members as follows:

1. By insertion of prefabricated elbow fittings.
2. By radius bends of radius indicated.
3. By mitering at elbow bends.
4. By bending.
5. By any method indicated above, applicable to change of direction involved.

D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. Welded Connections: Fabricate railing systems and handrails for connection of members by welding. For connections made during fabrication, weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At tee and cross intersections, notch ends of intersecting members to fit contour of pipe to which end is joined and weld all around.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

F. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors for interconnection of handrail and railing members to other construction.

G. Provide inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work. Fabricate anchorage devices capable of withstanding loadings imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.

H. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

I. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

J. For handrails and railing systems that are exposed to exterior or to moisture from condensation or other sources, provide weepholes or other means for evacuation of entrapped water in hollow sections of railing members.

K. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

L. Toe Boards: Where indicated, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated for connection to, and centered between, each railing post.

M. Fillers: Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

2.06 Finishes, General

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering prior to shipment.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are not acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples and they are assembled or installed to minimize contrast.

2.07 Galvanized Metal

A. General: Hot-dip galvanize items indicated to be galvanized to comply with applicable standard listed below:

1. ASTM A 153 for galvanizing iron and steel hardware.

2. ASTM A 123 for galvanizing iron and steel products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips.

B. For interior steel railings and handrails formed from steel pipe with galvanized finish, galvanize fittings, brackets, fasteners, sleeves, and other ferrous components.

PART 3 - EXECUTION

3.01 Preparation

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to project site.

3.02 Installation, General

A. Fit exposed connections accurately together to form tight, hairline joints.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/4 inch in 12 feet.
3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.03 Anchoring Posts

A. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.

3.04 Railing Connections

A. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use manufacturer's standard fittings designed for this purpose.

3.05 Anchoring Rail Ends

A. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with post-installed anchors and bolts.

3.06 Protection

A. Protect finishes of railing systems and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

– END OF SECTION 05521 –

SECTION 05534

ACCESS HATCHES

PART 1 - GENERAL

1.01 Description

A. Scope:

1. Contractor shall furnish all labor, materials, equipment, and incidentals required to provide hinged access hatch covers and accessories as shown on the Drawings specified below.

B. Related Work Specified in Other Sections:

1. Section 03000 - Concrete
2. Section 03400 - Pre-cast Concrete

1.02 Submittals

A. Access Hatches: Submit manufacturer's technical data, layout, and installation details of access hatches.

B. Security Systems: Submit manufacturer's technical data and installation details.

PART 2 - PRODUCTS

A. General:

1. Provide manufacturer's standard fabricated units, modified if necessary, to comply with the requirements. Where standard units are not available for the sizes and types required, custom fabricate units to match manufacturer's similar units.

1. Identification of project.

B. Covers with Frames and Drainage:

1. Access hatch shall be water tight.
2. Provide covers, with frames for drainage, designed to withstand loadings of 300 pounds per square foot.
3. Frame shall be 1/4-inch thick, minimum.
4. Door shall be equipped with heavy forged brass hinges, stainless steel pins and bolts, compression/pneumatic spring operators, and an automatic hold-open arm with release handle. Hardware shall be constructed of stainless steel.
5. Door leaves shall be checkered or diamond plate, or other approved non-slip surface.
6. Frames shall have anchor flanges or strap anchors.
7. Provide locking mechanism. Yale 1212 Deadbolt with 1-1/8 inch throw or equal. Keyway mechanism shall be protected by a brass removable threaded cover plug with rubber gasket. All lock mechanisms shall be keyed alike.

8. Provide a 1-1/2 inch drainage coupling located in the corner of the channel frame. Pipe drain to outside of valve vault.

9. Product and Manufacturer: Provide one of the following:

   a. Single-leaf or double-leaf door covers fabricated of heavy-duty gauge aluminum. Sizes as shown on the Drawings.

      1) Syracuse casting, CH, and CHD type.

      2) The Bilco Company, Series, JDAL.

      3) Or equal.

C. Insulation. The Contractor shall provide and install minimum 3-inch thick layer of NRG Barriers, Inc., SACO Main (207-283-8000) PSI Energy-Efficient Roofing and Building Insulation or equal, on the underside of all access hatches with suitable water proof adhesive or in another acceptable, permanently secure manner.

PART 3 - EXECUTION

3.01 Installation

A. Install doors in accordance with approved Shop Drawings, details, and manufacturer's recommendations.

B. Access hatch frames shall be integrally cast into reinforced concrete top slabs.

C. Set door plumb, level, and true line to grade, without warp or rack, for anchoring under other Sections of these Specifications.

D. Protection of Aluminum from Dissimilar Materials: Using approved asphaltic or zinc chromate paint, provide two heavy coats on aluminum surfaces in contact with dissimilar materials such as concrete, masonry, steel, and other metals.

E. Access hatch drains shall be hard piped outside the manholes which they overlay and be directed either to an open, exposed drainage area away from the manholes, or be directed into a dry well above the static water table consisting of not less than 0.5 cubic yards of uniformly graded selected fill specified by the Engineer.

-- END OF SECTION 05534 --

SECTION 07210

BUILDING INSULATION

PART 1 - GENERAL

1.01 Related Documents

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 Summary

A. This Section includes the following:

1. Insulation under slabs-on-grade.
2. Loose-fill block wall insulation.
3. Safing insulation.
4. Wall/Roof inulation.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 4 Section "Unit Masonry" for loose granular insulation installed in masonry cells.

1.03 Definitions

A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.04 Submittals

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of insulation product specified.

1.05 Quality Assurance

A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.06 Delivery, Storage, and Handling

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.01 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide insulation products of one of the following:

1. Perimeter Foundation Insulation.

    a. Dow: The Dow Chemical Company, blue board, or approved equal.

2. Perlite Block Insulation.

    a. Producer Member of Perlite Institute, Inc.

3. Safing Insulation.

    a. CertainTeed Corp.

    b. Manville Sales Corp.

4. Wall and roof insulation.

    a. Metal building manufacturers, Thermal Inc., or approved equal.

B. Molded Polystyrene Board Insulation: Rigid, cellular thermal insulation formed by the expansion of polystyrene resin beads or granules in a closed mold to comply with ASTM C 578 for type indicated; and as follows:

1. Type I, 0.9 pcf min. density, aged r-values of 4.0 and 3.6 at 40 and 75 deg F (4.4 and 23.9 deg C), respectively.

C. Perlite Loose Fill Insulation: Expanded perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or IV (surface treated for water repellency and limited moisture absorption), r-values of 3.3 - 2.8 for densities of 4.1 - 7.4 pcf at 75 deg F (23.9 deg C).

2.02 Safing Insulation and Accessories

A. Semi-Refractory Fiber Board Safing Insulation: Semi-rigid boards designed for use as a fire stop at openings between edge of slab and exterior wall panels, produced by combining semi-refractory mineral fiber manufactured from slag with thermosetting resin binders to comply with ASTM C 612, Class 1 and 2; nominal density of 4.0 pcf; passing ASTM E 136 for combustion characteristics; r-value of 4.0 at 75 deg F (23.9 deg C).

B. Calking Compound: Material approved by manufacturer of safing insulation for sealing joint between foil backing of safing insulation and edge of concrete floor slab against penetration of smoke.

C. Safing Clips: Galvanized steel safing clips approved by manufacturer of safing insulation for holding safing insulation in place.

2.03 Thermal Insulation

A. Provide glass fiber blanket insulation for walls and roof, of not less than 0.5 lb. per cu. ft. density, with UL flamespread classification of 25 or less, 2" wide continuous vapor tight edge tabs. R-19 for walls, R-30 for roof.

1. Vapor Barrier: Vinyl reinforced foil.
2. Joint Seal Tape: As recommended by manufacturer.

PART 3 - EXECUTION

3.01 Examination

A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.02 Preparation

A. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders.

3.03 Installation, General

A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.04 Installatin of Safing Insulation

A. Install safing insulation to fill gap between edge of concrete floor slab and back of exterior spandrel panels on safing clips spaced as needed to support insulation but not further apart then 24 inches o.c. Cut safing insulation wider than gap to be filled to ensure compression fit and seal joint between insulation and edge of slab with calking approved by safing insulation manufacturer for this purpose. Leave no voids in completed installation.

3.05 Protection

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

-- END OF SECTION 07210 --

SECTION 07270

FIRESTOPPING

PART 1 - GENERAL

1.01 Scope

A. This Section subject to requirements of the Contract Documents as applicable to fire rated walls.

B. Work includes all Firestopping required by the Contract, and in general, includes the following items:

1. Furnish and install all materials and labor required for installation of through-penetration firestop systems around, including but not limited to, pipe, duct, cable, cable tray, conduit, telephone cable, other electrical devices, blank openings, and at the periphery of fire-rated walls, floors, partitions, and floor/ceiling assemblies, for all contractors.

2. Submittals.

1.02 Definitions

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, water and hot gases.

1.03 Coordination

A. Coordinate work of this section with work of other sections and divisions as required to properly execute the work, and as necessary to maintain satisfactory progress of the work of other sections and divisions.

1.04 References

A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Published Fire-Rated Assemblies: UL 1479, "Fire Tests of Through-Penetration Firestops"

C. ASTM E-84, "Standard Test Method for Surface Burning Characteristics of Building Materials"

D. UL 723, "Standard for Test for Surface Burning Characteristics of Building Materials"

1.05 Quality Assurance

A. Applicator shall be trained by manufacturer in installation procedures based on published UL tested firestop systems.

B. Firestop system installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop material and methods shall conform to applicable governing codes.

d. Firestop systems do not re-establish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Contractor shall consult the A/E prior to penetrating any load bearing assembly.

1.06 Acceptable Manufacturers

A. Subject to compliance with requirements, provide products of the following manufacturers as shown below.

1. Hilti Construction Chemicals, Inc., Tulsa, Oklahoma, (918) 252-6901.
2. Dow Corning Corporation, Midland, Michigan, (517) 496-5206.
3. 3M Fire Protection Products, St. Paul, Minnesota, (612) 736-0203.
4. Metalines, Inc., Oklahoma City, Oklahoma, (405) 946-9721.

1.07 Submittals

A. Submit manufacturer's data indicating product characteristics, performance and limiting criteria, including documentation of fire testing by independent fire test lab.

B. Submit shop drawings showing each condition requiring penetration seals to document proposed UL Systems, materials, anchorage, methods of installation, and type of construction assembly being penetrated.

C. Submit Material Safety Data Sheets with product delivered to the jobsite.

1.08 Delivery, Storage and Handling

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at the jobsite.

C. Store materials under cover and protect from weather and damage in compliance with the manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in Material Safety Data Sheets, as applicable.

E. Do not use damaged or expired materials.

1.09 Project Conditions

A. Verify existing conditions and substrate before starting work. Correct unsatisfactory conditions before proceeding.

B. Do not use materials that contain flammable solvents.

C. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

D. Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation.

E. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

PART 2 - PRODUCTS

2.01 Materials

A. Penetration sealants/putty for non-combustible penetrating items.

1. Hilti CS 240 Firestop Sealant
2. Dow Corning Firestop Sealant 2000
3. 3M Brand "Fire Barrier" Caulk CP-25 and CP25WB
4. Metacaulk: proper Series for application

B. Intumescent firestop materials for use at openings and sleeves involving combustible penetrating items.

1. Hilti CS 2420 Intumescent Wrap
2. Dow Corning Firestop Intumescent Wrap Strip 2002
3. 3m Brand "Fire Barrier" FS-195 Wrap Strip
4. Metacaulk Metawrap

C. Provide material classified by UL to provide firestopping equal to time rating of construction being penetrated.

D. Firestopping materials shall be asbestos-free, emit no toxic or combustible fumes, and be capable of maintaining an effective barrier against flame, smoke, water and toxic gases in compliance with referenced standards specified above.

E. Firestopping materials/systems shall be flexible to allow for normal movement of building structure and penetrating items without affecting the adhesion or integrity of the system.

PART 3 - EXECUTION

3.01 Examination

A. Surfaces to which seal materials will be applied shall be free of dirt, grease, oil, loose materials, rust or other substances that may affect proper adhesion.

B. Clean metal and glass surfaces with a non-alcohol solvent prior to installation of firestop system.

3.02 Installation

A. Install penetration seal materials in accordance with published "Through-Penetration Firestop Systems" in UL's Fire Resistance Directory.

B. Comply with manufacturer's instructions for installation of through-penetration seal materials.

1. Seal all holes or voids made by penetrations to ensure an air, smoke and water-tight seal.

2. Protect materials from damage on surfaces subjected to traffic.

3. Tool surface of firestop materials, when applicable, to give a smooth, clean appearance.

3.03 Field Quality Control

A. Examine sealed penetrations to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section, patching and repairing of firestopping caused by cutting or penetrating by other trades.

3.04 Adjusting and Cleaning

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Neatly cut and trim materials as required.

-- END OF SECTION 07270 --

SECTION 07900

JOINT SEALERS

PART 1 - GENERAL

1.01 Scope

A. This Section subject to applicable requirements of the Contract Documents.

B. Work includes all Joint Sealers required by the Contract, and, in general, includes the following items:

1. Seal joints between concrete, precast concrete, and frames of doors, windows and louvers.
2. Seal between masonry and metal fascia edges.
3. Seal expansion joints in concrete work and concrete masonry unit work.
4. Seal miscellaneous joints where indicated.
5. Seal miscellaneous joints not indicated, including but not limited to, counter tops, backsplashes, door and other openings at finish walls, and where sealing is required to provide a finished surface or connection.
6. Submittals.

1.02 Submittals

A. Sample of each type and color of sealant, primer, backup material and bond breaker material.

1. Samples labeled with name of supplier, trade name, manufacturer, type of material.

1.03 Product Handling

A. Material shall be delivered to project in original sealed containers with manufacturer's labels attached.

B. Sealants shall be stored and handled as recommended by manufacturer.

1.04 Job Conditions

A. No sealants or primer shall be applied when ambient temperature below 40 degrees F.

1.05 Applicable Codes, Standards and Specifications

A. Work under this Section shall conform to the following, except as modified herein.

1. Federal Specifications and Standards.

1.06 Grarantees

A. Sealant guaranteed by manufacturer to be non-staining when installed according to manufacturer's recommendations and instructions.

PART 2 - PRODUCTS

2.01 Materials

A. Silicone rubber sealant, for exterior use only, conforming to Federal Specification TT-S-001543A or TT-S-00230C,Type II, Class A.

1. 790 Sealant of Dow Corning Corp., Construction 1200 Sealant of General Electric, Omniseal of Sonneborn, Spectrem 1 of Tremco.

B. Acrylic-latex sealant, for interior use, one part, conforming to ASTM C 834.

1. AC-20+Silicone of Pecora, Acrylic Latex 834 of Tremco, Sonolac of Sonneborn.

C. Horizontal joint sealant, one-part, self-leveling polyurethane sealant conforming to Federal Specification TT-S-00230C, Type I, Class A; ASTM C-290, Type S, Grade P, Class 25.

1. Sonolastic SL 1 of Sonneborn, Urexpan NR-201 of Pecora.

D. Primers, solvents and cleaners, non-staining, of type proven by test and experience to be compatible with sealant used, of brand recommended by sealant manufacturer.

E. Back-up material, non-staining, non-absorbing, compatible with sealant.

1. Closed cell resilient rod or tube, closed cell polyethylene or polyurethane foam, extruded polyisobutylene.

2. Impregnated materials not permitted.

3. Size and shape suitable to fit into joint when compressed 25 to 50 per cent.

F. Bond breaker, non-absorbent, compatible with sealant. Polyethylene tape with pressure sensitive adhesive or other tape material recommended by sealant manufacturer.

PART 3 - EXECUTION

3.01 Inspection

A. Inspect joints to be sealed. Starting of sealant application constitutes acceptance of joints to be sealed.

3.02 Preparation

A. Thoroughly clean surfaces of joints to be sealed.

1. Surfaces must be dry prior to application of sealant.

2. Remove protective coatings, lacquer, oil, wax film from metal surfaces by solvent cleaning and wipe surfaces with clean cloths, to remove residue.

3. Remove mill scale from steel by wire brushing or scraping.

4. Brick, stone, concrete and mortar joints, brush clean and remove loose particles.

B. Prepare joints in porcelain enamel, plastic, and glass as recommended by sealant manufacturer.

3.03 Application

A. Application of sealant shall comply with recommendations and instructions of sealant manufacturer, to provide a non-staining weather and water tight installation.

1. Prime joints as recommended by sealant manufacturer, allow to dry before applying sealant.

2. Install back-up material at proper depth in joint to provide for required sealant thickness.

3. Install bond breaker in joints where depth is not sufficient for back-up material installation.

4. Apply sealant by gun with proper sizes of nozzles to fit joints, with sufficient pressures to completely fill joints.

5. Seal joints of door, window and louver frames in exterior wall on the interior similar to sealing on exterior.

6. Control joints in masonry, apply with gun or knife as applicable to fill joint completely.

B. Joint depth, in general, as follows:

1. Joints minimum 1/4" wide by 1/2" deep unless indicated otherwise.

2. Depth of joint equal to width up to 1/2" wide joint.

3. Joints 1/2" to 1" wide, depth 1/2", if deeper install backing material to within 1/2" of face of adjacent surfaces.

4. Control joints 1" to 2" wide, depth not greater than 1/2".

C. Tool all sealed joints as sealant is applied to slightly concave surface to force sealant in joint cavity and insure good surface contact both sides.

1. Lubricant used in tooling, non-staining to sealant and adjacent surfaces.

2. Tooling white or light colored sealant done only with dry or clean water wet tool.

D. Finished sealed joints left without holes, cracks, sags or other imperfections, neatly finished against adjacent surfaces, smooth and even.

3.04 Repair and Clean

A. Clean adjacent soiled or stained surfaces immediately after application of sealant.

1. Use solvent or cleaning agent recommended by sealant manufacturer.

2. Finished work left clean and neat to satisfaction of A/E.

B. Joints improperly sealed or failing, remove sealant, clean joints and reseal.

1. Failure considered as leakage, hardening, cracking, crumbling, shrinking, running, sagging, staining of adjacent surfaces.

3.05 Protection

A. Protect joints in horizontal surfaces from traffic for a minimum of seven days.

-- END OF SECTION 07900 --

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 Scope

A. This Section subject to applicable requirements of the Contract Documents.

B. Work includes all Steel Doors and Frames required by the Contract, and, in general, includes the following items:

1. Interior Hollow metal doors.
2. Submittals.

1.02 Submittals

A. Shop drawings of doors and frames, showing each type of door and frame, frame conditions, and anchorage details.

1. Schedule including doors, frames and requirements for hardware.
2. Show fabrication, reinforcing, sound deadening treatment.
3. Note shop finish.

1.03 Product Handling

A. Protect doors and frames during shipment and while stored on site.

1. Store doors and frames upright in protected, dry areas, off the floor on wood blocking and separate with shims.
2. Doors or frames damaged or rusted, remove from site, replace at no additional cost to Owner.
3. Label each door and frame with metal or plastic tag indicating location, size, swing and other pertinent information.

1.04 Quality Assurance

A. All steel doors and frames on the project shall be from the same manufacturer.

PART 2 - PRODUCT

2.01 Materials

A. Steel sheet, hot or cold rolled, pickled and oiled, with clean surfaces, of gauges specified.

1. Steel sheet for door faces, stretcher leveled.

2.02 Frames

A. Frames for doors, combination buck, frame and trim type shall be of profile and design detailed and of sizes indicated on Door Schedule.

1. Minimum 14 gauge zinc coated for exterior frames, 16 gauge for interior frames.
2. Fixed and removable mullions shall be provided where indicated and scheduled.

B. Steel sheet shall be formed to provide profile and moldings straight and true to line, free of warp, buckles, fractures, or other defects.
1. Form stops integral with frames, extending to floor unless indicated otherwise.
2. Hospital type stops, terminate 4" (6") above floor with ends cut at 45 degrees and covered with welded filler plate.)

C. Corners and connections shall be mitered, welded, exposed welds ground flush and smooth.
1. Provide a minimum of four anchors at each jamb of welded frames, of type required for adjoining wall construction.
a. Fabricate anchors of minimum 16 gauge steel sheet .
b. Floor anchors shall be provided at each jamb, welded to jamb, drilled with two holes for anchoring to floor.
2. Steel spreaders shall be provide across bottom of frames for rigidity in shipment, handling and setting.
3. Provide mortar guards at all hardware cutouts.

D. Glazed openings:
1. Applied stops shall be formed of minimum 20 gauge steel sheet.
2. Corners butted and closely fitted.
3. Secure stops to frames with countersunk cadmium or zinc placed screws, maximum 9" on center.

2.03 Flush Doors

A. Full flush hollow steel construction, 1-3/4" thick unless scheduled otherwise, of size indicated on Door Schedule.

B. Face sheets, 16 gauge zinc coated for exterior, 18 gauge for interior, no exposed seams or joints on faces or edges.

C. Face sheets of interior doors stiffened by full honeycomb core.
1. Honeycomb core, resin impregnated 1" honeycomb, epoxy bonded to face sheets.

C. Insulated exterior doors shall be by metal building manufacturer or approved equal.

D. Door faces shall be jointed at vertical edges by continuous weld full height of door. Weld shall be ground, filled and dressed smooth.

E. Top and bottom edges of doors shall be reinforced full widths with continuous recessed steel channel, minimum 16 gauge, spot welded to both faces.

F. Louvers, if applicable, shall be provided where indicated, of sizes shown on Door Schedule, welded blade type construction. Louvers pierced into face sheets not permitted.

H. Opening for glass shall be provided of size shown on Door Schedule.

1. Fixed moldings securely welded to door.

2. Loose stops, minimum 20 gauge steel, with butted corners, secured to frame opening with cadmium or zinc plated countersunk screws. Snap on attachment not permitted.

I. Doors as specified herein, manufacturers as follows:

1. Exterior doors:

a. By metal building manufacturer or approved equal of Ceco Door Products, Steelcraft, or Pioneer.

2. Interior doors:

a. Regent Door of Ceco Door Products

b. Series L of Steelcraft (Honeycomb core)

c. Series CH of Pioneer Industries

2.04 Stile and Rail Doors

A. Stile and rail door construction, 1-3/4" thick; of sizes indicated on Door Schedule.

1. Fabricate to profiles indicated, minimum 16 gauge zinc coated steel.

2. Corners reinforced, welded and ground smooth.

B. Provide molding for glazing.

1. Fixed moldings securely welded to door on security side.

2. Loose stops, minimum 20 gauge steel, with butted corners, secured to frame opening with cadmium or zinc plated countersunk screws. Snap on attachment not permitted.

2.05 Labeled Fire Doors and Frames

A. Doors and frames shall be labeled as indicated on the Door Schedule (B Label 1-1/2 hours) (C Label 3/4 hour) (A Label 3 hours).

1. Conform with Underwriters' Laboratories, Inc. or Warnock Hersey International, Inc. requirements in all respects for label indicated, and have proper label attached.

2.06 Preparation for Hardware

A. Prepare doors and frames to receive hardware.

1. Mortise, reinforce, drill and tap at factory to receive hardware specified under Section for Finish Hardware.

2. Provide reinforcing for concealed and surface applied hardware.

3. Provide cover boxes in back of hardware cutouts.

4. Welding of butts in frames not permitted.

5. Self-tapping and sheet metal screws for attaching hardware not permitted.

6. Gauges of reinforcing plates not lighter than required by Commercial Standard CS 242-62.

2.07 Finish

A. Doors and frames shall be thoroughly cleaned, chemically treated to provide maximum paint adhesion and given one baked on coat of rust inhibitive primer.

1. Finish surfaces shall be smooth and free from irregularities, rough spots and defects.
2. Paint primed surfaces with:
    a. One coat of Tnemec 135 Chembild,
    b. Followed by one coat Tnemec 71 EnduraShield.

PART 3 - EXECUTION

3.01 Prime Coat Touch Up

A. Immediately after erection, touch up prime coat where damaged.

1. Remove rust prior to touch up.
2. Sand damaged area smooth and touch up with same primer as applied at shop.

– END OF SECTION 08110 --

SECTION 08362

SECTIONAL STEEL OVERHEAD DOORS

PART 1 - GENERAL

1.01 Scope

A. This Section subject to applicable requirements of the Contract Documents.

B. Work includes all Sectional Steel Overhead Doors required by the Contract, and, in general, includes the following items:

1. Steel insulated overhead doors.
2. Submittals.

1.02 Quality Assurance

A. Acceptable manufacturers:

1. Overhead Door Corporation, Series 422 or equal ofRaynor Manufacturing Co., Clopay Door Products Division.

B. Doors designed and reinforced to withstand a wind pressure of 20 pounds per square foot of door area with a maximum deflection of 1/120th of opening width.

C. Installation by qualified factory trained mechanics approved by the door manufacturer.

1.03 Submittals

A. Shop drawings of doors, showing each type of door.

1. Schedule including size and location of door.
2. Elevations of door type and details of construction.
3. Details of track and methods of support, bracing and anchorage.

1.04 Product Handling

A. Deliver products, materials and equipment in manufacturer's original undamaged packages with labels attached stating manufacturer's name, brand name, model designation and location.

B. Store panels, accessories and equipment in unopened packages in manner to prevent damage.

1. Remove damaged panels, accessories and equipment from project immediately.

PART 2 - PRODUCTS

2.01 Materials

A. Panel sections, 20 gauge steel, galvanized with minimum 1.25 ounces of zinc per square foot.

B. End stiles 2" deep, channel shaped 14 gauge steel, and center stiles, minimum 16 gauge steel, galvanized with minimum 1.25 ounces of zinc per square foot.

C. Insulation, polystyrene, full thickness of the panel.

D. Track 2" wide or 3" wide as required by door size, galvanized steel.

1. Track support at jambs, continuous steel angles, galvanized, adjustable for sealing door to jamb.

E. Counterbalance, heavy duty torsion springs on steel cross header shaft, adjustable for proper tension.

1. Shaft full width of opening, ball bearing mounted.
2. Lift cables, flexible galvanized steel with safety factor of 7 to 1.
3. Cables winding to grooved drums placed inside jambs and attached to corner lift brackets.

F. Hardware including lockset, hinges, brackets and corner lift brackets: Stainless steel where available, galvanized where not.

1. Track rollers, hardened steel, ball bearing rollers.

G. Floor, head and jamb seals, rubber, vinyl or neoprene.

H. Locks:

1. Interior latch operable from inside only, door shall latch automatically on closing.
2. Chain hoist operated doors provided with manufacturer's stand type locking device.

I. Primer: Prime all galvanized metal surfaces with one of the following:

1. Devoe: 13201 Mirrolac Galvanized Metal Primer.
2. Fuller: 621-05 Blox-Rust Latex Metal Primer.
3. Glidden: 5229 Glid-Guard All-Purpose Metal Primer.
4. Moore: IronClad Galvanized Metal Latex Primer #155.
5. PPG: 6-215/216 Speedhide Galvanized Steel Primer.
6. P & L: P & L Interior Trim Primer.
7. S-W: Galvite B50W3.

J. Paint: Paint galvanized metal after priming as follows:

1. One coat Tnemec 135 Chembild,
2. Followed by one coat Tnemec 71 EnduraShield.

2.02 Fabrication

A. Door panels shall be full 2" thick sections with ribbed outside face.

1. End and intermediate stiles, formed channel sections full thickness of door panel, accurately cut to fit formed panel sections and welded to panel sections.

2. Panel sections formed to provide rabbeted meeting rails forming weather joints and providing interlocking struts full width of all sections.

3. Door sections insulated with glass fiber, sized and fitted to completely insulate panels.

4. Interior cover panels secured to end and intermediate stiles.

5. Provide glass openings where indicated. Glass shall be thermal type, standard of the door manufacturer.

B. Track fabricated for (standard)(high lift)(low headroom)(full vertical lift).

C. Finish shall be a coat of baked-on, factory applied enamel primer, applied to both sides of exterior and interior panels.

2.03 Operation

A. Doors manually operated by pull down chain.

PART 3 - EXECUTION

3.01 Inspection

A. Examine openings to receive overhead doors for dimensions, square, plumb and finish.

1. Starting of installation constitutes acceptance of conditions.

3.02 Installation

A. Install doors as shown on approved shop drawings and as recommended by manufacturer, complete and ready for use.

1. Provide mounting pads, plates, anchors, brackets, and support framing required for complete installation.

2. Track bolted or welded to full angle supports and welded or bolted to steel door frames at not over 2'-0" on center.

3. Horizontal track reinforced with continuous angles adequate for door size and weight, cross braced and diagonally braced to provide a rigid installation.

3.03 Adjust and Clean

A. Upon completion, adjust doors for proper operation and lubricate operating parts as required. Manufacturer, adjust all limit switches, check and certify operation of all doors.

B. Clean all surfaces.

– END OF SECTION 08362 –

SECTION 08520

ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 Scope

A. This Section subject to applicable requirements of the Contract Documents.

B. Work includes all Aluminum Windows required by the Contract, and, in general, includes the following items:

1. Fixed windows.
2. Aluminum sills, including end caps, mullions, closures, cover plates.
3. Glazing beads, gaskets and accessories required for glazing.
4. Anchors, shims, plates and fastening devices required for installation.
5. Isolators.
6. Submittals.

1.02 Submittals

A. The following submittals shall be provided:

1. Shop drawings, showing details of construction, methods of assembly, location and spacing of anchors and fasteners, hardware location, weatherstripping, sealing methods, and details of accessories.
2. Samples of integral color finish of aluminum, showing color and range.
3. Sample of window, complete with hardware, weatherstripping, anchors, sealing, and accessories. Sample shall be glazed. Approved sample may be installed in project and location recorded.

1.03 Product Handling

A. Store windows in upright position, off ground or floor and supported on blocking. Protect from weather and damage.

1.04 Applicable Codes, Standards and Specifications

A. Work under this Section should conform to the following, except as modified herein.

1. ANSI/AAMA 101-88, Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Doors.
2. AAMA GS-001, Voluntary Guide Specifications for Aluminum Architectural Windows.
3. The Aluminum Association (AA).
4. American Society for Testing and Materials, (ASTM), Standard Specifications and Methods of Testing.

PART 2 - PRODUCTS

2.01 Materials

A. Aluminum extrusions, ASTM B 221, alloy 6063-T5, should be of commercial quality, free from defects impairing strength, durability and appearance. All surfaces to arrive primed with factory prime finish.

B. Isolators should be provided to separate plaster and acoustical material from contact with aluminum.

1. Tape, 1/8" thick, width minimum 3/8", pressure sensitive adhesive one side, closed cell gasket material.

2. Neoprene Type NN-1, Everlastic of Williams Products, Inc., or Norseal V-720 Series Gray of Norton Sealants.

C. Fasteners and anchors should be stainless steel or hardened aluminum, exposed fastener heads Phillips slotted, countersunk.

D. Paint one coat of Tnemec 135 Chembild followed by one coat Tnemec 71 EnduraShield.

2.02 Fabrication

A. Aluminum windows should be factory assembled by welding or mechanical means, conforming to reviewed shop drawings.

B. Glazing stops, aluminum, finished to match windows, for inside glazing.

C. Frames and sash shall provide proper bite and clearances for types of glass indicated.

PART 3 - EXECUTION

3.01 Inspection

A. Check window opening for dimensions, tolerance and conditions of surfaces to contact windows.

1. Do not proceed with installation until conditions are correct and acceptable.

2. Starting of installation implies acceptance of openings.

3.02 Installation

A. Install windows in accordance with reviewed shop drawings and instructions of window manufacturer.

1. Install windows plumb, level, and true line, without warp or rack of frames and sash.

2. Anchor frames solidly to surrounding construction to prevent distortion and misalignment.

3. Contacts between aluminum and other materials harmful to aluminum shall be separated with gasket composed of bituminous paint.

4. Install isolators to separate window frames from acoustical tile and plaster, and where shown.

5. Install insulating panels in location indicated.

6. Provide wood blocking over cavities in masonry walls.

3.03 Cleaning

A. Clean aluminum surfaces and remove excess sealant. Do not use abrasive, caustic or acid cleaners.

– END OF SECTION 08520 –

SECTION 08710

FINISH HARDWARE

PART 1 - GENERAL

1.01 Scope and Summary

A. This Section subject to applicable requirements of the Contract Documents.

B. Work includes all Finish Hardware required by the Contract, and, in general, includes the following items:

1. Furnish and deliver all finish hardware to complete the buildings, except such items as are specifically excluded. The schedules in this specification are intended to indicate the various combinations desired and are not guaranteed as to quantity. Check the Door Schedule and drawings for count, and any door omitted from this schedule shall be furnished with hardware as scheduled for a door with a similar location elsewhere in the building. IF A DOOR IS NOT INCLUDED IN THIS SCHEDULE, AND THERE IS NOT A SIMILAR DOOR ELSEWHERE IN THE BUILDING, AS A MINIMUM, EACH LEAF SHALL BE PROVIDED WITH 1-1/2 PAIR OF BALL BEARING BUTTS, A DOOR CLOSER, A CLASSROOM LOCKSET, AND A DOOR STOP.

2. Hardware subcontractor responsible for sending physical hardware to door subcontractor within eight (8) weeks after receiving reviewed door shop drawings.

3. Submittals.

C. This Section includes the following:

1. Hinges.

2. Key control system.

3. Lock cylinders and keys.

4. Lock and latch sets.

5. Closers.

6. Astragals.

7. Miscellaneous door control devices.

8. Door trim units.

9. Weatherstripping for exterior doors.

11. Automatic drop seals (door bottoms).

12. Thresholds.

13. Exterior hold-open chain and anchor.

D. Related Section: 08110, "Standard Steel Doors and Frames".

E. This Section includes items known commercially as finish or door hardware that are required for 3 interior and 3 exterior swing doors, and 1 interior double door (chemical room).

F. All door hardware is to be stainless steel.

1.02 Quality Assurance

A. The following hardware list includes manufacturers which are accepted by the A/E.

1. HINGES - Stanley: full mortise #FBB199 or approved equal.
2. LOCKSETS - Sargent: 10 line or approved equal.
3. DOOR OVERHEAD CLOSERS - Norton: Series 7500H SS or approved equal.
4. DOOR TRIM UNITS - Sargent: 6 Line OSL Series or approval equal.
7. DOOR SWEEPS & SEALS - Stanley: 5070 series sweep and 5030 series seals, or approved equal.
8. THRESHOLDS - Reese Enterprises: #S404D or approved equal.
9. ASTRAGALS - Reese: #183SP or approved equal.

B. Equivalent hardware may be substituted as specified. Provide physical sample of item or items to be substituted for approval by Engineer.

C. Provide hardware for fire-rated openings in compliance with AIA (NBFU) Pamphlet No. 80 and NFPA Standard No. 80. This requirement takes precedence over other requirements for such hardware. Provide only hardware which has been tested and listed by UL for the types and sizes of doors required, and complies with the requirements of the door and door frame labels.

D. Single Source Responsibility: Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer.

1.03 Submittals

A. Before ordering hardware, furnish to the A/E, product data and a legible itemized schedule giving the manufacturer's name, catalog number, material, finish, keying arrangements of locks, hands of doors, etc., of every item that will be furnished. Also include type, style, function, size, and finish of each hardware item. The A/E's review shall not relieve this subcontractor of responsibility for incorrect count or quality. Submit number of schedules as required.

B. This subcontractor is responsible for the maintenance of quality of the hardware specified. The review of the Contractor's schedule shall not preclude rejection of hardware items falling below, in the Engineer's opinion, the acceptable standards of quality specified.

C. After review of the itemized schedule by the Engineer, no item changed without prior approval of the Engineer, in writing.

D. Furnish and deliver to the Owner a booklet composed of all literature concerning the installation and adjustments of all hardware to be installed in the building. The instruction pamphlets shall be assembled in a hard covered binder similar and equal to "Accopress

Binder" of Acco Products Inc., labeled on the front "Maintenance Manual for Finish Hardware."

1.04 Product Handling

A. Delivery of finish hardware shall be made to the site of the construction in accordance with the instructions of the General Contractor.

B. Each item of finish hardware shall be individually packaged and delivered in the manufacturer's original container; no drop shipments allowed. Each package or box clearly marked with the manufacturer's name, catalog number, material, finish, hardware group and item number, and all other marking required for easy identification of the item of hardware.

PART 2 - PRODUCTS

2.01 Materials and Fabrication

A. Material and Finish

1. All hardware shall be stainless steel.

B. Hinges:

1. Hinges of size scheduled, of steel as scheduled. Steel hinges scheduled for exterior doors to be stainless steel. All hinges stainless steel.
2. Butt hinges for doors shall have non-rising loose pin with button tips. Phillips flat head screws. Hinges for exterior doors shall have non-removable pins held by a set screw in the barrel and Phillips flat head screws.
3. All doors shall have one and one-half (1-1/2) pairs of hinges per door leaf.
4. Finish of screws to match hinges.
5. Hinges
    a. shall be 180 degree type.
    b. Plain bearing medium to high frequency hinges.
    c. 4-1/2" hinge height x 4-1/2" width.

C. Locks:

1. Cylindrical locksets and latch sets to conform to
2. ANSI A156.2, Series 4000, Grade 1. Cylinders shall have 6 pin tumblers, keyed as scheduled or directed by Owner and A/E. Die cast working parts will not be accepted. Lock functions as scheduled. Latch throw minimum 1/2". Provide 3/4" minimum throw for latch bolts used on pairs of doors.
3. Strikes for all locks curve lipped.
4. Lock faces beveled, rounded or rabbeted where required.
5. Equip locks with manufacturer's special 6-pin tumbler cylinder with construction master key feature that permit voiding of construction keys without cylinder removal.

6. Equip locks with cylinders for interchangable-core pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove those when directed. Furnish final core and keys for installation by Owner.

7. Equip locks with high-security cylinders that comply with performance requirements for Grade 1 cylinders as listed in ANSI/BHMA A156.5 and that have been tested for pick and drill resistance requirements of UL437 and are UL listed.

8. Metals: Construct lock cylinder parts from stainless steel.

9. Key Material: Provide keys of nickel silver only.

    a. Key quantity: Provide 3 change keys for each lock, 5 master keys for master system, and 5 grandmaster keys for grandmaster system. Deliver keys to Owner.

D. Door Closers:

1. Door closers of type as scheduled, of size scheduled or required to operate properly and equipped with arms for full swing. Closers shall be provided with proper arms and installed so as to keep the cover out of public spaces. All closers shall be stainless steel.

2. All closers must be adjustable for minimum opening force as it applies to current barrier free code requirements, ANSI A117.1.

3. Surface closers, rack and pinion, spring power adjustment, full adjustable back check, for mounting on the door.

4. Provide closers with a lock-stop hold open capability.

5. Install on all doors designated.

6. Closers to have 180 degree & hold open capability.

E. Door Silencers:

1. All single doors with hollow metal frames shall have three GJ #64 silencers installed in the stop of the frame. Double doors provided with two silencers installed in the stop of the frame.

2. Exterior doors shall not be provided with door silencers.

F. Weatherstripping and Seals

1. General: Provide continuous weatherstripping on exterior doors. Provide non-corrosive fasteners.

2. Jambs and Heads: Provide bumper-type resilient insert and metal retainer strips, surface applied, of aluminum with natural anodized finish of 0.062 minimum thickness at main walls and flanges.

3. Door Bottoms: Provide threshold consisting of contact-type resilient insert, of aluminum with natural anodized finish of 0.062 minimum thickness at main walls and flanges.

G. Thresholds

1. General: Unless otherwise noted provide standard metal threshold of size applicable to each door.

2. For out-swinging doors provide rebbeted type units with replaceable weatherstrip insert in stop.

H. Hardware Finish

1. All hardware to be stainless steel.

2. Chain hold open on all doors, 1/2 "stainless steel chain- screwed.

PART 3 - EXECUTION

3.01 Installation

A. Fastening and Anchorage:

1. Hardware installed in accordance with the instruction of the manufacturer of the hardware used. All surface applied hardware on labeled and labeled construction doors shall be installed with through bolts.

2. Mortise hinges on UL labeled and labeled construction wood doors shall be attached with No. 12 x 1-1/4" steel threaded- to-the-head wood screws of cadmium plated or rust-resistant type in 5/32" pilot holes.

3. Furnish the proper fastenings which shall harmonize with the material and finish.

4. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Engineer.

a. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.

5. Do not install surface mounted items until finishes have been completed on the substrate involved.

6. Space fasteners and anchors in accordance with industry standards.

7. Set threshold for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3.02 Adjustment

A. It is the responsibility of this subcontractor to make final adjustments to finish hardware.

3.03 Hardware Schedule

A. Quantity of hardware listed under hardware group indicates amount of hardware required for each door under that group unless noted otherwise.

3.04 Adjusting and Cleaning

A. After final installation adjust all hardware to Engineer's satisfaction. At end of construction completion readjust if requested by Engineer. After installation clean all hardware surfaces and adjoining surfaces.

DOOR AND HARDWARE SCHEDULE

Door #101
Door size: 3'-0" x 7'-0"
Features: 24" x 24" wire glass,
Double insulated,

Hardware: Lockset exterior cylinder,
1-1/2 Pair of butts,
Silencers.
Exterior hold-open chain and anchor.

Door #102
Door size: 3'-0" x 7'-0"
Hardware: Lockset,
1-1/2 Pair of butts,
Silencers

Door #103
Door Size: 3'-0" x 7'-0"
Hardware: Lockset,
Overhead closure,
1-1/2 Pair butts,
Silencers

Door #104
Door Size: 3'-0" x 7'-0"
Features: "B" Label
Hardware: Lockset,
Overhead closure,
1-1/2 Pair butts,
Silencers

Doors #105A/105B
Door Size: 6'-0" x 7'-0"
Features: "B" Label
Hardware: Lockset for active leaf,
Overhead closures both doors,
Astragal,
1-1/2 pair butts each door,
Silencers.
Dead bolt at top of frame on inactive leaf.

Door #106
Door Size: 3'-0" x 7'-0"
Features: 24" x 24" wire glass, double insulated

Hardware: Lockset exterior cylinder,
1-1/2 Pair of butts,
Silencers
Exterior hold-open chain and anchor.

Door #107
Door Size: 3'-0" x 7'-0"
Features: 24" x 24" wire glass, double insulated
Hardware: Lockset exterior cylinder,
1-1/2 Pair of butts,
Silencers,
Exterior hold-open chain and anchor.

Door #108
Door Size: 10'-0" x 12'-0"
Features & Hardware: See Overhead Door Section.

Door #109
Door Size: 3'-0" x 7'-0"
Hardware: Lockset exterior cylinder,
1-1/2 Pair of butts,
Silencers.

-- END OF SECTION 08710 --

SECTION 09542

ACOUSTICAL CEILINGS TYPE 2

PART 1 - GENERAL

1.01 Scope

A. This Section subject to applicable requirements of the Contract Documents.

B. Work includes all Acoustical Ceilings Type 2 required by the Contract, and, in general, includes the following items:

1. Ceramic tile ceilings (AC.2), concealed mechanical suspension system, complete including all accessories.
2. Inserts and fastening devices required for installation of suspension systems.
3. Shop drawings.
4. Submittals.

1.02 Quality Assurance

A. Installation shall be made by applicator approved by manufacturer of acoustical materials.

B. Tolerance allowable for finished acoustical ceiling, level within 1/8" in 12'-0".

C. Deflection of complete suspension system including hangers, and fastening devices supporting acoustical tile, light fixtures and ceiling grilles shall be maximum 1/360 of the span when tested according to ASTM C 635.

D. Flame spread of tile, 25 or less when tested according to ASTM E 84.

1.03 Submittals

A. Shop drawings, show layouts of ceilings including lighting fixtures, grilles, and access panels.

PART 2 - PRODUCTS

2.01 Materials

1. Conform in general to ASTM C 635 for Heavy-Duty System.
2. All components of suspension system from one manufacturer.
3. Hangers, minimum 12 gauge galvanized soft annealed mild steel wire.
4. Carrying channels, 1-1/2" cold rolled channels weighing 475 pounds per 1000 lineal feet.
5. Main runners, concealed H, Z or J section, cold rolled steel, electro-zinc coated.
6. Splines, flat or tee, electro-zinc coated steel.
7. Hanger clips, galvanized wire spring clips or formed electro- zinc coated steel, standard of manufacturer.

8. Wall moulding, channel shaped, minimum thickness, .020" electro-zinc coated steel, flange width minimum 15/16", finish white baked on enamel, provided with spring steel spacers.

B. Ceramic tile (AC.2), uniform 24" x 24" size.

1. Exposed surface fissured, resembling travertine marble, no two tile identical in texture.
2. Edges square without chipped or broken edges.
3. All edges kerfed and back cut for concealed mechanical suspension.
4. NRC range 60 to 75.
5. Face and edges factory finished, uniform white, light reflectance value not less than .75.
6. Travertine Ceramaguard #601 by Armstrong or approved equal.

PART 3 - EXECUTION

3.01 General Requirements

A. Fire rated construction, where indicated, of ceilings, erected in accordance with applicable requirements to provide for rating specified or indicated.

3.02 Inspection

A. Examine surfaces to receive suspended acoustical ceilings for any irregularities or conditions affecting adversely the installation of the work.

1. Locate and mark access locations and sizes before starting installation of tile.

3.03 Installation

A. Suspension system installation shall conform to ASTM C 636 and as specified herein.

1. Hangers spaced maximum 4'-0" on center and 6" from ends of carrying channels.
2. Suspension system hung from roof framing or floor framing above. Do not hang from metal roof deck.
3. Hanger wire attached to carrying channels with saddle ties.
4. Provide supplemental hangers within 6" of each corner of lighting fixtures if fixtures are not supported separately from the ceiling suspension system.
5. Carrying channels spaced maximum 4'-0" on center, installed straight, true to line, level and at proper elevation.
6. Provide framing and supports for lighting fixtures, grille frames and access panels.
7. Concealed main runners spaced 12" on center at right angle to carrying channels, square to adjacent walls, clipped to channels at all intersections.
8. Wall moulding, install at intersections of ceiling and vertical surfaces, rigidly secured with mechanical fasteners. Interior corners, cut flange, bend web to form angle. Exterior corners, use preformed corner plates.

9. Install spring spacers at wall mouldings at each border tile.

10. Splines installed in unsupported joints of tile to provide hairline joints and hold tile in even plane without lipping.

B. Acoustical tile, install in straight square pattern, all joints in alignment in both directions and parallel to sides of room.

1. Border tile, equal width at opposite sides, not less than one half tile.

2. Fit tile snugly at electrical fixtures and grilles so that flanges of fixtures will cover edges of tile.

3. Cut tile to fit neatly at pipes, ducts, conduit, etc. passing through ceiling.

4. Tile left flat and in a true plane without lipping, buckling, or other imperfections.

3.04 Cleaning

A. Clean tile with soiled and discolored surfaces after installation.

1. Remove and replace tile that cannot be properly cleaned and damaged or improperly installed tile.

3.05 Extra Materials

A. Deliver extra materials to the Owner. These materials shall match the products installed and shall be packaged with protective covering for storage, and shall be labeled. Furnish quantity of each exposed component equal to 2% of the amount installed.

-- END OF SECTION 09542 --

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 Scope

A. This Section subject to applicable requirements of the Contract Documents.

B. Work includes all Painting required by the Contract, and, in general, includes the following items:

1. Painting as required by Room Finish Schedule and drawings.
2. Paint all exposed ductwork, mechanical equipment and miscellaneous metal work not factory finished.
3. Submittals.

1.02 Quality Assurance

A. The General Contractor and the painting subcontractor shall be sure that all coatings used on this project conform to all state and local regulations, including VOC (Volatile Organic Compounds) rules and regulations at the time of application.

1.03 Submittals

A. Samples, in duplicate, for approval of all finishes and colors to establish standard for surfaces on the project.

B. Submit, as shop drawings, paint schedule listing all surfaces to be finished and proposed products for each coat on each surface.

1.04 Product Handling

A. Deliver materials in original sealed containers with labels legible and intact.

B Store only acceptable materials on project, in a suitable location where designated.

1. Restrict storage to paint materials and related equipment.
2. Comply with applicable health and fire regulations.
3. Maintain storage space clean and free from oily rags, waste and debris. Remove empty cans and oily rags from site daily.
4. Do not use plumbing fixtures and drains for disposal of paint and related materials.

1.05 Job Conditions

A. Comply with manufacturer's recommendations of conditions under which paint and finishes may be applied.

1. Temperature of surfaces to receive paint and of atmosphere during painting and until paint is dry shall be maintained at 50 degrees F minimum.

B. Do not apply finish in areas or adjacent to areas where dust is being generated.

C. Protect by covering or other approved method finished work of other trades and surfaces not required to be painted.

1.06 Applicable Codes, Standards and Specifications

A. Work under this Section shall conform to following, except as modified herein.

1. American Society for Testing and Materials (ASTM), Standard Specifications and Methods of Testing.

a. D 16 Standard Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

b. D 2833 Standard Index of Methods for Testing Architectural Paints and Coatings.

c. D 3276 Standard Guide for Painting Inspectors (Metal Substrates).

d. D 3927 Standard Guide for State and Institutional Purchasing of Paint.

PART 2 - PRODUCTS

2.01 Acceptable Manufacturers

A. Painting and finishing materials shall be the best quality products of the following manufacturers.

1. Primer

a. Pratt & Lambert, Devoe & Reynolds, Benjamin Moore, PPG Industries, Sherwin-Williams, Glidden, Coronado, Con-Lux Coatings, Inc.

2. Paint

a. Tnemec for metal.

b. Pratt & Lambert, Devoe & Reynolds, Benjamin Moore, PPG Industries, Sherwin-Williams, Glidden, Coronado, Con-Lux Coatings, Inc. for all other materials.

3. Materials used for painting system for each type surface shall be the product of a single manufacturer.

2.02 Colors

A. Colors of paint and stains are indicated, in general, on Drawings. Manufacturers names are included to identify color selection only. Other manufacturers specified may be approved, providing finishes specified and colors indicated are matched on the job. If colors are not indicated, see Project Engineer.

2.03 Mixing

A. Paint shall be delivered to job ready-mixed in original sealed containers.

B. Job mixing and job tinting only on approval.

1. Mix only in containers placed on suitable protective floor covering or in metal pans.

2. Use only tinting colors recommended by manufacturer of specific type of finish.

3. Fungicidal agent shall be incorporated into paint by manufacturer.

C. Prime coats, undercoats and filler coats, shall be tinted to approximate color of finish coats to assure uniformity of color of the finish.

PART 3 - EXECUTION

3.01 Inspection

A. Examine general construction drawings and specifications and Mechanical drawings and specifications to become acquainted with materials and surfaces that require painting.

1. Mechanical work to be painted shall match color of adjacent surface unless noted otherwise.

B. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work.

1. Starting of painting and finishing shall constitute acceptance of surfaces and of shop and prime coats by others.

C. Do not proceed with surface preparation or painting application until conditions are suitable.

3.02 Preparation of Surfaces

A. Hardware, accessories, plates, lighting fixtures, electrical outlets, electrical receptacles, switches, and similar items in place and not intended to be painted shall be removed, masked or otherwise protected prior to surface preparation and painting. On completion of painting, reinstall and remove masking.

B. Surfaces of all materials to be painted or finished shall be dry, clean and free from dust, dirt, loose particles, and foreign matter before applying paint or surface treatment.

1. Oil, grease and other contaminants harmful to paint adhesion shall be removed with clean cloths and appropriate cleaning solvent prior to mechanical cleaning.

C. Concrete and masonry, dust, loose particles and other foreign material shall be removed by brushing or washing.

1. Concrete shall be allowed to cure at least 30 days.

2. Remove efflorescence and laitance by washing with weak acid solution and thorough rinsing with clean water.

3. Remove oil and grease with suitable solvents.

D. Ferrous metal, oil and grease shall be removed by solvent cleaner:

1. Remove loose rust, loose mill scale and other foreign material by cleaning with power wire brush or sandblasting.

2. Shop painted metal shall be protected from corrosion. Damaged areas shall be cleaned and touched up with paint compatible with primer.

E. Galvanized metal shall have surfaces cleaned prior to priming. Remove oil and surface residue with mineral spirits. Prime only with approved galvanized metal primer.

F. Aluminum shall have surfaces cleaned with mineral spirits. Remove oil and surface residue.

3.03 Application

A. Paint shall be applied by brush or roller, unless specified otherwise herein.

B. Finish all surfaces and edges of metal doors and frames.

C. First coats shall not be applied until moisture content of surfaces is within limits specified or recommended by paint manufacturer.

D. All coats shall be applied uniformly, free from sags, wrinkles, runs, holidays, smears, dirt, spatter and other defects.

1. Each coat shall be applied to produce a film of uniform thickness.
2. Rate of application shall be as recommended by paint manufacturer for surface involved.
3. Meeting lines between colors shall be straight and sharply defined with no blending, runs or gaps.
4. Allow sufficient time between coats for preceding coat to dry thoroughly, as recommended by paint manufacturer.
5. Sand and dust surfaces between each coat to remove defects before next coat is applied.
6. Color of undercoats shall vary slightly from color of preceding coat to enable visual determination of complete coverage.

3.04 Painting and Finishing Schedule

A. Products scheduled herein for painting and finishing of various surfaces are intended to establish a standard of material and quality. Equal materials of other manufacturers specified may be approved.

B. The following is a master list of paint types. This list may include paint types which are not required for this project.

C. The drawings and other portions of the specifications will indicate which of these paint types are required for this project.

EXTERIOR SURFACE

TYPE	SURFACE	FINISH
	Galvanized steel	1st coat: Shop prime coats by material supplier.
		2nd coat: Tnemec 135 Chembild.
		3rd coat: Tnemec 71 EnduraShield

Structural steel	1st coat: Shop prime coat by material supplier
	2nd coat: Tnemec 135 Chembild.
	3rd coat: Tnemec 71 EnduraShield
Concrete block & drywall	1st coat: (Epoxy Coating) P&L Vapex Wall Primer
	2nd coat: P&L Palgard Epoxy Coating
	3rd coat: P&L Palgard Epoxy Coating
Radiators, exposed pipe	1st coat: P&L Interior Trim Primer
	2nd coat: Tnemec 135 Chembild.
	3rd coat: Tnemec 71 EnduraShield

Flame Spread 25 or less

3.05 Cleaning

A. At completion, touch up and restore finish where damaged and defaced. Leave work free from blemishes.

B. Remove paint spots, splashes and spatter from all surfaces. Do not mar surface finish of item being cleaned.

C. Clean up paint storage area, remove rubbish, discarded materials, and surplus materials. Leave area in condition required for similar spaces.

-- END OF SECTION 09900 --

SECTION 10522

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 Related Documents

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification Sections, apply to this Section.

1.02 Summary

A. This Section includes the following equipment to be supplied by Owner and installed by Contractor:

1. Wall-Mounted Fire Extinguishers.
2. This section includes bracket-mounted extinguishers. Refer to drawings for locations of each type of equipment.

1.03 Submittals

A. General: Submit the following in accordance with Conditions of Contract and Division 1 specification Sections.

1. Product data for each type of product specified.
2. Provide a location plan showing different types of extinguisher mountings and their locations.

1.04 Quality Assurance

A. Single-Source Responsibility: Obtain fire extinguishers and related items from one source from a single manufacturer.

B. UL-Listed Products: Fire extinguishers UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

2.01 Manufacturers

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering product that may be incorporated in the Work include, but are not limited to, the following:

1. J.L. Industries.
2. Larsen's Manufacturing Co.
3. Modern Metal Products by Muckle.

2.02 Fire Extinguishers

A. General: Provide fire extinguishers for locations indicated in manufacturer's standard bright red or other finish, which comply with requirements of governing authorities.

1. Fill and service extinguishers to comply with requirements of governing authorities and manufacturer.

2. Abbreviations indicated below identify extinguisher types related to UL classification and rating system and not necessarily to type and amount of extinguishing material contained in extinguisher. Contact Engineer or Project Site's local County Fire Coordinator for additional information on UL Classification.

B. Multi-purpose Dry Chemical Type: 10 lb. nominal capacity, filled with non-toxic mono ammonium phosphate powder which smothers fires and helps prevent reflash. Provide heavy duty steel cylinder finished in manufacturer's standard bright red. Provide visual pressure gauge. Provide tags with wires on each extinguisher indicating date of last service and name of servicing firm. Provide only new extinguishers which have been filled and inspected.

2.03 Mounting Brackets

A. Provide brackets designed to mount extinguisher to walls and to prevent accidental dislodgment of extinguisher, of sizes required for type and capacity of extinguisher indicated, in plated finish.

1. Provide brackets for extinguishers not located in cabinets.

PART 3 - EXECUTION

3.01 Installation

A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities. Contact local County Fire Coordinator for local recommended mounting heights.

1. Securely fasten mounting brackets and fire extinguishers to structure, square and plumb, to comply with manufacturer's instructions.

2. Coordinate this work with the work of other trades.

-- END OF SECTION 10522 --

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.01 Scope

A. This section subject to applicable requirements of the Contract Documents.

B. Work includes all Toilet Room Accessories required by the Contract, and, in general, includes the following items:

1. Paper towel dispenser.
2. Toilet tissue dispenser.
3. Mirrors.
4. Grab bars.
5. Waste receptacle.
6. Submittals.

1.02 Quality Assurance

A. The manufacturers and model numbers included are listed as a standard of quality. Equivalent items approved by Engineer, of other manufacturers, are acceptable.

B. CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM ENGINEER OF TOILET ROOM ACCESSORIES BEFORE ORDERING SAME.

1.03 Submittals

A. Shop drawings or manufacturer's catalog and data sheets, including installation requirements for each accessory item specified.

B. Operating and maintenance instructions and keys as required for each type of accessory.

1.04 Product Handling

A. Deliver items in manufacturer's original unopened protective packages.

B. Store in protected area in original packages to prevent damage.

1. Damaged or defaced items shall be removed from the project immediately.

C. Handle with care to prevent damage to finished surfaces.

D. Protective covers shall be maintained on all units until installation is complete. Remove at final clean-up.

PART 2 - PRODUCTS

2.01 Acceptable Manufacturers

A. Toilet room accessories shall be the best quality products of the following manufacturers:

Bobrick Washroom Equipment Inc.

American Specialties, Inc
McKinney/Parker
A&J Washroom Accessories
Bradley Corp.

2.02 Materials

A. Stainless steel, Type 302 or 304, conforming to ASTM A 167, finish No. 4 on exposed surfaces, 22 gauge minimum unless otherwise indicated.

B. Sheet steel, cold rolled, ASTM A 366, commercial quality, 20 gauge minimum unless otherwise indicated.

1. Chromium plating, ASTM B 456, Type SC 2.

C. Chromium plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

D. Mirror glass: FS DD-G-451, Type I, Class 1, Quality q2, 1/4" thick, with silver coating, copper protective coating, and non-metallic paint coating complying with FS DD-M-411.

E. Galvanized steel mounting devices: ASTM A 153, hot dipped galvanized after fabrication.

F. Fasteners: screws, bolts, and other devices of same material as accessory or of galvanized steel where concealed.

2.03 Toilet Room Accessories

A. The manufacturer and model of the toilet room accessories listed herein is intended to establish a standard of material and quality. Equal accessories of the other listed acceptable manufactures may be approved by Engineer.

B. Paper towel dispenser:

1. Surface mounted, 4" deep, hinged front.
2. Capacity, 400 C-fold or 525 multifold paper towels.
3. Stainless steel, minimum 22 gauge, satin finish.
4. Provide lock with keys.
5. Model No. B-262 of Bobrick.

C. Waste receptacle, floor type:

1. Capacity: 2-3 gallon.
2. Stainless steel, satin finish.

D. Toilet tissue dispenser:

1. Capacity: One roll.
2. Cast aluminum, satin finish.
3. Roller: Molded plastic, concealed locking device, controlled delivery.
4. Model No. B-273 of Bobrick.

5. Provide one at each water closet.

E. Mirrors:

1. Surface mounted with H or rectangular hanger and concealed theft proof fasteners.
2. Frame: Stainless steel angle, minimum 20 gauge, corners mitered, welded, ground and satin finish.
3. Glass: 1/4" thick No. 1 quality polished plate, electrolytically copper plated, protected by filler strips and shock absorbing padding.
4. Back: Galvanized steel sheet, attached to frame with concealed fasteners, protected by 1/8" thick, waterproof, shock absorbing padding.
5. Wall hangers: Concealed, securing mirror in place with two thief proof locking screws.
6. Model No. B-290 Series of Bobrick.

F. Grab bars:

1. Stainless steel, minimum 1-1/4" outside diameter, minimum wall thickness 18 gauge (.050"), satin finish.
2. Flanges: 3" diameter, 1/2" deep, 11 gauge stainless steel locked to concealed mounting plate with not less than 3 stainless steel vandal proof set screws.
3. Mounting plate: 13 gauge stainless steel, with not less than 3 holes for anchoring.
4. Ends of grab bar shall pass through flanges, swaged and welded to flanges.
5. Model B-5507 Series of Bobrick, of lengths and configuration indicated.

2.04 Fabrications

A. Corners shall be welded and finished to match surface finish, no open miters, exposed edges hemmed or rounded, no sharp edges.

B. Recessed units shall be fabricated with seamless one piece flanges on exposed face.

C. Provide mounting plates, anchors and fasteners for each accessory as required for proper installation.

PART 3 - EXECUTION

3.01 Inspection

A. Check areas to receive surface mounted units for conditions that would adversely affect quality of installation.

B. Check openings to receive recessed units for proper location and dimensions, plumb and level of blocking and frames, and conditions that would adversely affect quality of installation.

C. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.

D. Starting of installation constitutes acceptance of surfaces and openings.

3.02 Installation

A. Accessories shall be installed plumb and level, secured rigidly in place with proper fastening devices.

1. Lock accessories securely to concealed mounting plates where applicable.
2. Anchors and fasteners shall be of type and size capable of developing retaining strength commensurate with strength of accessory to be mounted.
3. Exposed fasteners, where permitted shall be oval head, finished to match accessories, of tamper-proof design.

3.03 Adjust and Clean

A. Adjust accessories for proper operation.

B. Clean all exposed surfaces of accessories after completion of installation.

C. Deliver keys and instructions to Owner.

-- END OF SECTION 10800 --

SECTION 11001

GENERAL PROVISIONS - EQUIPMENT

PART 1 - GENERAL

1.01 Description

A. Provisions. Requirements specified in Division 1, form a part of this Section.

B. Work Included in this Section. The Contractor shall provide all the required labor, project equipment and materials tools, construction equipment, safety equipment, transportation, and test equipment (unless otherwise specified) for furnishing, installation, adjustment, and full test loading of all the mechanical work shown on the Drawings and included in these Specifications.

1.02 Quality Assurance

A. Incorporated Documents. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to these Specifications. In every situation, the latest specifications, standards, tests, etc., shall apply unless otherwise noted.

B. Variances. In instances where two codes are at variance, the restrictive requirements shall apply.

C. Contractor's Expense. The Contractor shall obtain and pay for the required bonds, insurance, licenses, permits, and inspections (unless otherwise specified), and pay all taxes, fees, and utility charges that shall be required for the construction work.

D. Extra Work. Work that is not included in the Contract Documents shall not be performed, except when approved in writing by the Owner.

E. Standard of Quality. Items of equipment are specified herein by the name of a manufacturer for the purpose of establishing a standard of quality and acceptable experience. Alternate equipment will be given consideration, per Section 01630.

F. Data. Unless otherwise specified, all equipment furnished shall have a data plate fabricated of 316 stainless steel with a minimum thickness of 1/16 inch and embossed preprinted lettering, and fastened to the frame with corrosion-resisting pins. Nameplates shall have stamped on them the manufacturer, serial number, model number, type, operating and performance data, and other pertinent data. Letters and numerals shall not be smaller than 3/16 inch high.

G. Taggings. When the size of the equipment prevents the fastening of data plates, name tags shall be provided and attached to the equipment and device item to identify it. The name tags shall have a rectangular configuration with square corners and shall be approximately 1-1/2 inches by 3 inches in size. They shall be made from brass or stainless steel sheet metal and have minimum thickness of 0.032 inches. Letters and numerals shall be engraved or etched in the name tags by a professional engraver and shall not be smaller than 3/16-inch in size. The name and number for each item of equipment, as designated on the Drawings, shall appear on the name tag for the item. A 3/16-inch diameter hole shall be provided in the upper left-hand corner of each name tag and shall be used to attach the name tags to the equipment and define items with 1/8-inch stainless steel cable.

1.03 Drawings

A. Project Drawing. The Mechanical Drawings are diagrammatic and show the general layout of the complete construction work.

1. Locations of equipment, inserts, anchors, motors, panels, conduits, stub-ups, fittings, fixtures, air, water, power and process inlets, unless specifically dimensioned on the Drawings, shall be determined to suit field conditions encountered, and the Contractor shall be responsible for ensuring clearance between pipes, equipment, and similar appurtenances, without extra cost to the Owner.

2. The Contractor shall review the Drawings and Specifications of other trades and shall include the mechanical work shown thereon that will be required for the installations.

3. Should there be a need to deviate from the Mechanical Drawings and Specifications, the Contractor shall submit written details and reasons for all changes to the Consultant for approval before making such changes. All extra costs to make the changes will be borne by the Contractor.

B. Shop Drawings

1. Prior to fabrication, the Contractor shall obtain, from the manufacturer, shop drawings for all equipment. Shop drawings shall include fabrication, assembly, unit support drawings, installation drawings, and wiring diagrams together with detailed specifications and data covering materials used, power drive assembly, parts, devices, and other accessories forming a part of the equipment to be furnished.

2. The Contractor shall submit Certified performance or Certified test curves, as specified for all equipment furnished under this Contract. The Contractor shall notify the Engineer three weeks prior to all testing should the Engineer elect to witness the test.

3. Submit shop drawings and material lists for approval as specified in applicable Sections and in conformance with the requirements of Division 1, Section 01300.

C. Coordination Drawings

1. The General Contractor will be required to submit mechanical coordination drawings prior to commencement of any equipment or piping installation and shall include all costs associated with coordination of such drawings. Coordination drawings to consider all piping, heating and ventilating duct work, lighting, fixtures, structural components, equipment, and other such items. Refer to Section 01300. Underground piping or piping outside the treatment plant may be submitted separately.

1.04 Adaptation of Equipment

Should any alternate equipment selected require any revision to the structure, piping, electrical, or other work shown on the Drawings, the Contractor shall include the cost of such revisions in his bid for the equipment and no extra payment shall be made for such revision. All such revisions shall be subject to the approval of the Consultant.

1.05 Utility Service and Process Interruption

All utility service and/or process interruptions initiated by the Contractor in the prosecution of his work shall be scheduled in advance and approved by the appropriate Utility Company and the Owner. Refer also to requirements of Section 01300 and information provided in Section 01040.

1.06 Operation and Maintenance Manuals

The Contractor shall submit to the Consultant operation and maintenance manuals on all mechanical equipment in accordance with the requirements of Division 1. Manuals shall be submitted for approval no later than the date of shipment of the equipment. Two final conformed copies shall be available to Owner's personnel at least two weeks prior to start-up and training instruction for each piece of equipment. Refer to Section 01300.

1.07 Installation Manuals

In addition to operation and maintenance manuals, the Contractor shall submit to the Engineer three installation manuals for each piece of equipment. This manual shall be submitted at the same time as the operation and maintenance manual. Installation of equipment shall not be performed until installation manuals are received. Refer to Section 01300.

1.08 Equipment Guarantee

The Contractor shall furnish and replace, without cost to Owner, all equipment parts that are defective or show undue wear within one (1) year from the date of acceptance of the work by the Owner unless extended periods of warranty for specific pieces of equipment are specified elsewhere. In addition to performance guarantees, all processes or systems shall comply with the requirements of applicable portions of the Sections of these Specifications describing those systems.

PART 2 - PRODUCTS

2.01 Materials and Workmanship

All equipment furnished under this Division shall be new and guaranteed free from defects in material, design, and workmanship. These Specifications, to the extent possible, identify service conditions and requirements for all equipment; however, it shall be the manufacturer's responsibility to ascertain, to his satisfaction, the conditions and service under which the equipment will operate and to warrant that operation under those conditions will be successful. All parts of the equipment shall be amply proportioned for all stresses that may occur during fabrications, erection, and intermittent or continuous operation.

All equipment shall be designed, fabricated, and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests. Materials shall be suitable for service conditions.

Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment, shall have a minimum nominal thickness of 1/4 inch. The location of the fabricator and his shop schedule shall be

furnished to the Consultant prior to the beginning of fabrication so that the Consultant can schedule shop inspection if so desired.

2.02 Safety Guards

All belt or chain drives, fan blades, couplings, exposed shafts and other moving or rotating parts shall be covered on all sides by safety guards which shall be free of all sharp edges and corners. Safety guards shall conform to the requirements of appropriate safety agencies, such as OSHA.

Safety guards shall be fabricated from 16 US Standard gauge, or heavier, galvanized or aluminum-clad sheet steel or 1/2-inch mesh, galvanized expanded metal. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be hot-dip galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

2.03 Equipment Bases and Bedplates

A heavy cast-iron or welded steel base shall be provided for each item of equipment which is to be installed on a concrete foundation. Equipment assemblies, unless otherwise specified, or shown on the Drawings, shall be mounted on a single, heavy, cast-iron or welded-steel bedplate. Bases and bedplates shall be provided with machined support pads, tapered dowels for alignment of mating, or adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. All seams and contact edges between steel plates and shapes shall be continuously welded and ground smooth. The plates shall have a minimum thickness of 1/4 inch. All pump bedplates must include a drip lip and provision for directing accumulated gland leakage to a single disposal drain point.

2.04 Jacking Screws and Anchor Bolts

Equipment suppliers shall furnish anchor bolts, nuts, washers, and sleeves of adequate design as required for proper anchorage of the bases and bedplates to the concrete bases. Sleeves shall be a minimum of 1-1/2 times the diameter of the anchor belts. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1 inch of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Anchor belts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Anchor bolts shall be 316 stainless steel which conforms to ASTM A-167 and ASTM A-267.

2.05 Drives

A. General. All drive units shall have an AGMA rating and service factor suitable for 24 hours per day operation under the specified maximum, or "worst case" scenario operating load. Drive unit housings shall be constructed of high-grade cast iron, welded steel, or other suitable material. Thermal rating of each unit shall exceed the design load or proper cooling devices shall be provided. All drives shall be designed especially for the service for which they are to operate.

B. Electric Motors. All electrical motors supplied under this Contract shall conform to all requirements specified in Division 16. Additional or superseding requisites for certain motors may be found in various Sections of Division 11, and to a lesser extent, in other Divisions wherein electric motor driven equipment is specified. The Contractor must coordinate the work of all trades, and the functional, safety and Code requirements for each installation, in order to comply with these Specifications.

C. V-Belt Drives. Where motors are mounted above the driven machine on a pedestal, the belt tensioning shall be accomplished by four studs which are double nutted to the motor plate to raise and lower the motor plate. Hinges with a jacking screw to tension the belts shall not be used. Where motors are mounted horizontally adjacent to the driven equipment, belt tensioning shall be accomplished by utilization of sliding rail type motor mount, with manual adjustment of motor location, and thereby, belt tension, through a manual, permanently mounted hand crank mechanism. All V-belt tensioning devices shall be such that under no circumstances will it be possible for any device, once set to the desired adjustment, to go out of the adjustment due to the load being imposed upon the drive at that setting. This requirement shall not be construed to mean that a set belt tension may not go out of adjustment due to gradual stretching of belts, but shall mean that no portion of any device or devices used to accomplish belt tensioning may slip, become loose, or otherwise move from the desired setpoint, once selected, except when manually reset by operating personnel by use of the adjustment device or devices.

2.06 Lubrication

Lubrication of equipment shall ensure constant presence of lubricant on all wearing surfaces. Lubricant fill and drain openings shall be readily accessible. Easy means for checking the lubricant level shall be provided. Prior to testing and/or operation, the equipment shall receive the prescribed amount and type of lubricant as required by the equipment manufacturer. **The Contractor shall provide to the Owner a 1-year supply of lubricants for each piece of equipment installed. All lubricants shall be properly packaged, labelled, and delivered to the Owner concurrent with equipment installation. An inventory listing of lubricant types by equipment and quantities shall be provided.**

2.07 Gears

Provide oil-lubricated totally-enclosed gear reducers and increasers.

A. Service Ratings. Each gear shall have a nameplate service horsepower rating equal to the nameplate rating of the driving motor. Each gear shall have mechanical and thermal capacity equal to or greater than an equivalent horsepower determined by multiplying the service horsepower rating by the specified service factor recommended by AGMA for heavy duty service, except each set of worm gears shall have a minimum service factor of 1.20 and all other gears shall have a minimum service factor of 1.50.

B. Thermal Rating. Obtain thermal rating for equivalent horsepower without auxiliary cooling equipment such as heat exchangers. Design units to operate continuously for the conditions specified in a location where ambient temperatures vary from 40 to 130 F (4.4 C to 54.5 C). If a cooling coil is required, provide minimum 1 in. diameter tubing and a 1 in. solenoid supply water valve with the gear.

C. Bearings. Provide antifriction bearings throughout, designed to give a minimum 20,000 hours B10 life for the specified horsepower in continuous operation, of proportions, mountings, and adjustment consistent with acceptable modern practices for applied radial and thrust loads at speeds involved. Provide thrust bearing rates at 1-1/2 times the maximum thrust loadings involved.

D. Gear Nameplates. Equip each gear with an AGMA nameplate which shows service horsepower, actual service factor for actual thermal rating as applicable, and AGMA gear Class I rating.

PART 3 - EXECUTION

3.01 Coordination

A. The Drawings show, in a diagrammatic form, the arrangements desired for the principal apparatus, piping, and similar appurtenances, and shall be followed as closely as possible. Proper judgement must be exercised in carrying out the work to secure the best possible headroom and space conditions throughout, to secure neat arrangement of piping, valves, fixtures, hangers, and similar appurtenances, and to overcome local difficulties and interferences of structural conditions wherever encountered.

B. The Contractor shall take all measurement for his work at the installation sites, verify all subcontractor Drawings prior to required submittal and be responsible for the proper installation, within the available space, of the apparatus specified and shown on the Drawings. The Contractor must secure the approval of the Engineer for all variations and/or substitution before making any changes.

3.02 Protection

A. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry and clean at all times. Pumps, blowers, motors, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weathertight storage facilities such as warehouses. All materials and equipment showing evidence of rust, dirt, contamination, or other surface or subsurface deterioration shall be cleaned and restored to the Engineer's satisfaction prior to installation.

B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted in accordance with the requirements of Section 09900 to the satisfaction of the Engineer.

C. Electrical equipment, controls, and insulation shall be protected against moisture or water damage.

D. The Contractor shall maintain equipment storage facilities in accordance with the provision of Division 1.

E. All equipment shall be stored in the designated storage facilities from delivery until installation.

F. All mechanical equipment, whether in the Contractor's designated storage facility prior to final installation, or whether installed, but not yet placed into service or accepted by the Owner, shall be periodically exercised at intervals, and in accordance with procedures prescribed by each manufacturer, if such a recommendation is included in the manufacturer's installation, operation and maintenance instructions.

3.03 Installation Checks

A. The Contractor shall have an experienced, competent, and authorized representative of the manufacturer or supplier of each major item of equipment visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The Contractor shall have the equipment supplier's representative revisit the job site as often as

necessary until all problems are corrected and the equipment installation and operation is satisfactory to the Engineer.

B. Each equipment supplier's representative shall furnish to the Owner, through the Contractor, a written report certifying that the equipment: (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from all stress imposed by connecting piping or anchor bolts; and, (4) has been operated successfully under full load conditions.

C. Equipment manufacturers shall furnish the services of competent, factory-trained personnel during the warranty period specified to inspect, service, and repair the equipment where required. Service requests shall be answered and acted upon promptly. This requirement shall not include normal maintenance and service of equipment, which will be the responsibility of the Owner.

D. All costs for this work shall be included in the price bid by the Contractor.

3.04 Equipment Installation

All equipment shall be installed in full accordance with the equipment manufacturer's recommendations and good practice. Where specified in other parts of this Division, factory-trained service personnel shall be on-site to supervise the installation. Sufficient notice shall be given to the Consultant prior to equipment installation in order that the consultant or his representative may be present during installation. In general, the following installation practices shall be followed:

A. Examine equipment for damage in shipping and handling. The examination shall include checking for corrosion, poor workmanship, dirt or deleterious substances, and poor fits.

B. Level the base plate or bedplate.

C. Install equipment.

D. Check alignment of couplings.

E. If grout has been used, check alignment and levelness after the grout has set.

F. Check direction of rotation and correct, if necessary, to insure proper operation.

G. Provide drain lines from all equipment gland leakage housings, seal water openings, spent cooling water outlets, and strainers to nearest floor drain or point of disposal. Blowdown valves shall be provided on all strainers whether or not shown on the drawings.

H. Ensure that all submerged or intermittently submerged powered equipment does not have power and control cable splices of any kind inside wells or pits.

3.05 Placing in Operation

Prior to being placed in operation, equipment shall be inspected by the manufacturer's factory-trained personnel. All defects discovered during this inspection shall be corrected prior to initial equipment start-up. Internal coatings applied at the factory shall be removed if required. Lubricant shall be applied in the proper places and levels shall conform to the manufacturer's recommendations. In the presence of the Consultant, full-load operational testing shall be performed and the results of such tests shall be recorded. Unsatisfactory performance shall be corrected and tests shall be repeated until the equipment performance meets the Specifications. The Contractor shall furnish all power, materials, services, test equipment and labor required to successfully complete all full load equipment testing specified. The Contractor shall certify in writing to the Consultant, in triplicate, that all tests were

conducted in accordance with these Specifications and that all components within each system successfully function as required. The Contractor shall notify the Engineer ten (10) calendar days in advance of the time when the equipment will be placed into operation. During the course of initial operation, the Contractor shall instruct Owner's personnel in the proper operation and maintenance of the equipment, as specified herein. Refer to Section 01650.

3.06 Instruction

After the equipment specified in Divisions 11, 13, 15 and 16 have been installed, tested, adjusted, and placed in satisfactory operating condition, services of representatives of each equipment manufacturer shall be provided to instruct the operating personnel in the use and maintenance of the equipment. The instruction period shall be scheduled at a time mutually agreed upon with the Owner. The manufacturer's representatives shall fully instruct the Owner's personnel regarding use and maintenance of the equipment. During this instruction period, it shall be the responsibility of the manufacturer to answer all questions from the Owner's operating personnel. Manufacturer shall also demonstrate lubrication, disassembly, adjusting, routine parts replacement, and other "hands-on" activities related to maintenance of the equipment. Provide a minimum of not less than eight (8) hours for this instruction for each piece of equipment or set of identical pieces of equipment provided unless otherwise specified. More days shall be provided if called for in the individual equipment specification. Each manufacturer shall include the service in the price of his equipment. Training session schedules shall be coordinated with the Owner and Consultant and under no circumstances shall more than two training sessions be scheduled for the same day.

3.07 Special Tools and Accessories

All special tools, special tool lists, equipment, or accessories required for the installation and maintenance of equipment specified in Divisions 11, 13, 15, and 16, as well as three (3) copies each of instruction manuals necessary for the proper use of such tools, equipment, or accessories shall be provided by the equipment manufacturer. Special tools shall be defined as those items manufactured by the equipment supplier specifically for performing maintenance and installation of their respective equipment.

3.08 Shop Painting

A. Except as specifically supplemented or superseded by requirements herein, shop painting shall conform to requirements in Section 09900, "Painting". Electric motors, gears, starters, and other similar self-contained or enclosed components shall be shop primed and finished with a high-grade oil-resistant acrylic enamel. Surfaces which will be inaccessible after assembly shall be painted or otherwise protected before assembly by a method which provides protection for the life of the equipment.

B. Surfaces to be painted at the project site shall be shop painted with one or more coats of a primer which will adequately protect the equipment until finishes are applied at the project site. Primers shall be as specified in Section 09900. All equipment shall be primed with primer compatible with the coating system selected by the Contractor, and if not, the Contractor shall reprime the equipment such that it is compatible and in conformance with Section 09900.

C. Machined and polished metallic surfaces which are not to be painted shall be coated with a rust preventive compound as specified in Section 09900.

3.09 Damaged Products

A. The Contractor shall notify the Engineer in the event that any equipment or material is damaged subsequent to receipt, and prior to acceptance of the installation by the Owner.

B. Repairs to damaged products in lieu of replacement shall not be made without prior approval by the Engineer.

3.10 Pumps

This Article covers general stipulations applicable to the plant pumps. All applicable parts of this Section shall also apply.

A. Shop Testing

1. General: Each major component as specified above shall be subjected to a complete witnessed shop test as specified herein. Certified test reports, in triplicate, shall be submitted to the Engineer. No equipment shall be shipped until receipt of the Engineer's written approval. All costs for the shop tests shall be borne by the Contractor and shall be included in his Bid Price.

2. Pumps: Each assembled unit and drive listed herein shall be shop tested to determine the following characteristics at the maximum speed at which the units are to be operated.

   a. Pressure-Capacity Curve.

   b. Brake Horsepower Curve.

   c. Efficiency Curve.

   d. Balance.

   e. Vibration.

   f. Bearing temperature and alignment.

   g. Percent slip at motor full-load torque.

   h. Load test at 115-percent of motor full-load torque and minimum load speed of 96-percent of motor speed with normal field excitation and determination of the motor current; output speed; and drive excitation.

3. All pump tests shall be performed in accordance with the latest Hydraulic Institute Standards.

4. The Contractor shall notify the Engineer not less than 10 days prior to the date on which the pump manufacturer will conduct the performance tests of the units.

5. In the event any unit does not meet the specified requirements, it shall be modified by the manufacturer to meet the requirements of the Specifications and shall be retested in accordance with the provisions of the Specifications. All costs of retesting shall be borne by the Contractor.

6. Motors shall be tested per requirements of Division 16.

B. Field Testing (All equipment unless modified in equipment section). Following completion of the installation and satisfactory start-up of the equipment, the Contractor shall provide the services of the equipment manufacturer's representative to operate each unit over the entire

specified range. The operation, over the entire specified range, shall be free of vibration, noise, or cavitation.

1. Vibration shall be checked and recorded. The full speed vibration of all pumps shall be equal to or less than the amplitude limits recommended in the Hydraulic Institute Standards and/or the manufacturer's recommendation, whichever is more stringent.

2. Each units performance shall be documented by obtaining concurrent readings showing motor voltage and amperage, pressure head and discharge head. Readings shall be documented for at least three conditions to ascertain the actual performance curve. One test shall be at shutoff conditions. Each power lead to the motor shall be checked for proper current balance.

3. Bearing temperatures shall be determined by a contact type thermometer. A running time of at least two hours shall be maintained at the maximum specified pressure. Bearing temperature shall not exceed the limits recommended in the hydraulic institute standards and/or the manufacturer's recommendation, whichever is more stringent.

4. In the event any equipment fails to meet the above test requirements, it shall be modified and retested in accordance with the requirements of these specifications.

SCHEDULE OF EQUIPMENT TESTING AND MANUFACTURER'S SERVICES

Equipment Item	Specification Section	Performance Affidavit	Field Tests/Instructions	Final Acceptance	Written Instructions
Horizontal-Mount Centrifugal Pumps	11214	Yes	Yes	!	Yes
Mixers (Portable)	11220	Yes	Yes	!	Yes
Mixers (Static)	11225	Yes	Yes	!	Yes
Plate and Frame Filter Press	11360	Yes	Yes	!	Yes
Chemical Feed Systems (Package Units)	11345	Yes	Yes	!	Yes
Extraction Well Pumps	11210	Yes	Yes	!	Yes
Submersible Sump Pumps	11212	Yes	Yes	!	Yes
Air Diaphragm Pumps	11216	Yes	Yes	!	Yes
Oil/Water Separator	13200	Yes	Yes	!	Yes
Inclined Plate Clarifier System	13205	Yes	Yes	!	Yes
Sludge Settling Tank System	13210	Yes	Yes	!	Yes
Pressure Filtration System	13290	Yes	Yes	!	Yes
Carbon Adsorption Pressure Vessel System	13295	Yes	Yes	!	Yes
Compressed Air System	15450	Yes	Yes	!	Yes
Grinder Pumps	11197	Yes	Yes	!	Yes

-- END OF SECTION 11001 --

SECTION 11197

GRINDER PUMPS

1.0 GENERAL

1.01 Summary

The work included in this section consists of furnishing all labor, equipment, tools, materials, and performing all operations required for the construction and installation of the grinder pump located outside the water treatment facility, complete and ready for operation as shown on the drawings and as specified herein. Refer to Figures 1, 2 and 3 of this section.

Provide grinder pumps as specified herein.

A. Work Included in This Section

1. Grinder pumps and associated valving.
2. Fiberglass Basin
3. Electrical Alarm/Disconnect Panel
4. Wiring and Controls

B. Related Work Specified in Other Sections

1. Site work.
2. Piping and appurtenances.
3. Electrical.

1.02 References

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 153(1982, R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B40.1(1985) Gauges-Pressure Indicating Dial Type Elastic Element

ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION (AFBMA)

AFBMA 9(1990) Load Ratings and Fatigue Life for Ball Bearings

AFBMA 11(1990) Load Ratings and Fatigue Life for Roller Bearings

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1(1988; Rev 1 & 2) Industrial Controls and Systems

NEMA MG 1(1987; Rev 1) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70(1990) National Electrical Code

1.03 System Description

The sump shall be factory built and shall consist of a grinder pump suitably mounted in a fiberglass basin, pump removal system, shut-off valve, anti-siphon valve, and check valve assembled within the basin, remote electrical alarm/disconnect panel, and all necessary wiring and controls. The pumps shall be semi-positive displacement type grinder pumps.

1.04 Submittals

Provide the following in conformance with applicable items contained in Division 1 and Section 11001.

A. Pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency, and pumping horsepower from 0 to 110 percent of design capacity. A complete list of equipment and material, including manufacturer's descriptive data and technical literature, catalog cuts, and installation instructions.

B. Certified shop drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, including installation of the sump within a concrete manhole, and equipment relationship to other parts of the work including clearances for maintenance and operation.

C. Diagrams and instructions sheets for posting.

D. Certificates of compliance.

E. Certified test reports: Each grinder pump core shall be submerged and operated for 5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharging piping, level sensors, each unit's dedicated controls, respective alarm/disconnect panel, etc. All factory tests shall incorporate each of the above listed items. Actual appurtenances and motor controls which will be installed in the field, shall be particular to the tested pump only. Certified test results shall be supplied showing the operation of each grinder pump at three (3) different points on its curve, with the maximum pressure not less than 60 psi.

F. Operation and maintenance manuals in accordance with Section 01730 Operations and Maintenance Data.

1.05 Delivery And Storage

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity, and excessive temperature variation; and dirt, dust, or other contaminants.

1.06 Project/Site Conditions

The sump will be installed under the concrete floor of the sludge building.

1.07 Warranty

The grinder pump station, including alarm/disconnect panel, shall be warranted from any defect in material and/or factory workmanship for a period of twenty-four (24) months from date of installation or

twenty-seven (27) months from date of shipment, whichever occurs first, providing the product is installed, serviced, and operated under normal conditions according to the manufacturer's instructions.

2.0 PRODUCTS

2.01 General Material And Equipment Requirements

A. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

B. Equipment shall be supported by a service organization that is convenient to the site.

C. Anchors bolts, nuts, and washers shall be steel, galvanized in accordance with ASTM A 153.

D. Standard pressure gauges shall be provided on the discharge piping of the pumps. Gauges shall comply with ASME B40.1. Gauge ranges shall be as appropriate for the particular installation.

2.02 Grinder Pumps

The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with mechanical seal. The rotor shall be through-hardended, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. The material shall be suited for domestic wastewater service.

A. Pump Characteristics

The grinder shall have the following operating characteristics:

1. Design Operating Point: 11 gpm flow at 40 psig.
2. Minimum Operating Point: 9 gpm flow at 60 psig of head.
3. Maximum Operating Point: 15 gpm at _____ psig.
4. The pump(s) must also be able to operate at negative heads without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create an apparent head.

2.03 Grinder

The grinder shall be placed immediately below the pumping element and shall be direct-driven by a single, one-piece motor shaft.

The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects", such as paper, wood, plastic, glass, rubber and the like, to fine particles which will pass freely through the passages of the pump and the 1-1/4" diameter discharge piping.

2.04 Electric Motor

The motor shall be a 1 HP, 1725 RPM, 460 Volt, 60 Hertz, 3 Phase, capacitor start, ball bearing, squirrel cage induction type with a low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application.

2.05 Mechanical Seal

The core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump.

2.06 Tank

The tank shall be custom molded of fiberglass reinforced polyester resin and shall be furnished with one PVC factory installed closet inlet flange to accept one 4-inch, one 6-inch, and one 8-inch nominal ductile iron drains as shown on the drawings. Tank capacities and dimensions shall be as shown on the contract drawings. The access way shall be an integral extension of the FRP tank and shall be custom molded of fiberglass reinforced polyester resin and have a minimum burial depth as shown on the contract drawings. It shall have an access opening at the top to accept a lockable fiberglass cover with skirt.

All discharge piping shall be constructed of ductile iron and terminate outside the access way bulkhead with a 2-inch mechanical fitting. The discharge piping shall include a stainless steel ball valve rated for 200 psi WOG. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

The access way shall also include a 2 inch PVC vent to prevent sewage gases from entering access way.

2.07 Core Unit

The grinder pump stations shall have a cartridge type easily removable core assembly containing pump, motor, grinder, controls, check valve, anti-siphon valve and wiring. The watertight integrity of the core unit, including wiring and access cover, shall be established by 100% factory test at a minimum of 5 psig.

2.08 Check Valve

The pump discharge shall be equipped with factory installed, gravity operated, flapper-type integral check valve built into the discharge pipe. Working parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer. A non-metallic hinge shall be an integral part of the flapper assembly. The valve body shall be a high gloss injection molded part made of PVC type I-II.

2.09 Anti-Siphon Valve

The pump shall be constructed in a positively-primed flooded suction configuration. As added assurance that the pump cannot lose prime, even under negative pressure conditions in the discharge piping system, the pump shall be equipped with a factory installed, integral anti-siphoning air relief valve, in the discharge piping immediately below the check valve. This valve will automatically open when the pump is off.

2.10 Redundant Check Valve

Each grinder pump station shall include in its package one separate check valve for installation in the service lateral between the grinder pump station and the sewer main. The valve shall be a gravity-operated, flapper-type check valve. Working parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimension stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly. The valve body shall be a high gloss injection molded part made of PVC type I-II.

2.11 Controls

Necessary controls for controlling pump operation shall be located in the top housing of the core unit inside a waterproof access cover. The cover will be attached with stainless steel, tamperproof fasteners.

The grinder pump core will be furnished with two twenty foot (20') lengths of type UF cable, pre-wired and water tight. The power supply cable shall be 12-2 with ground, designed for single phase, 240 Volt, 60 Hertz power supply and meet UL requirements. The signal cable to a high level alarm device shall be 14-2 with ground, designed for a single phase, 120 Volt, 60 Hertz power supply and meet UL requirements.

2.12 Alarm/Disconnect Panel

Each grinder pump station shall include a NEMA 3R, UL listed Simplex ALARM/DISCONNECT PANEL suitable for wall or pole mounting. The NEMA 3R enclosure shall be manufactured of thermoplastic or fiberglass to assure corrosion resistance. The enclosure shall include a hinged, pad lockable cover, secured dead font and component knockouts. The enclosure shall not exceed 7.5"W x 8.75"H x 3.75"D. The panel shall be Model MOD 250. Refer to Figures 4 and 5 of this specification.

For each core, the panel shall contain one (1) - 15 amp, double pole circuit breaker for the power circuit and one (1) - 15 amp single pole circuit breaker for the alarm circuit. The panel shall contain terminal blocks, integral power bus, and a complete alarm circuit.

The Alarm/Disconnect Panel shall include an audio-visual alarm device with alarm sequence as follows:

1. When liquid level in sewage wet-well rises above alarm level, visual and audio alarms will be activated.
2. Audio alarm may be silenced by means of the externally mounted, push-to-silence button.
3. Visual alarm remains illuminated until sewage in wet-well runs to normal operating level.

The visual alarm shall be a red fluted lens of least 2 5/8" in diameter and 1 11/16" in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain rain proof integrity. For duplex units, in addition to the above, two high level indicator lights shall be mounted behind the access cover. During a high level alarm condition, the appropriate light will illuminate to indicate which pump core requires servicing.

The audio alarm shall be a printed circuit board in conjunction with an 86 dB buzzer with quick mounting terminal strip mounted in the interior of the enclosure. The entire alarm configuration, mounted on the printed circuit board, shall not exceed 3" W x #" L x 1" D. The audio alarm shall be capable of being de-activated by depressing a push-type silence which is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.

The entire Alarm/disconnect Panel as manufactured, shall be listed by Underwriters Laboratories, Inc.

2.13 Serviceability

The grinder pump core unit shall have two lifting eyes complete with nylon lift-out harness connected to its top housing to facilitate easy core removal when necessary. All mechanical and electrical connections must provide easy disconnect accessibility for core unit removal and installation.

All maintenance tasks for the grinder pump station must be possible without entry of the grinder pump station.

2.14 Corrosion Protection

All materials exposed to wastewater shall have inherent corrosion protection: i.e. cast iron, fiberglass, stainless steel.

2.15 Safety

The grinder pump station shall be free from electrical and fire hazards as required in a residential environment. As evidenced of compliance with this requirement, the completely assembled and wired grinder pump station in its tank shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use.

2.16 Manufacturer

The grinder pump station Model 2010-93 as manufactured by Environment One Corporation of Schenectady, New York; or approved equal.

3.0 EXECUTION

3.01 Equipment Installation

A. Pump Installation

Pumping equipment and appurtenances shall be installed in a concrete manhole with fame and cover as shown on the attached sketch and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating pumping system shall be provided, including such items as piping, conduit, valves, wall sleeves, wall pipes, anchors, grouting, pumps, drivers, power supply, and controls.

B. Bedding and Tank Installation

A 6" diameter (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under the manhole. The unit shall be leveled, and filled with water, to the bottom of the inlets, to help prevent the unit from shifting while backfilling. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8" sleeve is required over the inlet prior to the concrete being poured.

3.02 Field Testing And Adjusting Equipment

A. Operational Test

Prior to acceptance, an operational test of all pumps, drivers, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption.

B. Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

3.03 Manufacturer's Services

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.04 POSTING FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

–END OF SECTION 11197–

SECTION 11210

EXTRACTION WELL PUMPS

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. Furnishing and installing four (4) extraction well pumps.
2. Testing of Equipment.

B. Related Sections

1. Section 13415, Instrumentation and Controls
2. Division 15, Mechanical
3. Division 16, Electrical

1.02 References

1. American Society for Testing and Materials
2. National Electric Code
3. Standards of National Electric Manufacturers Association
4. Institute of Electrical and Electronics Engineer
5. American National Standards Institute

1.03 System Description

A. Design Requirements - MANUFACTURER shall furnish four (4) extraction well pumps. The pumps will withdraw groundwater for delivery to the treatment system. The submersible pumps will be Redi Flo Environmental Pumps as manufactured by Grundfos Pumps Corp. or pre-approved equal.

B. Performance Requirements

1. Pump design flow rate: 5 gpm
2. Well depth: 50 feet
3. Well casing diameter: 6 inches
4. System head: As specified on drawings.
5. Operation: Controlled by level switch.

1.04 Submittals

The following is a list of submittals required for review by ENGINEER. Each submittal shall be reviewed, dated and stamped or signed by the MANUFACTURER and shall be conveyed with a transmittal cover sheet. Equipment and materials will not be admitted to the job site until after approval of all submittals by ENGINEER. MANUFACTURER shall provide six (6) copies of all submittals to ENGINEER in accordance with Section 01300.

A. Catalog bulletins describing pump construction that include, but not limited to, manuals of construction and motor data (minimum guaranteed efficiency and power factor (full load, 3/4 load, 1/2 load); current in amps; speed in RPM; etc.

B. Dimensional drawing of pump unit with motor.

C. Weight of total pump unit.

D. Capacity curves for pump.

E. Instructions for installation, routine operation, adjustment and repair, lubrication, assembly and disassembly.

F. Spare parts lists.

G. List of contacts for technical assistance.

H. Certification of construction material chemical resistivity.

I. Operation and Maintainable Manuals.

1.05 Quality Assurance

All pumping equipment furnished under this Section shall (1) be of a design and MANUFACTURER that has been used in similar applications and (2) be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by those MANUFACTURERs specifically named herein. Pumps shall not be delivered until approved.

A. Prior to shipment, the extraction well pumps shall be tested at the factory to demonstrate that they will function satisfactorily under all conditions specified.

B. The MANUFACTURER shall submit to ENGINEER a written report on the scope and results of factory testing, including any remedial actions.

C. Pumps shall not be shipped until the ENGINEER has approved the test reports.

1.06 Delivery, Storage and Handling

A. All equipment shall be handled and stored in accordance with manufacturer's instructions. Equipment shall be protected from weather, moisture, and other conditions which could cause damage.

B. Furnish and deliver the spare parts recommended in the Manufacturer's Operation and Maintenance Manual carefully boxed or packaged and plainly marked for reordering.

C. CONTRACTOR shall store and safeguard spare parts until completion of the Work at which time they will be inventoried, delivered and placed in an area designated by OWNER.

D. MANUFACTURER shall furnish a list of additional recommended spare parts for an operating period of one year. The list shall describe each part, the quantity recommended, and the unit price of the part. OWNER will purchase all, some, or none of the recommended spare parts at his option.

1.07 Project/Site Conditions

Location: Outdoors
Use: Extraction of contaminated groundwater to treatment system.

1.08 Warranty

A two-year warranty shall be provided beginning from date of equipment commissioning.

1.09 System Start-Up

A. After CONTRACTOR and ENGINEER have mutually agreed that the equipment installation is complete and ready for continuous operation, CONTRACTOR shall conduct a running test of the pump and controls in the presence of ENGINEER to demonstrate that the pump will function correctly.

1.10 Owner's Operations and Maintenance Data

A. Furnish operations and maintenance instructions approved in accordance with Section 01730 Operations and Maintenance Data.

PART 2 - PRODUCTS

2.01 Manufacturer

A. System shall be a Redi Flo Environmental Pump as manufactured by Grundfos Pumps Corp., Model No. 5E5.

2.02 Materials

Chassis: 304 Stainless Steel
Impeller: 304 Stainless Steel
Couplings: 329/420/431 Stainless Steel
Bearings: Teflon
Pump Tubing: 304 Stainless Steel

2.03 Equipment

A. The pump and motor shall be designed for continuous submerged service. The pump design shall include a built-in integral check valve. Each impeller shall have a Teflon seal ring around its eye to reduce hydraulic loss. A filter screen shall be provided as part of the suction inlet assembly. A priming inducer shall be included to provide lubricating flow and to prime the pump should the fluid pumping level fall below the first impeller.

B. Motor: The pump shall have squirrel cage induction motor (1/3 Hp) designed for submerged operation at 230V, 1 phase, 60 Hz. The pump motor components in contact with the pumped fluids shall be constructed of stainless steel, The motor shall not use any oil or greases for bearing lubrication.

C. The unit shall be fully supplied with continuous motor cable with no splices. The connector boot shall be constructed of viton and the connector of 300 series stainless steel.

PART 3 - EXECUTION

3.01 Installation

A. Installation shall be in complete accordance with manufacturer's instructions and recommendations.

B. Make all electrical connections in conformance with requirements of Division 16, Electrical.

C. Level Set Points - Level set points shall be adjustable. Low level set point shall be set at 4" above the clay layer. High level set point shall be set at 2'-0" above the clay layer.

D. Once installation is complete, touch-up damaged paint with manufacturer supplied paint.

3.02 Field Quality Control

A. MANUFACTURER shall make adjustments required to place system in proper operating condition. MANUFACTURER shall perform operating tests to assure that the equipment operates in accordance with these Specifications and to the satisfaction of the OWNER's project representative.

-- END OF SECTION 11210 --

SECTION 11212

SUBMERSIBLE SUMP PUMP

PART 1 - GENERAL

1.01 Description

Requirements specified in Conditions of the Contract and Division 1 form a part of this Section. Furnish all tools, controls, level floats, equipment, materials, supplies, and manufactured articles and perform all labor necessary for the construction and installation of submersible pumping equipment, ready for standard operation as specified herein and as indicated on the Drawings.

1.02 Submittals

Shop drawings showing fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering performance and materials of construction, power drive assembly, parts, devices, and other accessories forming a part of the equipment furnished shall be submitted. Data and specifications for the equipment shall include, but shall not be limited to the following:

A. Prior to preparation of shop drawings, the CONTRACTOR shall submit the following information for each pump specified under this Section.

1. Pump curves indicating total dynamic head, flow rate, brake horsepower, shutoff head, net positive suction head, and efficiency for entire operating range and for points specified on pump performance curves.

2. Materials of pump construction including shafts, bearings, impellers, castings, pump base, stuffing boxes, and shaft guards.

3. Electric motor data including size, make, type, designation, thermal protection (yes/no), NEMA insulation class, full load amperage, locked rotor amperage, voltage, horsepower, and full speed (rpm).

4. Standard wiring diagrams unless wiring diagrams are specially prepared and submitted with shop drawings.

B. After the above equipment submittals have been approved, complete fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering materials of construction, parts, devices, wiring diagrams, and other accessories forming a part of the equipment furnished, shall be submitted for approval.

1.03 Quality

All pumping equipment furnished under this Section shall be (1) of a design and MANUFACTURER that has been used in similar applications and (2) be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by those MANUFACTURERs specifically named herein. Pumps shall not be delivered until approved.

1.04 Related Sections

A. Division 1 - General Requirements.

B. Section 11001 - General Provisions - Equipment.

PART 2 - PRODUCTS

2.01 General

Pumps and motors shall be rated for continuous duty and shall be capable of pumping the specified flow range without surging, cavitation, or vibration. The pumps shall not overload the motors for any point on the maximum speed pump performance characteristic curve within the limits of stable pump operation as recommended by the MANUFACTURER to prevent surging, cavitation, and vibration, as well as throughout the entire pump operating range. The service factors for the motors shall not be applied when sizing the motors. To insure vibration-free operation, all rotative components of each pumping unit shall be statically and dynamically balanced. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case, the amplitude of vibration as measured at any point on the pumping unit shall not exceed the limits set forth in the latest edition of the Hydraulic Institute Standards. All parts of each pump shall be designed to withstand the stresses that will be imposed upon them during their handling, shipping, erection, and operation. The completed units, when assembled and operating, shall be free of cavitation, vibration, noise, and oil or water leaks over the range of operation. Pump supplier shall be responsible for proper operation of the complete pumping system, which includes pump and motor. The pumps shall be the product of a single MANUFACTURER unless otherwise specified.

2.02 Pump Schedule

The CONTRACTOR shall supply and install the following pumps:

Pump ID/Location	P-130	Grinder Pump
Operating Conditions		
- TDH (ft)	32 WC @ max. flow	10 WC @ max flow
- Flow (gpm)	50 max.	50 max.
PUMP		
- MANUFACTURER	Hydromatic	Flygt Corp.
- Model No.	SPD50 MH 4-2-2"	MP3067-212
- Hp	1/2 Hp	1.6 Hp
- Voltage/Phase	460 V/3 phase	115 V/1 phase
- Discharge Size (in NPT)	2"	2"
- Construction Materials		
casing	Carbon Steel	XX
impeller	Carbon Steel	XX
shaft	Carbon Steel	XX
hardware	Carbon Steel	XX

XX Must be suitable for pumping domestic waste.

2.03 Protective Coatings

A. All non-working interior and exterior surfaces of ferrous materials in the pumping units shall be factory applied. Corrosion resistant coatings for submerged service application.

2.04 Name Plates

A. The pumps shall have a Type 316 stainless steel plate permanently attached to the pump frame into which the following information shall be impressed, engraved, or embossed: MANUFACTURER's name, pump size, serial number, impeller diameter, capacity, head rating and speed. Nameplates shall also include information unique to each item of equipment and device to identify its function as described herein. Function nameplates shall be approximately one-inch by 3 inches if made separately. Letters of function titles shall not be smaller than 1/4-inch high.

2.05 Motors

A. Permanently sealed and rigidly coupled to the pump.

B. Grease-sealed lifetime lubricated bearings.

C. Voltage and horsepower ratings per pump schedule.

2.06 Pressure and Vacuum Gauges

A. Refer to gauge schedule and specifications in Section 13420 "Instrumentation".

2.07 Appurtenances

A. Start and stop float switches activated by change in water level.

PART 3 - EXECUTION

3.01 Installation and Start-Up

A. Install in accordance with MANUFACTURER's written instructions and approved submittals.

B. The CONTRACTOR shall furnish the services of competent factory-trained personnel to supervise the installation and initial operation.

3.02 Equipment Testing

A. Field Testing. Following completion of the installation and satisfactory startup of the equipment, the CONTRACTOR shall in the presence of the pump MANUFACTURER's representative, operate each pumping unit over the entire specified range. The operation, over the entire specified range, shall be free of vibration, noise, or cavitation.

1. Vibration shall be checked and recorded. The vibration of each pump, operating at full speed, shall be equal to or less than the amplitude limits recommended in the Hydraulic Institute Standards.

2. Each pump performance shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump suction head and pump discharge head. Readings shall be documented for at least three pumping conditions to ascertain the actual pumping curve. One test shall be at shutoff head. Each power lead to the motor shall be checked for proper current balance.

3. In the event any of the pumping equipment fails to meet the above test requirements, it shall be modified and retested in accordance with the requirements of these Specifications.

3.03 Manufacturer's Field Service

After the equipment has been installed, tested, adjusted, and placed in satisfactory operating condition, the CONTRACTOR shall provide the services of a representative of the MANUFACTURERs to instruct the operating personnel in the use and maintenance of the equipment. At least one week prior to commencement of the construction period, the CONTRACTOR shall give the Owner formal written notice of the proposed time of instruction. The MANUFACTURER shall provide a level of instruction which is adequate to train the Owner's personnel regarding use of the equipment, but not less than one 8-hour day. During this instruction period, it shall be the responsibility of the MANUFACTURER to answer any questions from the Owner's operating personnel.

-- END OF SECTION 11212 --

SECTION 11214

HORIZONTAL - MOUNT CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.01 Description

The requirements specified in Conditions of the Contract and Division 1 form a part of this Section. This Section outlines the work for groundwater treatment process pumps . The Contractor shall furnish and install five (5) horizontal centrifugal pumps, each direct-coupled to its driver, complete as specified in this Section. All requirements specified in this Section shall be carefully coordinated with the applicable Sections in Division 16 to ensure a complete, fully functional pumping system.

1.02 References

Related Work Specified in Other Sections.

1. Division 1 - General Requirements.
2. Section 11001 - General Provisions - Equipment.
3. 13415 - Sequence of Operation.
4. 13420 - Instrumentation.
5. 15100 - Valves.
6. Division 16 - Electrical.

1.03 System Description

A. Design Requirements

The pumps fall into three categories:

1. Equalization Tank Pumps (P-10, P-11). A duplex system of two pumps in alternating lead-lag configuration draws process groundwater from Tank T-10 and discharges to clarifier CL-20. Design maximum flow of 10 gpm per pump with both pumps in operation.
2. Clarifier Clearwell Pumps (P-20, P-21). A duplex system of two pumps in alternating lead-lag configuration draws process groundwater from Tank T-20 and discharges through the multi-media filtration system (F-30/F-31), through the carbon adsorption system (CA-40 and CA-41) to the treatment system outfall. Design maximum flow of 10 gpm per pump with both pumps in operation.

1.04 Submittals

Submit shop drawings in conformance with Division 1 showing fabrication, assembly, foundation, and installation details and dimensions, together with detailed specifications and data covering performance and materials of construction, power drive assembly, parts, devices, and other accessories in accordance with the requirements of "Shop Drawings" of these Specifications and the supplementary requirements specified herein. Data and specifications for the equipment shall include, but shall not be limited to the following:

A. Certified pump performance curves indicating total dynamic head, flow rate, brake horsepower, shutoff head, net positive suction head and efficiency. Submit curves for the pumps.

B. Motor data, including the manufacturer, the minimum guaranteed efficiency and power factor at full load, 3/4 load, and 1/2 load; locked rotor current in amps; full load current in amps; the motor synchronous and full load speed in rpm; and mounting details.

C. Data certifying conformance to the standards of the Hydraulic Institute, NEMA, AIEE, and the applicable government codes, as well as the requirements for construction service and durability specified herein.

D. Anchor bolt placement measured from contraction joints in the concrete structure, and anchor bolt details including projections from concrete.

E. Materials of pump construction including shafts, bearings, impellers, casings, pump base, stuffing boxes, and shaft guards.

F. Water volume and pressure requirement for stuffing box sealing, if required.

G. Details on grease lubrication system including the proper quantity of grease and the frequency of bearing lubrication.

H. Results of shop and laboratory testing performed under Paragraph 3.02 of this Section.

I. Operation and Maintenance Manuals.

1.05 Manufacturer

Furnish pumps constructed in accordance with these specifications manufactured by the following:

1. Price Pump Co. of Sonoma, CA

   Pumps P-10 and P-11 - Mod. 1M S 50-SS-33, 1/2 HP
   Pumps P-20 and P-21 - Mod. 2M S 50-SS-75, 1 HP

PART 2 - PRODUCTS

2.01 Project Conditions

	P-10/11	P-20/P-21
No. of Pumps	2	2
Liquid Pumped	Post-OWS groundwater	clarified groundwater
pH	6-9	6-9
Suction Condition	1' flooded suction at LWL; approx. 5' flooded suction at HWL	1' flooded suction at LWL; approx. 5' flooded suction at HWL
Suction (in.)	3/4	3/4
Discharge (in.)	1/2	1/2
Nominal Speed (rpm)	3600	3600
Design Flow	10 gpm @ 45' TDH	10 gpm @ 88' TDH
Drive	constant speed	constant speed
Motor Horsepower	1/2	1
Voltage	460 V/3 phase	460 V/3 phase
Pump Materials	316 SS Carbon (Rotary) Viton (Elastomers) Ceramic (Seat)	316 SS Carbon (Rotary) Viton (Elastomers) Ceramic (Seat)

2.02 Materials

A. Pump Construction.

1. Pump Casings. The Contractor shall furnish required reducer/increaser to match sizes of suction and discharge piping as shown on the Drawings. The pump casing shall be provided with vent, and drain connections.

2. Pump Impellers. The impellers shall be dynamically balanced. The impellers shall be keyed and positively held on the shafts to prevent damage if the direction of rotation should become reversed due to water flowing backward through the impeller. The impellers provided shall be sized for the existing head conditions.

3. Removable wearing rings shall be provided on the impellers and suction covers. The impeller wearing ring shall be noryl or AISI #416 stainless steel, heat treated to a Brinnell Hardness of 350-400. The suction cover wear ring shall be noryl or AISI #416 stainless steel, heat treated to a Brinnell Hardness of at least 400.

4. Pump Shafts. The pump shafts shall be AISI 4140 steel, accurately machined and ground over their entire length. Shafts shall be protected from wear in the stuffing box by AISI #416 stainless steel or 13% chrome steel shaft sleeves, heat treated to a Brinnell Hardness of at least 400.

5. Pump Bearings. Pump bearings shall be tapered antifriction type mounted in cast iron bearing frames independent of and above the stuffing box cover. The bearing frame shall include external provision for axial adjustment of the rotation element to allow maintenance of proper clearance between the impeller and suction cover wearing rings over the life of the pump. The bearings shall be able to take normal axial thrust loads due to unbalanced hydraulic loads on the impellers plus the weight of all rotating parts of the pumps.

   a. If the manufacturer offers more than one (1) type, class, rating or style of bearing housing for the proposed pump, dependent upon the load imposed by high vs. low head pumping conditions, the pump shall be furnished with the heaviest duty housing and appurtenances available.

   b. Pump bearings shall be designed with an AFBMA minimum B-10 life of 50,000 hours. The bearings shall be grease lubricated with provision for forcing out old grease and limiting pressure. The grease seals shall be spring loaded using Neoprene ES 16 or equal material.

6. Testing. Three (3) certified copies of test curves shall be furnished for each pump in accordance with Part 1 of this Section. Upon completion of accordance wi the requirements herein, all pumps, motors, and control system shall be full load field tested and shall demonstrate compliance with these Specifications.

7. Pump Supports and Anchor Bolts. Each pump shall be furnished with a suitable support, either cast integrally with the volute or otherwise attached to the pump casing, which shall serve to support each complete pump assembly at the elevation shown on the Drawings. In addition, each pump shall include an appropriate support for its electric motor such that each component will be adequately supported in its installed position without need for additional structural members or modification of the pump station structure.

8. Pump Balance. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that

resonance at normal operating speeds is avoided. In any case, the amplitude of vibration as measured at any point on the pumping unit shall not exceed the limits set forth in the latest edition of the Hydraulic Institute Standards. At any operating speed, the ratio of rotative speed to the critical speed of a unit, or components thereof, shall be less than 0.8 or more than 1.3.

9. Spare Parts and Tools. Each pump shall be furnished with the following spare:

    1 impeller
    1 set of wear plates
    1 set of pump bearings
    1 set of double mechanical seals
    1 shaft sleeve
    1 set of gaskets
    1 oil pressure gun

The above shall be packaged for long term storage and adequately marked.

B. Motor

1. Provide high efficiency, chemical duty, TEFC, NEMA design B with Class F insulation.
2. All single phase motors to have internal overload protection.

PART 3 - EXECUTION

3.01 Installation and Start-up

Provide as an option the services of a factory trained representative of the pump manufacturer to inspect the installation and supervise initial operation of the units. An appropriate allowance for this supervision shall be included by the pump manufacturer in the submittal.

3.02 Equipment Testing

A. Shop Testing.

1. General. Each major component of the pumping equipment shall be subjected to a complete shop test as specified herein, witnessed by the Owner or his agent if so desired. Test reports shall be submitted to the Engineer. All costs for the shop tests shall be borne by the Contractor and shall be included in his bid price.
2. Pumps.
    a. Each assembled pump shall be shop tested by the Contractor to determine the following characteristics for the minimum and maximum speed at which the pumps will be operated:
        1) Head-capacity curve
        2) Brake horsepower curve
        3) Efficiency curve
        4) Balance

All tests shall be performed in accordance with the latest Hydraulic Institute Standards.

3. Induction Motors. Each motor shall be shop tested by the manufacturer in accordance with the requirements of Division 16 of these Specifications.

B. Following completion of the installation and satisfactory start-up of the equipment, the Contractor shall operate the pumps over the entire range. The operation shall be free of vibration, noise, or cavitation. Vibration shall be within the amplitude limits recommended in the Hydraulic Institute Standards.

1. In the event any of the pumps fails to meet the above test requirements, it shall be modified and retested in accordance with the requirements of these Specifications.
2. Each pump performance shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump suction head and pump discharge head.
3. Pumping system field testing shall be witnessed by the Owner or his agent, and shall be accomplished in the following basic sequence so as to ensure accuracy of test data:
    a. Each pump shall be tested individually, under carefully monitored conditions, to assure duplication of all controllable test factors.
    b. Gauges shall be monitored at the pump suction and discharge.

-- END OF SECTION 11214 --

SECTION 11216

AIR DIAPHRAGM PUMPS

PART 1 - GENERAL

1.01 Summary

Work under this section includes furnishing air driven, double-diaphragm, pumps as specified herein, including pumps, bases, anchor bolts, controls and necessary appurtenances. Installation shall be by others.

A. Related Sections:

Section 11001 - General Provisions - Equipment

Section 13420 - Instrumentation

Division 15 - Mechanical

1.02 References

All material and equipment furnished under this specification shall be designed and constructed in accordance with the applicable requirements of the following publication:

A. American National Standards Institute (ANSI)

B. Standards of the Hydraulics Institute

C. Standards of the American Water Works Association

1.03 System Description

A. Design Requirements: The pump units shall be capable of the specified discharge capacity and heads when operating at the section conditions as listed on the Data Sheets. The pumps shall be compressed air driven controlled by an on-off solenoid valve as specified herein.

1.04 Submittals

A. Shop Drawings: Submit for approval the following:

1. Manufacturer's literature, illustrations, specifications and engineering data including: dimensions, materials, size, weight, performance, data, allowable suction lift, flow rate, required air pressure and consumption rate.
2. Shop Drawings showing: Fabrication, assembly, installation and wiring diagrams.
3. Operation and Maintenance Manuals including: complete installation, operation, and maintenance data including copies of all shop drawings.
4. Guarantee.

B. Quality Assurance/Control Submittals

1. Design Data

NOTE: Pump P-90 is specified in Section 11360.

1.05 Quality Assurance

The air driven, diaphragm pumps furnished under this section shall be of a design and manufacturer of Warren Rupp Company (P-22 amd P-110: Warren Rupp Model EB1-MTN-3-I, P-90: Warren Rupp Model EB 2-SS and P-25, P-26: Warren Rupp EB 1/2-ATN-2SS).

	P-25 Lime Recirculation Pump	P-26 Lime Dose to T-90 Pump	P-22 CL-20 Solids Pump to T-90	P-110 S-10 Solids Pump to T-90	P-90 FP-90 Feed Pump
Process Data					
Liquid	Lime Slurry from T-26	Lime Slurry from T-26	Solids from Lamella Clarifier	Solids from Oil/Water Separator	Solids from T-90 to Press
Sludge					
Pump Temperature			50-70°F	50-70°F	50-70°F
pH Range	7-12	7-12	6-9	6-9	7-11
Solids %	0-8%	0-8%	0-3%	0-3%	0-10%
Design Flow	3 gpm	3 gpm	20 gpm	20 gpm	Varies (at 100 psi)
Pump Design					
Strokes per min	Vary	Vary	Vary	Vary	Vary
Valve type	Ball	Ball	Flap	Flap	Flap
Air Consumption at Design Cond.,					
Maximum, cfm	4 @ 70 psi	4 @ 70 psi	10-15 @ 20 psi	5-10 @ 20 psi	40 @ 100 psi
Materials of Construction					
Case	Stainless Steel	Stainless Steel	Cast iron	Cast iron	Cast iron
Diaphragms	Neoprene	Neoprene	Neoprene	Neoprene	Neoprene
Valve	Urethane	Urethane	Urethane	Urethane	Urethane
Valve Seat	Neoprene	Neoprene	Neoprene	Neoprene	Neoprene
Connections					
Pump Suction, inch	1/2"	1/2"	1"	1"	2"
Pump Discharge, inch	1/2"	1/2"	1"	1"	2"
Air Data					
Inlet pressure, normal, psig	*	*	*	*	Varies
Inlet pressure, max., psig	*	*	*	*	100
Accessories					
(to be provided with each pump)					
Pneumatically actuated diaphragm	✓	✓	✓	✓	✓
Pulsation Dampener	✓	✓	✓	✓	✓
Muffler	✓	✓	✓	✓	✓
Inlet air filter - regulator lubricator	✓	✓	✓	✓	✓

* Indicates information provided by the Manufacturer.

1.06 Delivery, Storage, and Handling

A. All equipment shall be handled and stored in accordance with manufacturer's instructions and relevant organization standards. Equipment shall be protected from weather, moisture, and other conditions which could cause damage.

1.07 Warranty

A. A one year warranty will be granted from the date of equipment commissioning.

1.08 System Start-Up

A. Make adjustments required to place system in proper operating condition.

Test the air diaphragm pumps by pumping to a bucket and timing the rate of discharge to confirm the flow rate and self-priming capacity of the pumps.

2.0 PART 2 - PRODUCTS

2.01 Manufacturer

A. Product Manufacturer:

1. Provide pumps as manufactured by:

    a. Warren Rupp, Inc., or approved equal.

B. Pump Materials and Construction:

1. Brass or Stainless Steel Nameplates shall be attached to the pump giving:

    a. Manufacturer's model number.
    b. Manufacturer's serial number.
    c. Rated capacity.
    d. All other pertinent data.

2. Air Exhaust Muffler included to maintain noise level under 85dB.

3. Pumps shall be air powered, self-priming, double-diaphragm pumps, equipped with flap or ball valves as specified. All pumps of the same rating shall be identical.

4. Pumps shall be rated for continuous duty and shall be capable of pumping the specified flow range without surging, cavitation, excessive noise, or vibration and capable of running dry without damage.

5. All parts of each pump shall be designed to withstand the stresses that will be imposed on them during their handling, shipping, installation, and operation. The completed units, when assembled and operating, shall be free of excessive vibration, noise, and oil or pumped fluid leaks over the range of operation.

6. Solenoid valve, installation and connection to control circuitry by others.

2.02 Materials

Materials shall be as specified on the Data Sheets. Where a specific material is not identified, it shall be specified by the Manufacturer.

2.03 Air Filter-Regulator-Lubricants

Inlet air preparation system shall consist of a combination filter-regulator-lubricator compact in design containing no pipe nipples so that the total system or any portion of it can be removed from the pipe leaving all remaining components in place.

2.04 Pump Equipment

A. The air driven pump shall be mounted on a rigid base suitable for bolting to a permanent foundation.

B. The air assembly shall include:

1. Pump side air pressure indicator and isolation cock.
2. All valving and interconnecting air piping shall be of same diameter as part on pump or as otherwise specified.
3. Each pump shall have a free-flowing air exhaust muffler and air exhaust port.

D. After the tests are completed and inspection is made as specified in paragraph 3.02, all exposed machined surfaces and/or other working parts shall be coated thoroughly with a suitable rust preventative. All exterior parts of the unit, except machined surfaces shall be painted after surface preparation according to the Manufacturer's recommendations. All flanged openings shall be provided with substantial wood or metal closures. All threaded openings shall be fitted with solid steel plugs or caps. Plastic plugs are not allowed.

E. Each pump shall have a standard stainless steel nameplate securely affixed in a conspicuous location showing the name and address of the Manufacturer, serial and model number, and such other information as the Manufacturer may consider necessary to complete the identification of the item. The equipment item number shall also be shown.

PART 3 - EXECUTION

3.01 Installation

Pump and inlet air control valve installation shall be by others per Manufacturer's specifications. The Manufacturer shall give all necessary instructions for proper installation of the pumping equipment, including interpretation of the Manufacturer's printed instructions.

3.02 Testing

A. Field Testing - Field testing of the pump and calibration/connection to control circuitry of the control valve assembly shall be conducted by the Manufacturer after completion of installation and start-up of the equipment if requested by Owner. The price for field testing and checkout services shall not be included in the equipment price but shall be included in the Bid Submittal as a per diem rate (including travel).

B. All tests shall be performed in the presence of the Owner. Manufacturer shall submit a written report of the test results to the owner.

3.03 Start-Up and Checkout

The Manufacturer shall provide start-up and checkout services for the air driven diaphragm pumps.

-- END OF SECTION 11216 --

SECTION 11220

MIXERS (PORTABLE)

PART 1 GENERAL

1.01 Description

A. Section includes:

1. Three portable industrial mixer units
2. Furnishing and installation of mixer
3. Testing of equipment

B. Products furnished under this section

1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to provide:
   a. Three portable industrial mixer units
2. Mixers shall be top entering, furnished complete with motors, gears, control equipment and accessories as shown and specified. All equipment shall be furnished by the mixer manufacturer, who shall assume responsibility for proper alignment and operation of the complete mixing unit.

C. Related sections

1. Section 11500 - Process Tanks
2. Division 16 - Electrical
3. Section 11001 - General Provisions - Equipment

1.02 References

Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. American Gear Manufacturers Association
2. Anti-Friction Bearing Manufacturers Association
3. Occupational Safety and Health Act
4. National Electric Code
5. National Electrical Manufacturers Association
6. Institute of Electrical and Electronic Engineers
7. American National Standards Institute
8. Joint Industrial Council

1.03 System Description

1. Gear driven portable industrial mixers shall be top entering, furnished complete with motors, gears, control equipment and accessories as shown and specified.
2. Drawings are for purposes of guidance and to show functional features required. They do not show all components required to accomplish the desired results or all components required to interface equipment. All parts, equipment and devices necessary to meet the functional requirements shall be provided.
3. Drawings are not intended to show exact dimensions peculiar to any specific mixing equipment. The dimensions of the mixer bases, may have to be changed in order to accommodate the equipment furnished.
4. All mixers shall be designed and built for the specified service, without overheating, without excessive vibration or strain, and requiring only that degree of maintenance generally accepted as peculiar to the specific type of mixer required.

1.04 Submittals

A. Shop Drawings:

1. Manufacturer's literature, illustrations, specifications and engineering data for all equipment including:
    a. Dimensions; materials; size; weight; torque; bending moment; critical speed; diameter of shaft; shaft RPM; impeller diameter; pitch of impeller; velocity gradient range; distance from bottom of tank to impeller; and, bearing life calculations.
2. Drawings showing fabrication, assembly, installation and wiring diagrams.
3. Motor Data:
    a. For the motor furnish a certified motor data sheet for the actual motor or for a previously manufactured electrically duplicate motor which was tested. Provide the following minimum data:
        1) Starting torque; efficiency at 1/2, 3/4 and full load; power factor at 1/2, 3/4 and full load; percent slip; running light, full load and locked rotor current; current balance check; vibration check; temperature rises and results of dielectric tests; motor type and frame size; bearing type and lubrication medium; and, insulation and enclosure type.

B. Test Reports

1. Four copies of certified mixer tests.
2. Four copies of certified motor tests,

C. Operation and Maintenance Manuals

1. Submit Operation and Maintenance Data.
2. Data shall include:
    1. Name and address of the factory representative nearest to Project site.
    2. Cross-sectional view of proposed mixer, showing dimensions and installation.

3. Weights of major components.
4. Materials of construction of each major component.
5. Mounting detail.

1.05 Quality Assurance

A. Shop Tests:

1. Each mixer shall be given a complete initial shop test.
2. Each motor shall be given a complete shop test according to NEMA standards prior to shipment from the factory. The test shall include:
   a. No load reading of current and speed at normal voltage and frequency.
   b. Locked rotor current.
   c. Winding resistance measurement.
   d. High potential test.
   e. Vibration test.
   f. Efficiencies and power factors at 100, 75, and 50 percent full load.
3. Each test shall be witnessed by a registered professional engineer, who may be an employee of the manufacturer. If tests indicate that any unit or units do not meet design requirements, they shall be modified and retested until they do, all at the CONTRACTOR'S expense.
4. Mixing unit shall not be shipped until the ENGINEER has approved the test report.

1.06 Delivery, Storage, and Handling

A. Package mixer to protect from shipping and handling damage. Transportation of the mixer to the OWNER'S facility shall be arranged by the CONTRACTOR.

B. Handle mixer with care to avoid impact damage or excessive localized stresses. Do not throw or drop mixer.

C. Inspect shipment with care on arrival. Notify carrier regarding damage or missing items.

D. Do not accept or store on site items damaged in shipping.

1.07 System Description

1. Gear driven portable industrial mixers shall be top entering, furnished complete with motors, gears, control equipment and accessories as shown and specified.
2. Drawings are for purposes of guidance and to show functional features required. They do not show all components required to accomplish the desired results or all components required to interface equipment. All parts, equipment and devices necessary to meet the functional requirements shall be provided.
3. Drawings are not intended to show exact dimensions particular to any specific mixing equipment. The dimensions of the mixer bases, may have to be changed in order to accommodate the equipment furnished.

4. All mixers shall be designed and built for the specified service, without overheating, without excessive vibration or strain, and requiring only that degree of maintenance generally accepted as peculiar to the specific type of mixer required.

PART 2 - PRODUCTS

2.01 Project Conditions

A. Portable Industrial Mixers:

1. Mixers shall be gear driven type as shown on Drawings. They shall be specially designed, constructed and installed for the service intended and shall comply with the following conditions:

Design Conditions

	Mixer M-26	Mixer M-27	Mixer M-28
Location:	Interior	Interior	Interior
Use:	Chemical Mixing	Chemical Mixing	Chemical Mixing
Liquid Mixed:	5-8% Lime Slurry	0-1% Ferric Surface Sol'n	0-1.5% HCl Sol'n
Liquid Temp.:	35-90°F	35-90°F	35-90°F
Tank Size:	66" dia.	66" dia.	66" dia.
Tank Height:	72"	72"	72"
Mounting Platform Elevation Abovegrade:	6.5 ft.	6.5 ft.	6.5 ft.
Tank Bottom Elevation Abovegrade:	0.0 ft.	0.0 ft.	0.0 ft.
Flowrate:	Batch	Batch	Batch
No. Required:	1	1	1
Motor HP:	1 1/2	1/2	1/2
Electrical Requirement:	460 V, 3 phase, 60 Hz	460V, 3 phase, 60 Hz	460 V, 3 phase, 60 Hz
Materials of Construction:			
Wetted Parts:	316 SS	316 SS	316SS coated w/ 0.035" KF polymer
Non-Wetted Parts:	Painted	Painted	Painted
Mixing Impellars:	18" A-310	12.8" A-310	12.8" A-310
Manufacturer/Model:	Lightnin Vektor V5P110	Lightnin Vektor V5P37	Lightnin Vektor V5P37

2. Mixing units shall be designed for continuous 24 hour per day operation.

3. Sound pressure levels of the equipment shall not exceed 85 dB at a point 3 feet from the equipment.

2.02 Materials/Equipment

A. Portable Industrial Mixers:

1. Speed Reducers:

a. Double or triple reduction units, with fully-enclosed spiral bevel and/or helical gears.

b. Lubrication: Oil splash mechanism. Leakage of oil along the output shaft shall be prevented.

c. All gear motors shall have an AGMA Class III gear rating. Gears shall be designed and rated for an AGMA service factor of not less than 1.5.

d. Thermal rating of the speed reducer shall exceed the design mechanical rating to eliminate the need for external coolers.

e. Speed reducer output shaft shall be constructed and supported such that shaft deflections caused by operating loads to not cause misalignment of the bearings or of the gearing. Output shaft shall be equipped with extra heavy tapered roller bearings.

f. All bearings shall be antifriction type, oil lubricated, except for the lower output shaft bearing which may be grease lubricated. All bearings shall have a minimum L-10 life of 100,000 hours.

g. Housing and Baseplate: Case iron or fabricated steel.

h. The output speed of the reducer shall be 350 RPM.

2. Impeller Shaft:

a. Type 316 stainless steel, removable (HCl mixer (M-28) shaft to be welded).

b. Maximum operating speed shall be less than 60 percent of first lateral critical speed. Bottom steady bearings are not acceptable.

c. Total shaft runout shall not exceed 0.25 inches per 10 feet of shaft length.

d. Maximum impeller shaft speed shall not exceed 360 RPM.

e. Impeller shaft shall be connected to the gear reducer output shaft by a rigid flanged coupling welded to the shaft. Coupling shall be designed to transmit any torque and withstand any bending moments which the coupling may be subject to.

f. HCl mixer (M-28) shaft shall be coated with .035" KF polymer.

3. Impellers:

a. Type 316 stainless steel, axial turbine type, keyed to the shaft.

b. Blades shall be pitched at a maximum of 45 degrees from the horizontal, and bolted to the impeller hub.

c. HCl mixer (M-28) impeller shall be coated with 0.035" KF polymer.

4. Motors:

   a. Suitable for continuous operation, of sufficient horse-power to operate the mixer within the nameplate rating without overloading. All motors shall be built in accordance with current NEMA, IEEE and ANSI standards.

   b. Single speed, squirrel cage induction, alternating current. Motor speed shall not exceed 1800 RPM.

   c. NEMA Design B, TEFC, with Class F insulation.

   d. Equipped with non-hygroscopic ball bearings of the extended duty type, grease or oil lubricated.

   e. Motor frame and shields shall be cast iron or heavy fabricated steel of such design and sizes as to hold the motor components rigidly in proper position. They shall be provided with lifting lugs and stainless steel rating nameplates indicating motor characteristics.

   f. Critical speed of the shaft and rotor assembly shall be at least 20 percent greater than maximum motor operating speed.

   g. Service factor shall be minimum of 1.0.

5. Product and Manufacturer:

   a. Lightnin Vektor V5 P110 (M-26) and Lightnin Vektor V5 P37 (M-27 and M-28).

2.03 Accessories

A. Each mixer shall be furnished with the following:

   1. One set of each type of bearings used.

   2. Two year supply of bearing grease or oil.

   3. Special tools required for maintenance or operation.

2.04 Fabrication/Protection

A. Equipment shall receive manufacturer's shop primer prior to shipment. Primer shall be compatible with field painting specified herein.

B. Machined, polished, and non-ferrous surfaces shall be coated with corrosion prevention compound.

PART 3 - EXECUTION

3.01 Installation

A. CONTRACTOR shall provide structural supports for mixers as shown on Drawings.

B. Installation shall be in complete accordance with manufacturer's instructions and recommendations.

C. Make all electrical connections in conformance with requirements of Division 16, Electrical.

D. Once installation is complete, touch-up damaged paint with manufacturer supplied paint.

3.02 Field Quality Control

A. CONTRACTOR shall make adjustments required to place systems in proper operating condition. He shall perform operating tests to assure that the equipment operates in accordance with these Specifications and to the satisfaction of the OWNER'S project representative.

B. A manufacturer's representative shall check and approve the installations before operation and assist contractor in performing field tests.

C. CONTRACTOR shall provide the services of a factory-trained operating specialist for one eight hour period for the instruction of the OWNER'S operating personnel.

– END OF SECTION 11220 –

SECTION 11225

MIXERS (STATIC)

PART 1 - GENERAL

1.01 Summary

A. Section includes:

1. Furnishing and installation of three in-line static mixers.
2. Testing of equipment.

B. Related sections:

1. Section 11345 - Chemical Feed Systems
2. Section 13415 - Sequence of Operation
3. Division 15 - Mechanical
4. Section 11001 - General Provisions - Equipment

1.02 References

Comply with applicable provisions and recommendations of the following, except at otherwise shown or specified:

1. American National Standards Institute

1.03 System Description

Three in-line mixers shall be furnished to provide the following mixing:

	SM-35	SM-16	SM-18
Process Matrix	Contaminated groundwater	Contaminated groundwater	Contaminated groundwater
Process Flow Rate:	20 gpm	20 gpm	20 gpm
Chemical Feed Solution:	0-1.5% HCl Solution	0-1% Ferric Sulfate Solution	4-8% Lime Slurry
Chemical Injection Rate:	0.375 L/min. max.	0.45 L/min. max.	0.75 L/min. max.
Mixer Housing:	304 SS, 2"	304 SS, 2"	304 SS, 2"
Internal Helix:	polypropylene	polypropylene	polypropylene
Pipe Connections:	MNPT into union fittings	MNPT into union fittings	MNPT into union fittings
Process Temperature:	10-30° C	10-30° C	10-30° C

1.04 Submittals

A. In-line Mixer

Shop drawings showing bill of material items of specified equipment, assembly, fabrication, installed dimensions, location and size of all connections, detailed specifications, and performance data shall be submitted in accordance with Section 01300. Additional information for the equipment shall include, but shall not be limited to the following:

1. Housing size, material and length.
2. Mixing element size, material and length.
3. Head loss data.

Instruction manuals shall include standard publications and installation diagrams. Format and content shall be in accordance with Division 1.

1.05 Delivery, Storage, and Handling

A. Package mixers to protect from shipping and handling damage. Transportation of the mixers to the Owner's facility shall be arranged by the Contractor.

B. Handle mixers with care to avoid impacts. Do not throw or drop mixer.

C. Inspect shipment with care on arrival. Notify carrier regarding damage or missing items.

D. Do not accept or store on site items damaged in shipping.

PART 2 - PRODUCTS

2.01 Manufacturers

The static mixers shall be Model FMX7321 by Omega Engineering, Inc. of Stamford, Connecticut.

2.02 Equipment

The equipment will provide complete mixing of groundwater and a 0-1.5% HCl solution (SM-35); groundwater and a 0-1% ferric sulfate solution (SM-16) and groundwater as a 5-8% lime slurry (SM-18) at the flow rates presented above.

2.03 Accessories

Each mixer shall be furnished with any special tools required for maintenance or operation.

PART 3 - EXECUTION

3.01 Installation

A. The contractor shall install the in-line mixer to allow quick manual removal from the process pipe system. The in-line mixer shall be clearly marked to indicate flow direction and shall be installed correctly.

B. Installation shall be in complete accordance with manufacturer's instructions and recommendations.

3.02 Field Quality Control

A. Contractor shall make adjustments required to place system in proper operating condition. Operating tests shall be performed to assure that the equipment operates in accordance with these Specifications and to the satisfaction of the Engineer.

-- END OF SECTION 11225 --

SECTION 11360

PLATE AND FRAME FILTER PRESS

PART 1 - GENERAL

1.01 Summary

Section Includes:

A. Furnishing one Plate and Frame Filter Press complete with all appurtenances to meet the following design parameters:

Design Operating Pressure	100 psi (7 bar)
Total Volume - (per filtration cycle)	20 ft^3
Total Filtration Area	411 ft^2
Plate Size	800 mm x 800 mm
Number of Chambers	39
Cake Thickness	1.25 inches (32 mm)
Filtration area per chamber	10.55 ft^2

B. Related Sections

Section 09900, Painting
Section 11001, General Provisions - Equipment
Section 11216, Air Diaphragm Pumps
Section 13415, Sequence of Operation
Section 13420, Instrumentation
Division 15, Mechanical
Division 16, Electrical

1.02 References

All material and equipment furnished under this specification shall be designed and constructed in accordance with the applicable requirements of the following publications:

1. Standards of the American Society for Testing and Materials.
2. National Electric Code.
3. Standards of National Electrical Manufacturers Association.
4. Institute of Electrical and Electronics Engineer.
5. American National Standards Institute.
6. AWS D1.1, Structural Welding Code.
7. AISC, Manual of Steel Construction.
8. AGMA Standards.
9. Joint Industrial Council.
10. OSHA.
11. Standards of the Hydraulics Institute.
12. Standards of the American Water Works Association.

1.03 System Description

The filter press shall be designed to efficiently dewater waste lime solids at approximately 5% solids for handling as a dry cake (>30% solids) and shall include all components necessary for a complete operating unit as specified herein. All components shall be new, free of defects or mechanical damage and in operating condition. The filter press shall be supplied complete in all respects and shall be supplied with the following components, features, appurtenances and accessories.

Polypropylene, gasketed recessed chamber plates
Back-up plate
Fabricated steel skeleton
Automatic, pneumatic-hydraulic opening and closing system
Filter press controls
Automatic Pump Control System (APCS)
Sidebar plate suspension system
Semi-automatic, pneumatic plate shifting system
Air blow/precoat/even-fill feed and discharge liner pipes with manifold
Air Diaphragm Pump
Dumpsters

1.04 Submittals

The Manufacturer shall provide the following performance information:

A. Product Data - Submit for approval four copies of the following:

1. Manufacturer's literature, illustrations, specifications and engineering data including: general arrangement, outline drawings, dimensions, materials, size, weight, performance data and curves showing overall efficiency, flow rate, discharge head, brake horsepower, motor horsepower, and speed. The following additional information shall be supplied for the air diaphragm transfer pump: allowable suction lift; flowrate; required air pressure; and, consumption rate.
2. Manufacturer's literature of all appurtenances.
3. Assembly, and installation drawings.
4. Setting drawings, template, and directions for the installation of anchorages.
5. Shop test results of plate and frame unit.
6. Results from the field testing as specified in Section 11001.

B. Operational and Maintenance Manuals: Submit for approval four copies of the following:

1. Complete installation, operation and maintenance manuals including copies of all approved Shop Drawings.

C. Quality Assurance/Control Submittals - Submit for approval four copies of the following:

1. Design Data
2. Test Reports
3. Certificates
4. Manufacturer's Instructions and Field Reports

1.05 Quality Assurance

A. Manufacturer's Qualifications: Manufacturer shall have a minimum of 5 years of experience in the production of substantially similar equipment, and shall show evidence of satisfactory operation in at least 5 installations.

1.06 Delivery, Storage and Handling

A. Deliver materials to the site to insure uninterrupted progress of the Work.

1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete in ample time not to delay that Work.

2. Ship filter press with openings sealed.

B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, and other supports. Protect steel members and packaged materials from corrosion and deterioration.

C. Store mechanical equipment in covered storage off the ground and prevent condensation.

1.07 Project/Site Conditions

Location: Indoors
Temperature: Room Temperature
Processing Mode: Batch operation (4 cycles/week)
Sludge Type: Thickened lime solids
Sludge Feed: Room Temperature
5% solids
Operating Frequency: 2 days per week, one shift per day, maximum one cycle per shift

1.08 Manufacturer's Warranty

The Manufacturer shall provide a minimum 12 month product warranty for the filter press and any additional components supplied or assembled by the said Manufacturer.

1.09 System Start-Up

A. After CONTRACTOR and ENGINEER have mutually agreed that the equipment installation is complete and ready for continuous operation, CONTRACTOR shall conduct a running test of the filter press and controls in the presence of ENGINEER to demonstrate that the filter press will function correctly.

1.10 Owner's Operations and Maintenance Instructions

A. Furnish four complete sets of operations and maintenance instructions approved in accordance with Section 1.04.

B. The VENDOR shall furnish a list of recommended spare parts with his proposal, for an operating period of one year. The list shall describe each part, the quantity recommended, and the unit price of the part.

C. CONTRACTOR shall store and safeguard spare parts until completion of the Work at which time they shall be inventoried, delivered and placed in an area designated by OWNER.

D. Manufacturer shall furnish a list of additional recommended spare parts for an operating period of one year. The list shall describe each part, the quantity recommended, and the unit price of the part. OWNER will purchase all, some, or none of the recommended spare parts at his option.

1.11 Commissioning

A. CONTRACTOR shall statically and dynamically test the operation of systems to ensure the operation of the peristaltic dispensing pump throughout the range of building operating conditions.

PART 2 - PRODUCTS

2.01 Manufacturer

1. JWI, Inc., Model 800 mm J-Press, 100 psi (Plate & Frame Filter Press).

2.02 Materials

Frame: ASTM A-36 Carbon Steel
Filter Cloth: Woven Polypropylene
Plates: Virgin Gray Polypropylene with no fillers
Plate Gasketing: EPDM elastomer compound (O Ring)
Sidebar Wear Strips: 304 Stainless Steel
Follower Travel Assembly: Delrin Rollers on Stainless Steel Axles
Hydraulic Tubing: 304 Stainless Tubing
Plate Shifter System - Delrin Rollers and Stainless Steel Axles on 304 Stainless Steel Rails
Feed and Discharge Piping: Schedule 80 PVC
Air Blowdown Manifold Piping: Schedule 80 PVC
Back up Plate - Virgin Gray Polypropylene with no fillers

2.03 Equipment

A. Filter Plates:

1. Filter plates shall be of the center feed, alternating corner discharge design for operation at 100 psi pressure at ambient temperature. Plates shall be of the gasketed design. Gasketing shall be on the perimeter sealing surface and around each of the corner eyes. Plates shall come complete with filter cloths installed.

2. Recessed plates shall be molded from virgin, gray polypropylene and shall contain no fillers. Plates shall have a drainage surface design that shall provide adequate support for filter cloths and shall have integrally molded stayboss supports equally spaced on the drain field. Plate sealing surfaces shall be machined to a maximum parallel plane tolerance of .3 mm. Chamber recess depth dimension shall have a tolerance not to exceed .5 mm.

3. Plates shall have a round bottomed caulking groove machined around the perimeter of each drainfield for installation of filter cloths. Grooves of the dovetail design shall be machined around each corner port and around the cake chamber on the sealing surface for the installation of gasketing.

4. Filter cloths shall be made of polypropylene fabric. Fabric shall be heat set and calendared. Cloths shall have a monofilament fiber warp and a multifilament fiber weave.

Cloths shall have a satin design weave. Minimum cloth weight shall be 9 oz./yd. Cloths shall have a porosity of 4 SCFM as measured on the Frazier scale. Cloths shall be of the barrel neck design. Neck material shall be of the same or less porous material.

Cloths shall be held in place on the filter plates by a woven, high density polypropylene cord sewn into the perimeter of the cloth. It shall be pressed or caulked into place on the filter plate and held there by an interference fit.

5. Gasketing shall be molded of EPDM elastomer compound and shall be of the O'ring-types design. Gasketing shall have a minimum 70A durometer hardness.

6. The filter press shall be supplied with a back-up plate to allow for the processing of less than a full capacity press load. The blank back-up plate shall be capable of being inserted, along with the tail filter plate, at any point in the press plate stack to reduce the operating capacity of the filter press.

B. Filter Press Skeleton

1. The filter press skeleton and related sub-components shall be designed to maintain the filter pack in a closed position against an internal operating pressure of 100 psi plus a minimum clamping factor of 25% greater than the maximum internal operating pressure multiplied times the filter area of the tail filter plate. Minimum closure force shall be 78 tons.

2. The filter press frame shall be fabricated of ASTM-A36 carbon steel plate and structures. Weldments shall be totally enclosed box construction for maximum strength and ease of maintenance. All weldments shall be designed to evenly distribute the operational forces developed during filtration over the entire component. All components shall be continuously welded with a fillet weld for maximum strength. Intermittent welding of joints shall not be acceptable. Enclosed compartments within the head end weldment shall have drain holes. All components shall be designed with a minimum safety factor of 1.5 times the maximum closure force. Critical assembly points such as sidebar/end weldment shall be machined to close tolerances to ensure uniform load distribution at all stress bearing areas.

   All edges and welds shall be deburred and ground smooth. All weld splatter, weld slag and mill scale shall be removed before painting.

3. The head end weldment and the cylinder bracket shall be connected at two points each. Two side bars of hot rolled steel shall connect the head and cylinder bracket at the horizontal centerline of the plate pack so as not to interfere with cake discharge. Each connection point shall be designed with a minimum safety factor of 1.5 times the maximum closure force.

   Each connection point shall have the intersecting components machined to tolerances that shall ensure proper fit.

4. The side bars shall be of sufficient size and weight to support the full operational weight of the filter place pack including the follower head, plate pack, plate shifter and filter cake with a maximum deflection of 1/900 of the length of the filter press assembly.

5. To prevent corrosion of the sidebars due to surface finish erosion, the side bars shall come complete with 304 SS wear strips on the contact surface with plate suspension handles and follower head rollers.

6. The follower head sub-assembly shall be suspended from the side bars. The follower shall ride on Delrin rollers on stainless steel axles. Grease nipples shall be provided on the axles for periodic interspacial flushing of the roller/axle assembly.

7. All non-stainless steel metallic surfaces shall be finished for maximum corrosion resistance in accordance with the following.

   A. Surface preparation: Blast to SSPC-10, near white metal blast cleaned surface.

   B. Primer: One coat, two component, chrome free, low VOC polyurethane primer @ 1.5 to 2.0 MDFT.

   C. Finish: Two coats, single stage, two component acrylic urethane @ 1.5 MDFT each coat.

C. Pneumatic/Hydraulic Closure

1. The pneumatic/hydraulic opening and closing system shall include One (1) double acting hydraulic cylinder and one (1) hydraulic power pack. The system shall be designed to automatically compensate for any thermal expansion or contraction of the plate stack as well as maintain the proper clamping force throughout the process cycle.

2. The hydraulic cylinder shall be capable of producing 78 tons of clamping pressure at an hydraulic input pressure of 3100 psi. They cylinder shall have an 8 inch diameter bore and a 24-inch stroke to provide a filter pack cake discharge cleanout space of 21 inches. The cylinder shall be of the tie rod design for ease of servicing hydraulic seals. The piston rod shall be covered by a flexible neoprene bellow to protect the rod from contamination. The piston rod shall be connected to the follower head by means of a rod eye and clevis arrangement that allows follower head movement only in a vertical plan perpendicular to the length of the press. The rod eye and clevis shall be equipped with grease fittings. The cylinder, rod eye and clevis shall be designed with a minimum safety factor of 3.0 times the maximum cylinder capacity. The cylinder shall meet all JIC requirements.

3. The peneumatic/hydraulic power pack shall contain an air driven hydraulic pumping module that shall clamp the press by pressurizing the hydraulic system after the plate pack is fully closed. The hydraulic pumping module shall be designed to only operate after the hydraulic cylinder has been fully extended through the use of a pressurized oil reservoir. To minimize the use of the hydraulic pumping module, the press shall be opened by means of pressurizing the retraction stroke of the cylinder with compressed air. All hydraulic tubing, subject to system pressure, within the power pack and to and from the cylinder shall be of 304 SS and shall have a minimum burst pressure rating of 3.5 times the maximum operating pressure of the power pack. The power pack shall be fully enclosed in a fabricated steel cabinet for protection from damage and shall be easily accessible for maintenance from a full width hinged cabinet door. All components shall be modular for ease of maintenance. Air requirements shall be 25 scfm @ 100 psi.

D. Controls

1. The filter press control panel shall be mounted to the hydraulic cylinder bracket and shall be NEMA 12. The control panel shall contain all necessary switches, gauges, valving and tubing. The panel shall come complete with two position selector switches for the following functions:

   A. Air Supply, on/off

   B. Filter press, open/close

   C. Hydraulic Pump, on/off

2. An automatic feed pump control system shall be included in the control panel as specified above. The automatic feed pump control system shall be designed to sequence the start-up of the air-operated diaphragm feed pump (P-90, Refer to Section 11216) by 5 min/25 psi increments. Time and pressure increments shall be field adjustable (0-30 minutes; 0-100 psi). the control shall visually signal when the press cycle is complete by sensing the duration between pump strokes and illuminating a "cycle over" lamp. The control system shall also include a low hydraulic pressure safety shut down circuit designed to interrupt the air supply to the feed pump in the event of loss of hydraulic closure pressure.

E. Plate Shifter

The filter press shall be supplied with a semi-automatic plate shifter system that shall be designed to assure each plate is straightened and is perpendicular to the side bars prior to shifting. To maintain proper alignment, the shifter shall have Delrin rollers (V-notch on one side and spool type on the opposite) with sealed roller bearings and stainless steels shafts. The rollers shall ride on 304 stainless steel rails. The plate shifter shall operate in a semi-automatic mode, requiring operator initiation of each plate shifting sequence. The plate shifting shall be accomplished with pneumatic operators. The plate shifter shall have the capability to shift individual or multiple plates per shifting sequence.

F. Feed and Discharge Piping

1. Feed and discharge liner piping shall be supplied. Piping shall be fabricated of Schedule 80 PVC providing the connections through the head from the center fee slurry port and the corner filtrate discharge ports in the filter pack through the stationary head. All threads shall be NPT standard.

2. The feed and discharge manifolding shall be of the air blow/precoat type. Material of construction shall be PVC. Valving shall be of the butterfly type.

G. Dumpsters

The filter press shall be supplied with two solids collection hoppers. The dumpsters shall be furnished with large ball-bearing casters for manual positioning under the press. The dumpster, capacity 20 cubic feet, shall be a JWI-dumpster assembly-800 mm press.

2.04 Accessories

A. Furnish all special tools for maintenance and operation of the filter press.

PART 3 - EXECUTION

3.01 Installation

Installation of filter press and associated materials shall be by others per Manufacturer's specifications. The Manufacturer shall:

A. Give all necessary instructions for proper installation of the Filter Press and associated materials, including interpretation of the Manufacturer's printed instructions.

3.02 Field Quality Control

The Manufacturer shall provide the services of a factory-trained technical representative to review the installation, make final adjustments and place the filter press into operation, if requested by the Owner. The price for start-up and checkout services shall not be included in the equipment price but shall be included in the Bid Submittal as a per diem rate (including travel).

3.03 Demonstration

As part of the field quality control services provided in Section 3.02, the Manufacturer shall provide a demonstration of the equipment to the Owner and/or the Engineer, if requested by the Owner.

-- END OF SECTION 11360 --

SECTION 11500

PROCESS TANKS

PART 1 - GENERAL

1.01 Description

A. Scope:

1. CONTRACTOR shall furnish and install all materials, equipment, and incidentals required to provide process tanks. The tanks will be constructed of high density polyethylene (HDPE) plastic. All tanks will be complete with appurtenances and accessories as specified and shown on design plans and section drawings necessary to provide complete operational systems. Refer to tank schedule in this section for detailed tank information.

2. The process tanks will be designed and manufactured by Nalgene of Nalge Co. of Rochester, New York, Chem-Tainer Industries, Inc. of N. Babylon, New York.

3. Each tank will have openings to accommodate electro mechanical liquid level sensing devices, venting ports, sample ports, and piping connections at several locations on the tank as specified and shown on the Drawings.

B. Related Specifications:

1. Section 11001, General Provisions - Equipment.

2. Section 15060, Pipes and Appurtenances.

3. Section 15100, Valves.

1.02 Quality Assurance

The tanks will be constructed from virgin materials and resins and shall be rotationally molded into one seamless piece, where possible.

1.03 Submittals

A. General. Shop drawings, together with other required information specified, shall be submitted in accordance with the requirements of Division 1 of these Specifications and the requirements specified in this Section.

B. Shop Drawings. Shop drawings, complete with material, grade, and dimension for all appurtenances shall be submitted. The drawings shall show and identify the pipe joints, fittings, couplings, and miscellaneous details. Detailed catalog and engineering data sheets shall be submitted for all components such as tank stands and a proposed schedule for delivering and installing the process tanks shall be included.

1.04 Delivery, Storage, and Handling

A. General. Transportation of tanks to OWNER'S facilities shall be arranged by CONTRACTOR, OWNER will inspect tanks for damage or improper construction. The CONTRACTOR shall provide shipping, unloading, and storage per MANUFACTURER'S recommendations. The CONTRACTOR shall be responsible for proper installation.

PART 2 - PRODUCTS

2.01 General Requirements.

All process tanks, fittings, and appurtenances shall be new, free from defects or contamination, and wherever possible, shall be the standard product of the manufacturer. They shall be furnished as specified or shown.

2.02 Materials

A. Process Tanks and Appurtenances. Tanks and appurtenances will be fabricated of high-density polyethylene. The HDPE resins shall be natural, unpigmented, without UV stabilizers.

B. Tank Stands and Pipe Supports.

1. No support bolts shall penetrate the tank walls or top. Fastening bolts shall be SS minimum, 3/4-inch diameter, with SS nuts and locking washers. Provide means to support all tank appurtenances.

C. Tank Schedule. Process tanks shall conform to the schedule included within this Section.

2.03 Performance Criteria

A. Vapor pressure in each tank will be atmospheric.

B. Liquid product temperature will be ambient (5-37°C),

C. Liquids will have a specific gravity of approximately 1.0.

D. pH of process flow will be between 5 and 10.

PART 3 - EXECUTION

3.01 Field Quality Control

A. Prior to installation, OWNER will inspect tanks for damage or improper construction and the CONTRACTOR shall arrange for unloading and storage per MANUFACTURER'S recommendations. If corrections or repairs are necessary, CONTRACTOR, MANUFACTURER, and ENGINEER will be notified at once.

B. Prior to installation, repairs and modifications shall be made in accordance with MANUFACTURER'S instructions and ENGINEER'S approval.

3.02 Installation

Installation will be in complete conformance with manufacturer's instructions, at locations specified in drawings. The CONTRACTOR shall provide for leveling of the tanks supported on a floor.

3.03 Start-Up

Prior to system start-up, tanks shall be demonstrated to be leak-free.

SECTION 11500

TANK SCHEDULE

Tank ID	Nominal Capacity	Tank Type	Tank Material	Tank Dimension	Tank Stand Required	Fittings	Process	Comments on Appurtenances to be Provided
T-20	1,550 gallons	Vertical, cylindrical open top, flat bottom	HDPE	127"H x 64" diameter	No (Placed on equipment pad)	Welded, flanged. 2" inlet, 5.5' from bottom center; 2" drain bottom center; 2" outlet, 0.5' from bottom center	Clarifier clearwell tank	Provide hold down lugs on concrete pad.
T-10	2,000 gallons	Vertical, cylindrical domed top, flat bottom	HDPE	66"H x 96" diameter	No (Placed on equipment pad)	Welded, flanged. 2" inlet, 5' from bottom center 2" drain bottom center, 2" outlet, 0.5' from bottom center	Equalization tank	Provide rails on top for future mounting of mixer; bracket for future mounting of still well; hold down lugs on concrete pad

-- END OF SECTION 11500 --

SECTION 12302

WOOD CASEWORK

PART 1 - GENERAL

1.01 Scope

A. This Section subject to applicable requirements of the Contract Documents.

B. Work includes all Wood Casework required by the Contract, and, in general, includes the following items:

1. Wood manufactured casework as indicated.

a. Base cabinets.

b. Wall cabinets.

c. Cabinet hardware and accessories.

d. Filler panels, scribes and finished side.

e. Factory finish of casework.

2. Countertops and splash backs

a. Acid resistant.

3. Sinks directly attached to casework including rims, trim, overflows, plugs and strainers

a. See Plumbing Section for sink specifications.

4. Submittals.

1.02 Quality Assurance

A. Provide wood casework with tops, sinks, special equipment and service fixtures, furnished by the same wood casework company for single responsibility.

B. Acceptable manufacturers: Campbell Rhea/Mohon International, Inc: Style S2-W with chrome plated pulls or approved equal of Hamilton Industries, Inc., Kewaunee Scientific Equipment Corp., Taylor/Division of American Desk.

1.03 Submittals

A. Product Data

1. Submit manufacturer's data and installation instructions, including descriptions of each item identifying parts and accessories, materials and other information necessary to establish conformance with requirements indicated.

2. Identify species of wood to be used in both lumber and plywood materials.

B. Shop Drawings

1. Submit within 60 days, rough-in drawings, showing complete rough-in dimensions for plumbing, ventilating and electric work required for the casework. Drawings

should also indicate location of existing rough-in locations and dimensions where applicable.

2. Shop drawings shall show plans, elevations, ends, cross-sections, service run spaces, location and type of service fixtures with lines thereto. Show details and location of anchorages and fitting to floors, walls, and base.

C. Samples

1. Submit one set of manufacturer's full range of finishes, colors and materials as required for selection by A/E.

D. Operating and Maintenance Instructions

1. Submit operating instruction sheets or manuals which include requirements and recommendations for lubrication, general care, maintenance, operating adjustments and parts lists covering casework and other related items indicated.

2. Include name, address and telephone number of manufacturer's authorized service representative.

1.04 Product Delivery, Storage and Handling

A. The casework shall be delivered to the job site after wet operations in the building are complete. Store completed wood casework in a ventilated place protected from weather, with relative humidity therein of 50% or less at 70 degrees F.

B. All casework shall be delivered in one piece where possible. When it is impractical to do so, such casework may be delivered in sections and assembled in position.

C. All casework shall be delivered in such a manner as to protect it against dirt, water, chemical and mechanical injury.

1.05 Job Conditions

A. Before proceeding with any work, the wood casework supplier shall examine all spaces and conditions existing at the job site and shall notify the A/E of any work performed by others or any other conditions prevailing which prevent, inhibit or otherwise interfere with the performance of his contractual obligations.

B. Prior to fabrication or ordering of any casework specified herein, all measurements shall be verified at the job site of actual space reserved therefore, and shall, under no condition, be taken from the contract drawings. Due consideration shall be given to any architectural, structural or mechanical discrepancies which may occur during construction of the building. Such discrepancies shall immediately be made known to the A/E who shall clarify the discrepancy in writing before any affected work shall proceed.

C. Provide materials and devices necessary to make complete the solid connections to the existing structure. No claims for extra work or materials shall be allowed because of existing job conditions.

1.06 Guarantee

A. Casework supplied, assembled and set in place shall be guaranteed to be free from defects in materials and workmanship for one year from date of acceptance.

PART 2 - PRODUCTS

2.01 Wood Casewood

A. Definitions

A. Exposed portions of casework include surfaces visible when doors and drawers are closed. Visible members in open cases also shall be considered as exposed portions.

B. Semi-exposed portions of casework includes those members such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors.

C. Concealed portions of casework include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

B. Exposed Materials Do not use exposed faces of lighter-than-average color joined with exposed faces of darker-than-average color. Do not use two adjacent faces which are noticeably dissimilar in grain, figure, and natural character markings.

1. Solid Lumber

A. Air dried, then kiln dried to uniform 4% - 6% (by Weight) moisture content before fabrication.

1. Appalachian Red Oak free from defects and structurally sound with only natural variation. Premium grade.

C. Semi-exposed Materials

1. Solid Lumber: Dry, sound, selected to eliminate appearance defects. Any species of hardwood, or softwood of similar color and grain to exposed portions.

2. Plywood: Hardwood, ANSI/HPMA HP, Good Grade (1), or softwood ANSI/VOL. PROD. STD. PS-1, Group 1, A-A, INT, of species to match color and grain of exposed members.

D. Concealed Members

1. Solid Lumber or Plywood: Any species, with no defects affecting strength or utility.

2. Hardboard: ANSI/AHA A135.4, Class 1, tempered.

2.02 Countertops

A. Molded epoxy resin tops, compounded and cured to provide optimum physical and chemical resistance properties, and shall be a uniform mixture, full thickness. Non-glaring and black in color. 1" thick with 3/4" integrally molded 4" high backsplash and end splashes where required.

1. Physical properties

a. Flexural strength: 18,600 psi

b. Compressive strength: 32,500 psi

c. Hardness: 83

d. Density: 1.34

e. Flame test: 15

2.03 Hardware and Accessories

1. Drawer and swing door pulls: Aluminum with clear epoxy finish mounted with 2 screws fastened from the back; fully recessed for sliding doors.
   a. Provide two pulls for drawers over 24" wide.
2. Hinges shall be heavy duty 5 knuckle institutional type, pinned with rounded ends, 2-1/2"
3. Catches for doors base cabinet shall be double action, spring tension, nylon roller type or dual self-aligning permanent magnet type. On all tall cases, heavy duty, spring tension, rubber roller type.
4. Drawer stops provided on all drawers, located on the inside.
5. Sliding door hardware sets shall be manufacturer's standard, to suit type and size of sliding door units.
6. Base molding: Extruded vinyl, 4" high.
   a. Provide on exposed sides and fronts of floor mounted cabinets with matching corner pieces.
7. Adjustable shelf supports shall be BHMA B84073, wrought steel, mortise mounted.

2.04 Finishes

1. Wood components (except unexposed backs): Manufacturer's standard stains as selected by A/E from full range.
   a. Sand and buff with a fine abrasive, not coarser than 3/0 garnet finishing paper. Absolute cleanliness shall be achieved before finishing coat is applied, to provide a smooth, burr free finish.
   b. Pigmented stains consisting of non-fading, non-bleeding colors.
   c. Finish shall be varnish and shall consist of a mixture of chlorinated polymers and co-polymers, compounded with an oil modified alkyd resin and resinous plasticizers. Finish process shall be one (1) coat baked on, sanded and buffed and a finish coat baked on.
   d. Finish process must be completed before final fabrication.
2. Laboratory grade finish criteria
   a. Chemical resistance
      1) Test: One hour contact with 5 drops (0.25 cc) applied to finish surface, covered with watch glass, then washed and dried.

         Acids
         Hydrochloric Acid, 10%
         Nitric Acid, 10%
         Sulphuric Acid, 25%
         Phosphoric Acid, 25%
         Acedic Acid, 50%

Solvents

Ethyl Alcohol
Buytl Alcohol
Methyl Alcohol
Ethyl Acetate
Ethyl Ether
Methyl Ethyl Ketone
Toluene
Acetone
Benzene
Carbone Tetrachloride
37% Formaldehyde
Gasoline
Naptha
Kerosene
Xylene
Glycerin
Furfural

Bases and Salts

10% Sodium Hydroxide
28% Ammonium Hydroxide
10% Potassium Hydroxide
Saturated Zinc Chloride
Saturated Sodium Sulphide
Saturated Sodium Carbonate

2) Result: No visible effect other than slight discoloration, change of gloss or temporary softening of film.

2.05 Fabrication

A. General

1. Provide finish overlay (overlap) style construction for doors and drawers in cabinets.
2. Assemble units in shop in as large components as practical to minimize field cutting and jointing.
3. Mortise and tenon, glue and screw joints for maximum strength with square corners and plumb vertical surfaces.
4. Provide laboratory grade finish on semi-exposed interiors and shelves to match exterior.

B. Base cabinets: All compartments, whether drawer-and-compartment or all drawer type, shall be fully enclosed at the bottom.

1. Tops shall consist of a horizontal frame with pinned mortise and tenon joints and shall be fastened securely into cabinet sides.
2. Drawer divider rails shall be 3/4" x 1-3/4" oak pinned mortise and tenon joints fastened securely to cabinet sides.

3. Sides shall be 3/4" thick solid flush panels faced with select hardwood veneers. Hardwood nosing at front shall be 3/8" thick oak.

4. Bottoms shall be 5/8" thick solid panels with pinned mortise and tenon joints secured to cabinet sides and bottom panel.

5. Backs shall be 3/16" thick hardboard faced.

6. Finished backs shall be flush 3/4" thick solid flush panels faced with select hardwood veneers.

7. Toe space shall be 4" high by 3-1/4" deep with solid hardwood 3/4" thick toeboard.

8. Shelves shall be 3/4" thick. Shelves shall be adjustable on metal pilasters on 1/2" center.

9. Drawers

   a. Drawer heads shall be 3/4" thick solid oak core with select oak veneer.

   b. Sides and backs shall be 1/2" thick oak.

   c. Bottom shall be 3/16" thick hardboard.

   d. Drawer slides shall be providing at least a 75 pound load capacity and incorporating positive stops. File drawer slides shall be Grant #329, or equal, and provide a 100 pound load capacity.

   e. Drawer bottom shall be rabbeted into drawer sides, back and front. Drawer box shall be tongue and grooved, glued and stapled.

10. Doors shall be of flush construction. Edging of doors shall be 3/4" thick by 1-1/8" thick solid oak on all four sides with 3/8" radius lipped.

C. Filler Panels: Provide panels as follows, finished to match cabinet exteriors.

1. From base cabinets back to wall or adjacent cabinets -minimum 1/4" thick hardwood plywood.

2. Between cabinet faces or from cabinet side to adjacent wall - minimum 3/4" thick hardwood plywood.

D. Provide removable backs and access panels at all required services.

E. No shimming will be allowed. Provide adjustable feet for all cabinets.

2.06 Mechanical Service Fittings

A. General

1. Comply with Scientific Apparatus Makers Association (SAMA) Standards, including marking of buttons in accordance with SAMA Standard Color Code.

2. Provide all working parts removable and interchangeable with fittings of same type and number.

PART 3 - EXECUTION

3.01 Installation

A. Install equipment under supervision of factory trained installation superintendent. Provide all bolts, blocking, miscellaneous items necessary for a complete working installation in the existing space.

B. Installation shall be plumb and level, properly aligned between sections and neatly finished at walls and floors. Operation of working parts shall be smooth without binding.

C. Upon completion leave installation adjusted and in perfect working order. Clean the equipment and surrounding work soiled as a result of work of this contract. Remove all debris and surplus material.

-- END OF SECTION 12301 --

SECTION 13020

SAFETY SHOWER AND EYEWASH

PART 1 - GENERAL

1.01 Description

A. Section includes:

1. One combination safety shower/eyewash
2. Furnishing and installation of safety shower/eyewash
3. Testing of equipment

B. Products furnished under this section:

1. CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to provide:
   a. one combination safety shower/eyewash

C. Related sections:

2. Section 13586, Hydropneumatic Systems
3. Section 15052, Pipe and Pipe Fittings

1.02 References

Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. American National Standards Institute
2. Occupational Safety and Health Act

1.03 System Description

A. Description

1. CONTRACTOR shall furnish and install a combination safety shower/eyewash, to be located in the building as shown on the Drawings, and discharging into the sanitary sewer system.

B. Performance requirements

1. The safety shower shall discharge a spray pattern with a delivery flow and pressure in accordance with ANSI Z358.1-1990.
2. The safety shower/eyewash shall be a Model 28-426A by C&H, or pre-approved equal.

1.04 Submittals

The CONTRACTOR shall submit shop drawings and material certifications for the shower/eyewash assembly to the ENGINEER prior to installation.

PART 2 - PRODUCTS

2.01 Materials/Equipment

A. The safety shower/eyewash shall be of the floor-mounted type, with stainless steel eyewash bowl. The mounting base shall allow for anchoring to the floor by means of stainless anchor bolts.

B. The piping shall be heavy wall schedule 80 hot dip galvanized steel piping. Valves shall be chrome-plated bronze stay open ball valves with chrome plated ball, stainless steel acturators, and actuation graphics.

C. The shower head shall be heavy wall schedule 80 hot dip galvanized steel piping. Values shall be chrome-plated bronze stay open ball valves with chrome plated ball, stainless steel actuators, and actuation graphics.

D. Self-adjusting eye-facewash regulators shall be provided, to assure a constant even flow of 8.0 gpm under varying hydraulic conditions.

E. Water supply fitting shall be 2 inch NPT. The waste shall discharge to the sanitary sewer.

F. The safety shower shall have a spring-loaded actuation handle which shall reach to within 5'-0" of the floor level. The handle shall provide full water flow actuation upon application of between 1 lbs. and 5 lbs. of force.

G. The safety shower/eyewash shall be certified by the Safety Equipment Institute and shall meet applicable OSHA and ANSI standards.

H. The safety shower shall deliver 30 gpm minimum at an influent pressure of 5 psi.

PART 3 - EXECUTION

3.01 Installation

A. The shower/eyewash shall be mounted secure and plumb to discharge to the sanitary sewer system as shown on the drawings. The shower post shall be supported and restrained from lateral displacement. The shower actuator handle shall be easily accessible but shall not interfere with other normal operations.

B. The CONTRACTOR shall provide connections to the potable water line.

3.02 Field Quality Control

A. The CONTRACTOR shall perform a flow test on the shower and eyewash to demonstrate proper operation.

– END OF SECTION 13020 –

SECTION 13120

PRE-ENGINEERED BUILDINGS

PART 1 - GENERAL

1.01 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specifications sections apply to work specified in this section.

1.02 Summary

A. Extent of pre-engineered buildings work is shown on drawings.

B. Building Type: The pre-engineered metal building shown is a single story, single span, rigid frame type metal building of the nominal length, width, eave height and roof pitch indicated. Exterior walls are covered with factory assembled insulated metal wall panels. One endwall is expandable.

1. Manufacturer's standard components may be used, providing components, accessories, and complete structure conform to architectural design appearance shown and to specified requirements.

C. Concrete floor and foundations and installation of anchor bolts are specified in Division-3.

1.03 Submittals

A. Product Data: Submit manufacturer's product information, specifications and installation instructions for building components and accessories.

B. Shop Drawings: Submit complete erection drawings showing anchor bolts settings, sidewall, endwall, and roof framing, transverse cross sections, covering and trim details, exterior doors and frames, gutters and downspouts, overhead door trim, interior metal liner panels, and accessory installation details to clearly indicate proper assembly of building components.

C. Samples: Submit samples of the following items. Engineer's review will be for color and texture only. Compliance with other requirements is the responsibility of the Contractor.

1. Roofing and siding panels, with required finishes.
2. Fasteners for application of roofing and siding panels.
3. Sealants and closures.
4. Non-insulated interior metal liner panels.

D. CertificAtion: Submit written Certification prepared and signed by a Professional Engineer, registered to practice in New York State, verifying that the building design meets indicated loading requirements and codes of authorities having jurisdiction.

1.04 Quality Assurance

A. Design Criteria

1. Structural Framing: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practices Manual". Take into consideration wind and snow loading specific to the site.

2. Structural Steel: For design of structural steel members, comply with requirements of the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.

3. Light Gage Steel: For design of light gage steel members, comply with requirements of the American Iron and Steel Institute's (AISI) "Specification for the Design of Cold Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.

4. Welded connections: Comply with requirements of the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.

B. Design Loads: Basic design loads, as well as auxiliary and collateral loads, are to be indicated on shop drawings.

1. Basic design loads include live load, wind load and seismic load, in addition to the dead load.

2. Auxiliary loads include dynamic live loads such as those generated by cranes and materials handling equipment.

3. Collateral loads include additional dead loads over and above the weight of the metal building system such as sprinkler systems and mechanical systems.

4. Design each member to withstand stresses resulting from combinations of loads that produce the maximum allowable stresses in that member as prescribed in MBMA's "Design Practices Manual".

1.05 Delivery, Storage, and Handling

A. Deliver and store prefabricated components, sheets, panels, and other manufactured items so that they will not be damaged or deformed.

B. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal sheets or panels so that water accumulations will drain freely. Do not store sheets or panels in contact with other materials which might cause staining.

PART 2 - PRODUCTS

2.01 Manufacturers

A. Manufacturer: Subject to compliance with specified requirements, provide the pre-engineered building systems provided by one of the following:

1. Butler Manufacturing Co.

2. Steelox Building Systems.

3. Varco Pruden.

2.02 Materials

A. Metals

1. Hot-Rolled Structural Shapes: Comply with requirements of ASTM A36 or A529.
2. Tubing or Pipe: Comply with requirements of ASTM A500, Grade B, ASTM A501, or A53.
3. Members Fabricated from Plate or Bar Stock: Provide 42,000 psi minimum yield strength. Comply with requirements of ASTM A529, A570, or A572.
4. Members Fabricated by Cold Forming: Comply with requirements of ASTM A607, Grade 50.
5. Galvanized Steel Sheet: Comply with requirements of ASTM A446 with G90 coating. "Class" to suit building manufacturer's standards.
6. Bolts for Structural Framing: Comply with requirements of ASTM A307 or A325 as necessary for design loads and connection details.

B. Paint and Coating Materials: Color to be chosen by Engineer from standard colors.

1. Primers:
   a. Shop Primer for Ferrous Metal: Provide fast-curing, lead-free, abrasion-resistant, rust-inhibitive primer as selected by the manufacturer for compatibility with substrates, with types of alkyd finish paint systems indicated and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Comply with performance requirements only of FS TT-P-86, Types I, II or III.
   b. Shop Primer for Galvanized Metal Surfaces: Provide zinc dust-zinc oxide primer as selected by the manufacturer for compatibility with substrate. Comply with performance req'ts of FS TT-P-641.
2. Finish Coats for all interior metal including (but not limited to): frames, metal panels.
   a. Paint Shop-Primed Metal Surfaces:
      1. One coat Themec 135 Chembild,
      2. Followed by one coat Themec 71 EnduraShield.

2.03 Structural Framing

A. Rigid Frames shall be fabricated from hot-rolled structural steel. Provide built-up "I-beams" shape or open web type rigid frames consisting of either tapered or parallel flange beams and tapered columns. Provide frames factory welded and shop painted. Furnish frames complete with attachment plates, bearing plates, and splice members. Factory drill frames for bolted field assembly.

1. Provide length of span and spacing of frames indicated. Slight variations in length of span and frame spacing may be acceptable if necessary to meet manufacturer's standard.

2. Provide rigid frame at endwalls where indicated.

B. End Wall Columns: Provide factory welded, shop painted endwall columns of not less than 14-ga. built-up "I" shape or cold-formed sections.

C. Wind Bracing: Provide adjustable wind bracing using not less than 1/2" diameter threaded steel rods; comply with requirements of ASTM A36 or A572, Grade D. Locate interior end bay bracing only where required. Avoid conflicts with doors and windows.

D. Secondary Framing

1. Provide not less than 16-ga. shop painted rolled formed sections for the following secondary framing members:

a. Purlins.

b. Eave struts.

c. Endwall beams.

d. Flange bracing.

e. Sag bracing.

2. Provide not less than 14-ga. cold-formed galvanized steel sections for the following secondary framing members:

a. Base channels.

b. Sill angles.

c. Endwall structural members (except columns and beams).

d. Purlin spacers.

F. Bolts: Provide shop painted bolts, except when structural framing components are in direct contact with roofing and siding panels. Provide zinc-plated or cadmium-plated bolts when structural framing components are in direct contact with roofing and siding panels.

G. Shop Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease, and other matter precluding paint bond. Follow procedures of SSPC-SP3 for power tool cleaning, SSPC-SP7 for brush-off blast cleaning, and SSPC-SP1 for solvent cleaning.

1. Prime structural steel primary and secondary framing members with the manufacturer's standard rust-inhibitive primer.

2. Prime galvanized members, after phosphoric acid pretreatment with manufacturer's standard zinc dust-zinc oxide primer.

2.04 Roofing and Siding Panels

A. General: Provide roofing and siding sheets formed to the general profile or configuration indicated.

B. Zinc-Coated Steel Sheets: Provide structural quality hot-dip galvanized steel sheets, complying with requirements of ASTM A446, Grade C, with G90 coating complying with ASTM A525.

C. Metal thickness.

1. Roof not less than 24 ga.

2. Walls and liner panels not less than 26 ga.

D. Standing Seam Roof Panels: Provide manufacturer's standard factory-formed standing seam roof panel system designed for mechanical attachment of panels to roof purlins using a concealed clip. Form panels of 24-ga. galvanized steel sheets complying with requirements of ASTM A 446, Grade C, with G90 coating.

1. Clips: Provide not less 16-ga. panel clips.

2. Cleats: Provide factory calked, mechanically seamed cleats formed from 24 ga. galvanized steel complying with ASTM A 446, Grade C with G90 coating.

E. Fasteners: Provide self tapping screws, bolts, and nuts, self- locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners as standard with the manufacturer designed to withstand design loads. Exposed fasteners on walls.

1. Provide metal-backed neoprene washers under heads of fasteners bearing on weather side of panels.

2. Use aluminum or stainless steel fasteners for exterior application and galvanized or cadmium plated fasteners for interior applications.

3. Locate and space fastenings in true vertical and horizontal alignment. Use proper type fastening tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.

4. Provide fasteners with heads matching color of roofing or siding sheets by means of factory applied coating.

F. Accessories: Provide the following sheet metal accessories factory formed of the same material and finish as the roofing and siding.

1. Flashings.

2. Closers.

3. Fillers.

4. Metal expansion joints.

5. Ridge covers.

6. Fascias.

7. Any additional accessories the manufacturer deems necessary to meet the general design criteria as outlined in the drawings.

G. Flexible Closure Strips: Provide closed-cell, expanded cellular rubber, self-extinguishing flexible closure strips. Cut or premold closure strips to match corrugation configuration of

roofing and siding sheets. Provide closure strips where indicated or necessary to ensure weathertight construction.

H. Sealing Tape: Provide pressure sensitive 100 percent solids grey polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, non toxic, non staining tape not less than 1/2" wide and 1/8" thick.

I. Joint Sealant: Provide one-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as recommended by the building manufacturer.

J. Liner Panels

1. Interior liner panels shall be standard non insulated, in locations shown on plans.

2.05 Sheet Metal Accessosries

A. General: Provide coated steel sheet metal accessories with coated steel roofing and siding panels.

B. General: Provide aluminum sheet metal accessories with aluminum roofing and siding panels.

C. Gutters: Form gutters in sections not less than 8 feet in length, complete with end pieces, outlet tubes and other special pieces as may be required. Join sections with riveted and soldered or sealed joints. Provide expansion-type slip joint at center of runs. Furnish gutter supports space at 36" o.c., constructed of same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at each outlet. Finish to match roof fascia and rake. Gutters shall be same manufacturer as metal building.

D. Downspouts: Form downspouts in sections approximately 10 feet long, complete with elbows and offsets. Join sections with not less than 1-1/2" telescoping joints. Provide fasteners, designed to securely hold downspouts not less than 1" away from walls; locate fasteners at top and bottom and at approximately 5 feet on center in between. Finish to match wall panels.

2.06 Fabrication

A. General: Design prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged and reassembled with a minimum amount of labor.

1. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams and instruction manuals.

B. Structural Framing: Shop fabricate structural framing components to the indicated size and section complete with base plates, bearing plates and other plates required for erection, welded in place. Provide required holes for anchoring or connections either shop drilled or punched to template dimensions.

1. Shop Connections: Provide power riveted, bolted or welded shop connections.

2 Field Connections: Provide bolted field connections.

PART 3 - EXECUTION

3.01 Erection

A. Framing: Erect structural framing true to line, level and plumb, rigid and secure. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use a non-shrinking grout to obtain uniform bearing and to maintain a level base line elevation. Moist cure grout for not less than 7 days after placement.

B. Purlins and Girts: Provide rake or gable purlins with tight fitting closure channels and fascias. Locate and space wall girts to suit door and window arrangements and heights. Secure purlins and girts to structural framing and hold rigidly to a straight line by sag rods.

C. Bracing: Provide diagonal rod or angle bracing in both roof and sidewalls as indicated.

1. Movement resisting frames may be used in lieu of sidewall rod bracing, to suit manufacturer's standards.

2. Where diaphragm strength of roof or wall covering is adequate to resist wind forces, rod or other forms of bracing will not be required.

D. Framed Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical or electrical work. Securely attach to building structural frame.

3.02 Roofing and Siding

A. General: Arrange and nest sidelap joints so that prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line. Protect factory finishes from damage.

1. Provide weatherseal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene or other closures to exclude weather.

B. Standing Seam Roof Panel System: Fasten roof panels to purlins with concealed clip in accordance with the manufacturer's instructions.

1. Install clips at each support using self-drilling fasteners.

2. At end laps of panels install tape calk between panels.

3. Install factory-calked cleats at standing seam joints. Machine seam cleats to the panels to provide a weather-tight joint.

4. Hand crimp panels at end of each working day. Permamently crimp as soon as possible.

C. Wall Sheets: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as necessary for waterproofing. Handle and apply sealant and back-up in accordance with the sealant manufacturer's recommendations.

1. Align bottoms of wall panels and fasten panels with blind rivets, bolts or self-tapping screws. Fasten flashings, trim around openings, and similar elements with self-tapping screws. Fasten window and door frames with machine screws or bolts. When building height requires two rows of panels at gable ends, align lap of gable panels over wall panels at eave height.

2. Install screw fasteners with power tool having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

D. Sheet Metal Accessories: Install gutters, downspouts, ventilators, louvers, and other sheet metal accessories in accordance with manufacturer's recommendations for positive anchorage to building and weathertight mounting. Adjust operating mechanism for precise operation.

E. Thermal Insulation: Install insulation concurrently with installation of roof panels in accordance with manufacturer's published directions. Install blankets straight and true in one-piece lengths with both sets of tabs sealed to provide a complete vapor barrier. Locate insulation on the underside of roof sheets, extending across the top flange of purlin members and held taut and snug to roofing panels with retainer clips. Install retainer strips at each longitudinal joint, straight and taut, nesting with roof rib to hold insulation in place. See Insulation Section for types.

3.03 Field Painting

A. General: Apply touch up finish coating to the following:

1. Structural framing components.

2. Finish colors shall be as indicated or, if not indicated, as selected by A/E from manufacturer's standards.

B. Cleaning and Touch-Up: Prior to application of finish coats, clean component surfaces of matter that could preclude paint bond.

1. Touch up abrasions, marks, skips or other defects to shop-primed surfaces with same type material as shop primer and paint.

C. Protection: Protect work of other trades. Correct painting related damages by cleaning, repairing or replacing, and refinishing, as directed by the Engineer.

D. Coordination: Provide finish coats that are compatible with prime paints used.

E. Surface Preparation: Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.

1. Remove hardware and accessories and similar items in place and not to be finish-painted, or provide surface-applied protection. Reinstall removed items.

F. Material Preparation: Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

G. Application: Apply painting and finishing materials in accordance with manufacturer's directions. Use applicators and techniques best suited for material and surfaces to which applied.

1. Apply additional coats when undercoats or other conditions show through final coat, until paint film is of uniform finish, color and appearance.

2. Finish exterior hollow metal doors on tops, bottoms and edges same as exterior faces.

3. Sand lightly between succeeding enamel or varnish coats. Thickness of not less than 2.5 mils for the entire coating system of prime and finish coats.

H. Dissimilar Materials: Where aluminum surfaces come in contact with ferrous metal or other incompatible materials, keep aluminum surfaces from direct contact by applications to the other material as follows:

1. One coat of zinc chromate primer, FS TT-P-645, followed by two coats of aluminum paint, SSPC-Paint 101.
2. In lieu of 2 coats of aluminum paint, apply one coat of high- build bituminous paint, SSPC-Paint 12, applied to a thickness of 1/16" over zinc chromate primer.
3. Backpaint aluminum surface where it is impractical to paint the other surface.

END OF SECTION 13120

SECTION 13200

OIL/WATER SEPARATOR

PART 1 - GENERAL

1.01 Description

A. Scope

1. CONTRACTOR shall furnish and install all materials, equipment and incidentals required to provide one oil/water separator (OWS). Also included is an elevated platform and walkway for the OWS and a recovered product storage tank.
2. The OWS and appurtenances will be Model SRC-30 as manufactured by Great Lakes Environmental of Addison, IL.
3. The OWS will be capable of removing non-emulsified oils to a concentration of 20 mg/L or less for 20 micron droplets at a maximum flowrate of 20 gpm.

B. Related Specifications

1. Section 09900 Painting and Protective Coatings
2. Section 11001 General Provisions - Equipment
3. Section 15060 Process Piping and Appurtenances
4. Section 15100 Valves

1.02 Quality Assurance

The OWS will be constructed from virgin materials and shall be tested at the factory for performance, water tightness of all compartments, fittings, and connections.

1.03 Submittals

A. General. Shop Drawings shall be submitted in accordance with the requirements of Division 1 of these specifications and the requirements specified in this Section.

B. Shop Drawings. Manufacturer's literature, illustrations, specifications, and engineering data for all equipment including:

1. Dimensions
2. Materials
3. Grade
4. Pipe Joints
5. Fittings
6. Couplings

C. Installation Manuals

1. Submit in accordance with the requirement of Section 01300 Submittals.

D. Operation and Maintenance Manuals

1. Submit in accordance with the requirements of Section 01300 Submittals.

1.04 Delivery, Storage, and Handling

A. Package OWS and appurtenances to protect from shipping and handling damage. Transportation of the OWS and appurtenances to the OWNER'S facilities shall be arranged by the CONTRACTOR.

B. Handle OWS and appurtenances with care to avoid impact damage or excessive localized stresses. Do not drop OWS or appurtenances. MANUFACTURER shall provide suitable lifting locations to enable mechanical or manual lifting of the OWS and appurtenances.

C. The CONTRACTOR shall carefully inspect the shipment upon arrival and immediately notify the carrier regarding damage. Do not accept or store items damaged in transit.

D. CONTRACTOR shall unload and store the OWS and appurtenances in accordance with the MANUFACTURER'S recommendations.

E. The CONTRACTOR shall be responsible for proper installation.

1.05 System Description

The OWS will be designed and fabricated per the following specifications, and shall be capable of treating water flows which vary from 0 to 20 gpm.

A. Influent Chamber. Influent flow enters the clog proof influent diffuser pipe via a 3" connection NPT and is immediately spreadout across the depth and width of the chamber. Any readily settleable solids drop to the bottom of the V-shaped solids accumulation chamber located directly under the coalescing media bundle.

B. Oil/Water Separation Chamber. The separation chamber is to be packed corrugated coalescing media with a minimum design surface loading rate of 0.05 gpm/square foot. The media pack will be designed to create a quiescent zone, a laminar flow pattern to facilitate the impingement of oil on the media, and will provide numerous impact sites and changes of flow direction. The media shall have a 45 degree (minimum) angle. The media shall not clog under operation conditions.

C. Solids Accumulation Chamber. The separator shall have a V-shaped solids accumulation chamber located under the coalescing media. This chamber will provide temporary solids storage. The chamber walls are to be pitched at 45 degrees to assure simple and thorough solids removal. The 3" NPT outlet from the solids accumulation chamber shall be equipped with a normally closed valve.

D. Clean Water Effluent Chamber. The cleansed water will flow under the oil baffle, over the water weir, and into the effluent chamber. The discharge from this chamber will be through a 3" NPT outlet and will flow by gravity and/or siphon to the equalization tank (T-10). Proper venting of this pipe will be required to insure flow is unobstructed.

E. Oil Reservoir. An integral oil reservoir is to be provided for the temporary storage of separated oils. The reservoir will have a bottom outlet to facilitate oil discharging by gravity to the product storage tank.

F. Separator Cover. The separator is to have a cover that provides complete closure of the tank. The separator cover will be mounted to the tank via quick release latches and shall be vapor sealed. Venting, if necessary, shall be provided.

G. Fittings. All wetted fittings must be integrally bonded to the tank. Gasketed fittings are not to be used.

H. Platform. A steel platform shall be provided to elevate the base of the oil/water separator as shown. A walkway shall be provided along one side of the platform. An access ladder and handrails shall be provided in accordance with all OSHA, state, and local requirements. Fabrication of the platform shall be in complete accordance with the Drawings and Division 5 - Metals.

I. Product Storage Tank. Oil removed by the OWS will flow by gravity to a 55 gallon drum for storage. The drum shall be constructed of polyethylene-lined steel and shall have a removable top with bungs.

PART 2 - PRODUCTS

2.01 General Requirements

All oil/water separation equipment shall be provided by one MANUFACTURER and shall be the standard product of the MANUFACTURER.

2.02 Project Conditions

The OWS will be located indoors, treating a groundwater from an array of four extraction wells. The purpose of the OWS is to intercept free NAPL which may be present. Recovered NAPL would be removed to an oil and grease concentration of 20 mg/L.

2.03 Materials and Equipment

All materials will be compatible with the water being treated and/or the resultant oil that is generated. The OWS shall be constructed of epoxy-coated steel or solvent resistant plastic with epoxy-coated steel, stainless steel, or solvent resistant plastic internals.

A. Fiberglass Construction. Tank shell, baffles, and cover shall be molded of premium grade DION 6694/95/FR resin with a minimum of 25% chopped fiberglass fiber to resin mix. An ultraviolet stabilized gel coat shall be used to coat the surfaces.

B. Steel Construction. Tank shell, baffles, and cover constructed of carbon steel shall be a minimum of 1/4" thick. The OWS exterior shall be coated with a coal tar epoxy. The OWS interior and internal steel components shall be coated with a zinc primer and a finish coating of polyurethane overcoat (Safety Blue) - 6 dmt min.

C. Stainless Steel Construction. Tank internals constructed of stainless steel shall be of Type 304 or 316 stainless steel and shall be a minimum of 1/4" thick. No coating are required for stainless steel components.

D. Piping. Internal/external piping shall be Schedule 80, grade 1 PVC, epoxy coated steel, or stainless steel. All connections to the tank will be with flanged connections.

E. Coalescing Media. Corrugated, oleophilic coalescing media shall be provided as manufactured by Great Lakes Environmental or equal, and will not clog under actual operating conditions.

F. Cover Gasketing. Vapor sealed cover gasketing shall be provided.

G. Platform. Carbon steel platform shall be provided to the dimensions shown on the Drawings. Factory supplied platform will be fabricated of welded carbon steel; sand blasted; shop primed, and finish coated in accordance with Section 09900 of these specifications. No support bolts will penetrate the OWS. The OWS shall be securely fastened to the platform, and the platform shall be securely fastened to the concrete splash pad using 3/4" SS diameter bolts, with SS nuts, and SS locking washers.

2.04 Accessories

One set of the MANUFACTURER'S recommended accessories shall be provided with the OWS.

2.05 Warranty

The MANUFACTURER shall warrant its products to be free of defect in materials and workmanship for a period of one year from the date of installation. The MANUFACTURER shall provide a five year warranty on the materials of construction.

PART 3 - EXECUTION

3.01 Installation

A. Prior to installation, CONTRACTOR will inspect equipment for damage or improper construction. If connections are necessary, MANUFACTURER and ENGINEER will be notified at once, and repairs will be made in accordance with the MANUFACTURER'S instructions and the ENGINEER'S approval.

B. CONTRACTOR shall mount tank to platform and platform to splash platform in accordance with MANUFACTURER'S instruction and recommendations.

C. The OWS shall be installed in the location indicated in Drawings and provided by the ENGINEER. Once installation is complete, any damages to the OWS shall be repaired in accordance with the MANUFACTURER'S recommendations.

3.02 Field Quality Control

A. The OWS and all related appurtenances will be tested and verified to be operational and free of leakage.

-- END OF SECTION 13200 --

SECTION 13205

INCLINED PLATE CLARIFIER SYSTEM

PART 1 - GENERAL

1.01 Description

A. Section includes:

1. Furnishing and installation of one Lamella-type gravity settler/thickener.
2. Testing of equipment.

B. Products furnished under this section:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide:
   a. One Lamella-type gravity settler/thickener.
2. Lamella-type gravity settler/thickener shall be furnished complete with vessels, piping, valving, flocculation tank, flocculator, control equipment and accessories as shown and specified. All equipment shall be furnished by the Manufacturer. The Contractor shall be responsible for the proper installation and operation of the complete flocculation/clarification unit.

C. Related sections:

1. Section 11001 General Provisions - Equipment.
2. Section 13415, Sequence of Operation.
3. Section 13420, Instrumentation.
4. Section 15010, Basic Mechanical Requirements.
5. Division 16, Electrical.

1.02 References

Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. American Society for Testing and Materials.
2. American Society of Mechanical Engineers.
3. American Water Works Association.

1.03 System Description

A. Description

1. Contractor shall furnish and install all materials, equipment, controls and incidentals required to provide one (1) Lamella-type gravity settler/thickener. The clarification unit will be constructed of 3/16" ASTM-A-36 steel with FRP plates. The clarification unit shall be furnished with a flocculation tank and flocculator as shown and specified. The

clarifier will be compete with controls, fittings, appurtenances, and accessories as supplied by the clarifier manufacturer.

2. The Lamella-type gravity settler will be of the design and construction of a Model 75/55 clarifier as manufactured by Parkson Corporation.

B. Performance requirements

1. Water temperature will be ambient (35-90°F).

2. Clarifier must have the capability to remove influent total suspended solids (TSS) down to an effluent concentration of $\leq$30 mg/L.

1.04 Submittals

The following is a list of submittals required for review by Engineer. Each submittal shall be reviewed, dated and stamped or signed by the Contractor and shall be conveyed with a transmittal cover sheet. The clarification unit will not be admitted to the job site until after approval of all submittals by Engineer.

A. Layout and all critical dimensions.

B. Materials of construction and total weight of constructed clarifier.

C. Details of openings constructed on filter.

D. Details of anchors and supports.

E. Certification of construction material flexural strength.

F. Three copies of comprehensive operations and maintenance manual including troubleshooting, cleaning, and parts replacement.

G. A detailed description of the pre-startup, startup and operating methods to be followed.

1.05 Quality Assurance

The unit shall be structurally designed for installation in Seismic Zone 4 in accordance with 1979 Uniform Building Code. Manufacturer to submit Seismic calculations upon request.

1.06 Delivery, Storage, and Handling

Transportation of clarification system to Owner's facility shall be arranged by Contractor. Engineer will inspect the clarifier system for damage or improper construction. Contractor shall arrange for unloading and storage per Manufacturer's recommendations. Contractor shall notify carrier regarding damaged or missing items.

PART 2 - PRODUCTS

2.01 Project Conditions

A. Lamella-type gravity settler/thickener

1. Clarifier, as shown on drawings, shall be designed, constructed, and installed for the service intended and shall comply with the following conditions:

Design Conditions

Location:	Interior
Use:	Provide clarification of groundwater to remove solids
Solid Type:	Lime Solids
Liquid Flowrate:	20 gpm
Influent TSS:	Approx. 850 mg/L
Effluent TSS:	$\leq$30 mg/L
Liquid Temperature:	35 to 90°F

2.02 Materials/Equipment

A. Lamella-type gravity settler/thickener

1. The Lamella Gravity Settler shall provide 75 square feet of total projected plate area. This area shall be divided to provide 60 square feet of clarification area and 15 square feet of inlet area. Plates shall be a minimum of 0.09" thick FRP. Plates shall be 5.5 feet long by 2 feet wide. Continuous PVC I-Beam stiffeners shall run the full length of the plates, forming a minimum flow profile ratio of 8:1. The stiffeners shall be placed on a maximum 12" centers. Plates shall be manufactured in rigid plate pack assemblies held together with nylon clips. The Lamella Gravity Settler tank shall be fabricated from ASTM A-36 steel. Minimum tank thickness shall be 3/16" Weldments shall be designed and performed in general conformance with AWS design standards. Continuous welds shall be used for all seal or structural support welds and intermittent welding for stiffener wells.

Surface Preparation

1. All carbon steel surfaces shall be sandblasted in accordance with the Steel Structures Painting Council Surface Preparation ANSI SSPC SP-06 "Commercial Blast Condition", latest edition, on all non-wetted surfaces and ANSI SSPC-SP10 "Near-white metal blast condition" for all wetted surfaces.

Painting and Coating

1. Exterior Surfaces:
   A. The base coat shall be DuPont High Solids Epoxy Mastic LF-63325P shale gray at a spread rate of 5-6 mils DFT.
   B. The finish coat shall be Dupont High Solids 50P Polyacryl Anhydride Enamel, Safety Blue at a spread rate of 1.5 - 2.5 mils DFT.
   C. Total DFT shall be 6.5 mils minimum average.
   D. Primer and paint shall be applied in accordance with coating manufacturer's recommendations.
2. Interior Surfaces:
   A. The base coat shall be DuPont High Solids Epoxy Mastic LF-63325P shale gray at a spread rate of 5-6 mils

B. The finish coat shall be DuPont Solids Epoxy Mastic LF-65M25P Safety Blue at a spread rate of 5-6 mils DFT.

C. Total DFT shall be 10.0 mils minimum average.

D. Primer and paint shall be applied in accordance with coating Manufacturer's instructions.

B. Sludge Hopper

1. The Lamella-type clarifier shall be furnished with a sludge collection hopper. The Lamella Gravity Settler sludge hopper shall be fabricated from ASTM A-36 steel. Minimum hopper thickness shall be 3/16". The sludge hopper shall provide a minimum of 50 gallons of sludge storage.

C. Flocculation Vessel/Flocculator

1. The clarification system shall be equipped with an integral flocculator tank and mixing system. The flocculator mixer shall be a variable slow-speed unit comprised of a turbine-type mixer with a hollow shaft gear reducer, 1/2 HP. Electrical requirements shall be 460V, three phase, 60 Hz. Motor enclosure to be TEFC.

PART 3 - EXECUTION

3.01 Installation

Installation will be performed in complete conformance with Manufacturer's instructions at the location specified in the drawings. The work shall be conducted by competent, trained, workmen, skilled in the field to which they are executing the work. The equipment shall be properly and securely installed such that undue stresses are not exerted on the equipment and connections.

3.02 Shop Testing

A. All seal welds are to be visually and dye-penetrant tested.

B. All tankage is to be shop-hydrostatically tested.

3.03 Field Quality Control

A. Prior to installation, Contractor will inspect clarification/flocculation system for damage or improper construction. If corrections or repairs are necessary, Manufacturer and Engineer will be notified at once.

B. Prior to installation, repairs and modifications shall be made in accordance with Manufacturer's instructions and Engineer's and Owners approval.

3.04 Demonstration

During system start-up, the clarification/flocculation system will be demonstrated to work properly.

– END OF SECTION 13205 –

SECTION 13210

SLUDGE SETTLING TANK SYSTEM

PART 1 - GENERAL

1.01 Description

A. Section includes:

1. One modular steel solids thickener tank 8 feet diameter, 10 feet straightside, cone bottom, on structural steel legs.
2. Thickener tank internals including assembly, sludge collector, and effluent launder.
3. Furnishing and installation of thickener
4. Testing of equipment

B. Products furnished under this section:

1. Contractor shall furnish all labor, materials, equipment, and incidentals required to provide:
   a. One modular steel solids thickener system.
   b. Modular steel solids thickener shall be furnished complete with tank, piping, valves, control equipment and accessories as shown and specified. All equipment shall be furnished by the Manufacturer, who shall assume responsibility for proper operation of the complete unit.

C. Related sections:

1. Section 09900, Painting
2. Section 11001, General Provisions - Equipment
3. Section 13415, Sequence of Operation
4. Section 13420, Instrumentation
5. Division 15, Mechanical
6. Division 16, Electrical

1.02 References

Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. American Society for Testing and Materials
2. American Society of Mechanical Engineers
3. American Water Works Association
4. Occupational Safety and Health Act
5. National Electric Code
6. Institute of Electrical and Electronic Engineers
7. American National Standard Institute

1.03 System Description

A. Description

1. The Contractor shall furnish and install the factory fabricated thickener, complete with connecting piping and appurtenant work as detailed on the drawings and specified herein.

2. The thickener tank shall be 8 feet diameter, cone bottom, 10 feet straightside, with cone bottom and straightside ports as shown on the drawings. The thickener tank shall come complete with structural steel legs designed to support live and static operational loads.

3. The modular steel solids thickener will be as manufactured by Davco Division, Davis Water and Waste Industries, Inc., Thomasville, Georgia.

B. Performance requirements:

1. Water temperature will be ambient (35 to 90°F).

2. Agitation will be required to prevent bridging of inorganic settled solids (lime and metal hydroxides).

3. Vessel and piping will be free of any leaks.

1.04 Submittals

The following is a list of submittals required for review by Engineer. Each submittal shall be reviewed, dated and stamped or signed by the Contractor and shall be conveyed with a transmittal cover sheet. The unit will not be admitted to the job site until after approval of all submittals by Engineer.

A. Layout and all critical dimensions.

B. Materials of construction and total weight of modular solids thickener.

C. Details of all openings constructed on tank.

D. Details of anchors and supports.

E. Certification of construction material flexural strength.

F. Control details and wiring diagrams.

G. Performance data (motor data, gear reducer data).

H. Shop drawings.

1. The Contractor shall submit a minimum of six (6) copies of all shop drawings to the Engineer for approval. Each set of shop drawings shall include, but not necessarily be limited to:

a. Drawings showing dimensions of all major components and minimum required spacings.

b. Complete installation instructions including anchor bolt layout, piping details, and mechanical connections.

c. Electrical control data covering the following details:

i. Approximate enclosure dimensions including height, width, and depth.

ii. Maximum wire size (main terminal block or disconnect device).

iii. Air circuit breaker data including: function, reference designator, frame size, poles, rated current, and estimated load.

iv. Motor starter data including: function, reference designator, NEMA size, service voltage, phase, number of overload heaters, and coil voltage.

v. Motor data including: function, horsepower, phase, frequency, voltage, approximate full load current, service factor, nominal RPM, frame size, NEMA speed torque design, and insulation class.

vi. A control schematic diagram shall be provided that shows power and control circuits in sufficient detail to evaluate the control system design. Control schematic shall be color coded.

d. Performance data covering all internal mechanical components

1.05 Delivery, Storage, and Handling

Transportation of system to Owner's facility shall be arranged by Contractor. Engineer will inspect unit for damage or improper construction. Contractor shall arrange for unloading and storage per Manufacturer's recommendations. Contractor shall notify carrier regarding damage or missing items.

1.06 Warranty

The Manufacturer of the equipment shall warrant for one year from date of start-up or 18 months from date of shipment, whichever occurs first, that the equipment will be free from defects in design, material, and workmanship.

PART 2 - PRODUCTS

2.01 Materials/Equipment

The thickener shall be prefabricated in the factory of the Manufacturer and shall be shipped complete and operable as detailed on the drawings and specified herein. The principal items of equipment shall include mechanical sludge collector, central electric control panel, all internal rakes, piping and valves.

A. Outer Steel Wall

1. The outer steel wall shall be structurally designed to withstand full hydrostatic forces applied from either side of the wall. The method used to initially fill the thickener with liquid may be selected by the Engineer to test the hydrostatic design. The minimum wall thickness shall be 1/4" ASTM A36 steel plate.

2. All shop welds shall have burrs, spatter, etc. removed prior to blasting. All chain or skip welds on surfaces above water level or on an outer surface shall be caulked prior to painting.

B. Influent Assembly

1. The thickener influent piping shall be designed to prevent liquid backup in the influent system during peak flows and to prevent settling out of solids that may clog the pipe. From the inlet point at the outer wall of the tank, the inlet pipe runs horizontally toward the center of the thickener, vertically upward into the stilling well, and discharges downward into the thickener through the bottom of the stilling well.

C. Sludge Collection Mechanism

1. The sludge collector mechanism shall be a center collection type to facilitate the rapid return of sludge from the thickener back to the sludge sump. The unit shall consist of all mechanical equipment required for operation including complete gear reduction drive unit, drive center shaft, truss type sludge scraper arms with thickening pickets, return sludge pipe and collection sump.

2. The mechanism shall be centered in the thickener tank and shall be supported by the bridge structure. The shaft shall extend to the bottom of the thickener at which point it shall be pivoted in such a manner as not to introduce binding.

3. Torque shall be calculated based on the formula WR^2 where W = 30 # of loading per foot of collector arm length and R = the radius of the tank.

4. The sludge collector drive unit shall consist of a triple reduction reducer with integral motor coupled to the sludge collector center shaft. The reducer shall be rated for the minimum running torque as calculated above.

5. The reducer shall be equipped with two sets of overload contacts. The first set shall close upon reaching rated torque and shall sound an alarm. The second set of contacts shall close when the system reaches 110% of rated torque. These contacts shall shut down power to the reducer motor in order to prevent damage to the mechanism.

6. The reducer shall also be equipped with a torque indicating gauge for direct readout of operating torque.

7. The drive motor shall be a TEFC, C face motor directly coupled to the drive unit. The motor shall operate on 460/volt, 3 phase power supply. Horsepower shall be as required to produce the design torque, but shall be a minimum of 3/4 Hp.

8. The thickener shall be provided with two rotating truss type scraper arms. The rotating scraper arms shall be attached to and supported by a center shaft designed to support and rotate the scraper arms under maximum load conditions with an adequate factor of safety. The scraper arms shall be fabricated from structural steel members to provide support for scraper blades. Blades shall be provided on the rotating arms to move settled solids to the center collection point. The blades shall be spaced on each arm such that settled solids are collected over the full area of the basin by each arm. The scraper arm outer ends shall be radially adjustable. Thickening pickets shall be attached to the scraper arms to aid in concentrating the solids.

9. The solids shall be moved toward the center of the clarifier by means of scraper blades at the rate of two blade separation distance per revolution. Solids shall be collected in the thickener center sump and removed from the sump by means of a solids drawoff pipe. A scraper shall be provided in the sump to move solids to the pick-up point.

D. Effluent Launderer

1. A thickener effluent launderer shall be provided around the inside periphery of the thickener to collect the clear supernatant. The launderer shall be designed to carry the expected peak flow without becoming submerged. A serrated weir shall be attached to the side of the launderer and shall be vertically adjustable for leveling.

E. Stilling Well

1. The stilling well shall be designed to provide an area of velocity dissipation for the liquid entering the clarifier and to prevent short-circuiting from the center to the weir. The stilling well shall be fixed to the bridge.

F. Bridge

1. The access bridge shall be made of structural steel shapes and shall be supported on the plant walls. The bridge shall extend across the thickener as shown on the drawings.

2. Access to the bridge shall be provided as shown on the drawings. The bridge shall have a walkway surface of 1 x 3/16 aluminum bar grating and shall be designed to withstand a uniform live load of 75 lbs. per square foot plus the dead load of the structure and to conform with all applicable OSHA requirements. The deflection shall not exceed 1/360 of the unsupported span when the design loads are applied. The bridge shall be provided with aluminum handrails on both sides and each handrail shall consist of an upper and intermediate rail and vertical posts. Rails and post shall be fabricated from 1 1/2" diameter schedule 40, anodized aluminum pipe. Toeplate fabricated from 4" x 1/4" anodized aluminum shall be provided.

G. Surface Preparation/Finishing

1. All steel surfaces shall receive a near white blast to remove rust, mill scale, and weld slag. All weld splatter and surface roughness shall be removed by chipping and grinding smooth. Blasting shall be accomplished indoors using steel shot to produce a mil profile for optimum adhesion of the primer. Sand blasting shall not be accepted.

2. All prepared surfaces shall be thoroughly dry and free from preparation dust and foreign matter prior to the application of any coating. Craftsmen applying protective coating shall be thoroughly familiar with the application guidelines and preparation requirements of the product to be applied. All materials shall be evenly applied and shall be free from obvious defects.

3. Protective coatings shall not be applied to improperly prepared surfaces or during conditions considered to be not conducive to sound painting practices or in fog, rain, snow, mist, or when the surface temperature is less than 40°F or the humidity exceeds 85%.

4. Immediately after surface preparation, a polyamine-cured high-build epoxy designed for protection of steel shall be applied. No discoloration of the cleaned areas shall occur prior to the application of this coat. All steel surfaces shall receive a 3 mil dry film thickness of this protective coating.

5. After surfaces are suitable for top coating, a 3 mil dry film thickness of polyamine-cured high-build epoxy of the specified color shall be applied.

6. Total dry film thickness of the coatings shall be 6 mils. Dry film thickness of all coats shall be made by employing standard calibrated dry film thickness gauges.

7. A paint touch-up kit shall be provided for repair of any scratches or mars that occur during shipment or installation. Detailed instructions shall be included and the materials shall be compatible with the coatings as outlined above.

H. Electrical Controls

1. The control system shall include but not be limited to solids collector controls. Design, fabrication, and installation of all electrical components shall be in accordance with the revision of the National Electric Code that is current at the time of award of contract.
2. The revision of the National Electrical Code that is current at the time the job is submitted will be used to evaluate the submittal and for construction of the approved design.
3. The control system shall include necessary starters, breakers, HOA switches, and relays to control the specified functions of the clarifier drive unit. The controls shall be housed in a NEMA 3R enclosure and shall be mounted on the handrails adjacent to the drive unit.
4. A 110 volt, red light and horn unit shall be mounted on the control panel to signal thickener drive malfunction. A duplex weatherproof receptacle shall be mounted on the side of the control enclosure.
5. The enclosure shall be designed for 460/volt, 3 phase, electrical service.

PART 3 EXECUTION

3.01 Installation

Installation will be performed in complete conformance with manufacturer's instructions, at the location specified in drawings provided by Parsons Engineering Science.

3.02 Field Quality Control

A. Prior to installation, CONTRACTOR will inspect system for damage or improper construction. If corrections or repairs are necessary, MANUFACTURER and ENGINEER will be notified at once.

B. Prior to installation, repairs and modifications shall be made in accordance with MANUFACTURER'S instructions and ENGINEER'S and OWNER's approval.

3.03 Demonstration

During system start-up, Thickener system will be demonstrated to work properly. MANUFACTURER'S representative shall provide training to OWNER'S personnel in use of Thickener system.

– END OF SECTION 13210 –

SECTION 13290

PRESSURE FILTRATION SYSTEM

PART 1 GENERAL

1.01 Description

A. Section includes:

1. Two multi-media pressure filters with supports, immediate valves and piping, and appurtenances as specified.

2. Four electro-mechanical, actuated control valves and an electronic controller configured to automatically operate the filter system in an alternating active filter / stand-by filter mode.

2. Furnishing and installation of multi-media pressure filters and appurtenances.

3. Testing of equipment.

B. Products furnished under this section

Contractor shall furnish all labor, materials, equipment and incidentals required to provide two multi-media pressure filters that shall be furnished complete with vessels, piping, valves, media, control equipment and accessories as shown and specified. The system shall operate automatically, using only one filter at a time. When the active filter becomes loaded with solids and requires backwashing, the system shall automatically actuate valves to bring the stand-by filter on-line and take the loaded filter off-line. The system shall automatically perform a backwash cycle on the loaded filter, using potable water. The newly-backwashed filter will then become the stand-by filter. All equipment shall be furnished by the filter manufacturer, who shall assume responsibility for proper operation of the complete filtration system.

C. Related sections

1. Section 11001, General Provisions - Equipment

2. Section 13415, Sequence of Operation

3. Section 13420, Instrumentation

4. Section 15060, Process Piping

5. Division 16, Electrical

1.02 References

Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. American Society for Testing and Materials

2. American Society of Mechanical Engineers

3. American Water Works Association
4. Occupational Safety and Health Act
5. National Electric Code
6. Institute of Electrical and Electronic Engineers
7. American National Standard Institute

1.03 System Description

A. Description

1. CONTRACTOR shall furnish and install all materials, equipment, controls and incidentals required to provide two multi-media pressure filters with automatic backwash. Each filter vessel will be constructed of welded carbon steel or composite material. Piping and valving will be 2" steel or 2" Schedule 80 PVC.. The filter media will consist of sand, garnet, PVC pellets, and anthracite coal media as specified. The automated backwash system will initiate a vessel change (from the loaded filter to the standby filter) and backwash the loaded filter when the operator-adjustable pressure differential set-point is reached by the loaded filter. The filter system will be complete with automatic filter isolation and backwash controls, actuated valves, fittings, appurtenances and accessories as supplied by the filter manufacturer.
2. The multi-media pressure filter system will be of the design and construction of two Model 2-CDM-36 Multi-Media Filters with automatic isolation and backwash controls by U.S. Filter.
3. Each pressure filter will have a double dish underdrain system and support bed.
4. Each pressure filter will have structural features as specified, including lifting lugs. The tank and support structure will be designed to safely bear live loads from filtration and backwash operations.
5. The pressure differential set-point to initiate filter isolation and backwash shall be easily operator-adjustable at the filter system control unit.

B. Performance Requirements

1. Water temperature will be ambient (35 - 90 F).
2. Pressure Filter system will perform process filtration and automatic backwash based on pressure differential.
3. Vessel and piping will be free of any leaks.
4. Each multi-media filter must have the capability to remove particles down to 50 microns.

1.04 Submittals

The following is a list of submittals required for review by ENGINEER. Each submittal shall be reviewed, dated and stamped or signed by the CONTRACTOR and shall be conveyed with a transmittal cover sheet. The filter system will not be admitted to the job site until after approval of all submittals by ENGINEER.

A. Equipment and piping layout with all critical dimensions.

B. Materials of construction and total weight of constructed filter system.

C. Details of all openings constructed on filters.

D. Details of electro-mechanical actuated control valves.

E. Details of anchors and supports.

F. Electrical schematic(s) of automatic filter isolation and backwash controller.

G. Certification of construction material flexural strength.

1.05 Quality Assurance

The pressure filter will be designed for zone one seismic forces and will conform to the latest edition of AWWA B100-89 Standard for Filtering Material.

1.06 Delivery, Storage, and Handling

Transportation of tanks to OWNER'S facility shall be arranged by CONTRACTOR. ENGINEER will inspect filter system for damage or improper construction. CONTRACTOR shall arrange for unloading and storage per MANUFACTURER'S recommendations. CONTRACTOR shall notify carrier regarding damage or missing items.

PART 2 - PRODUCTS

2.01 Project Conditions

A. Filtration system shall be specially designed, constructed and installed for the service intended and shall comply with the following conditions:

Design Conditions

Location:	Indoor (heated)
Use:	Filtration of groundwater treated with hydrated lime and processed through inclined-plate clarifier. Filtration to remove solids 50 microns and larger. Groundwater pH to range from 6 to 10.
Liquid Temperature:	35 to 90 F
No. Required	Two, operated through central controller
Operating Method	Automatic backwash and cycling based on pressure differential

Multi-Media Pressure Filter Features

Filter Column Diameter:	36 inches
Tank Height:	36 inches (approximate)
Mounting:	Support legs

Filter Media

Total bed depth of 3.0' to consist of anthracite, fine sand, garnet, and coarse sand in proportions as recommended by the filter manufacturer. PVC pellet filter media shall be omitted from these filters due to possible incompatibility with low concentrations

of chlorinated and non-cholorinated organic compounds present in the groundwater. All filter media must meet AWWA Std. No. B 100-89.

Underdrain	welded, double-dish design
External piping	2" galvanized steel or Schedule 80 PVC
Valves	2" polypropylene ball valves with electro-mechanical actuators

B. Filtration unit shall be designed for continuous 24 hours per day operation. Actual process flow through filter system will cycle on and off with the level-controlled operation of pumps P-20 and P-21.

2.02 Materials/Equipment

A. Filter vessel:

Two cylindrical, 36" I.D. vessels, with domed ends. Sealable top port of at least 11" x 15" (oval) diameter to facilitate media change-out. Sealable handhole on straightside. 2" flanged inlet fitting on top or straight-side of vessel, 2" flanged outlet fitting either on bottom of vessel. The vessel will have support legs sized to give safe support to the filter vessel and contents during operation. Any interior ferrous surfaces will be sandblasted and given a shop-applied coating, 12 mil thick, of black coal tar epoxy. All exterior ferrous surfaces will be given one coat of epoxy primer followed by a finish coat of epoxy paint (4-6 mil d.f.t.). The pressure filter vessel shall be able to withstand 100 psig pressure, and shall be designed and fabricated in accordance with appropriate ASTM and ASME standards.

B. Filter media and underdrain:

Drainage of filter media and prevention of media loss via discharge will be achieved with a non-corrosive welded, double-dish underdrain system all surrounded by gravel or coarse sand support. Above the support will be layers of coarse sand, garnet, fine sand, and anthracite.

D. External piping:

External piping of 2" diameter will be plumbed to provide process flow through each filter and also for backwash flow. Piping that is used for both flows will also be 2" diameter. Joints will be flanged or threaded at the filter vessel shell and valve connections. Pipe supports will be installed where necessary in order to provide a rigid structure.

E. Valves

The valves for isolating a filter from the process flow in this filter system will be 2" electro-mechanical actuated ball valves as provided by the filter manufacturer. The actuators will be operated by the automatic backwash control system.

F. Backwash system and controls:

The filter system control unit shall be positioned at the filter system.

A pressure differential sensing device will be installed on the main inlet and outlet pipes of the two-filter system. At a differential pressure set-point that will be easily operator-adjustable, the backwash system will perform a programmed series of valve changes to bring the stand-by filter on-line and isolate the loaded filter. The loaded filter will then be backwashed using plant water

supply. After the backwash period has elapsed, the multi-port valve of the newly backwashed filter will be positioned to accept process flow but the electro-mechanical actuated isolation valves shall remain closed (thereby keeping the newly backwashed filter in stand-by mode).

The automatic backwash control system will include a manual override control for the operator to initiate a backwash cycle.

PART 3 EXECUTION

3.01 Installation

Installation will be performed in complete conformance with manufacturer's instructions, at the location specified in drawings provided by the ENGINEER. During media installation, the CONTRACTOR shall perform separate backwashes after the placement of each media type to provide effective removal of media fines.

3.02 Field Quality Control

A. Prior to installation, CONTRACTOR will inspect pressure filter system for damage or improper construction. If corrections or repairs are necessary, MANUFACTURER and ENGINEER will be notified at once.

B. Prior to installation, repairs and modifications shall be made in accordance with MANUFACTURER'S instructions and ENGINEER'S and OWNER's approval.

3.03 Demonstration

During system start-up, the pressure filtration system will be demonstrated to work properly during filtration and automatic backwash cycle. MANUFACTURER'S representative shall provide training in the use of the system to personnel designated by OWNER.

-- END OF SECTION 13290 --

SECTION 13295

GRANULAR ACTIVATED CARBON SYSTEM

PART 1 - GENERAL

1.01 Summary

A. Section Includes:

Furnishing a complete and operable granular activated carbon adsorption system including materials and service for the fabrication, delivery, unloading, storage, installation, and startup of all equipment. The system includes, but is not limited to the following:

1. Granular activated carbon adsorption system including two (2) downflow carbon-adsorption vessels with distribution underdrain and activated carbon.
2. Influent and effluent piping including interconnection piping and valves between adsorption vessels to allow them to be operated in series with either vessel in the lead or lag position, without repiping.
3. Granular activated carbon fill and discharge piping and valves.
4. Vent and safety relief piping, rupture disk, pressure gauges, sample taps, water piping and connection.
5. 2000 pounds (minimum) of granular activated carbon per vessel.
6. Necessary piping and water connections to allow hookups for backflushing of either carbon adsorption vessel.
7. Carbon eduction system.
8. Bulk-back bin carbon storage vessel.
9. Structural supports.
10. List of recommended spare parts.
11. Partial pre-assembly of system on a steel skid for ease of shipment and installation (Carbon shipped separately for field installation).
12. Assembly/arrangement drawings for installation.
13. Complete set of technical specifications and manual for operation and maintenance.
14. Experienced technical assistance as required.

B. Related Specifications:

1. Section 09900 Painting and Protective Coatings
2. Section 11001 General Provisions - Equipment
3. Section 15060 Pipes and Appurtenances
4. Section 15100 Valves

1.02 References

A. American Society for Testing and Materials

B. American Society of Mechanical Engineers

1.03 System Description

A. Design Requirements:

The MANUFACTURER shall provide a pre-engineered factory-built granular activated carbon (GAC) adsorption system with all the necessary equipment required for the removal of volatile organic compounds (VOCs) and semi-volatile organic compounds (SEMI-VOCs) from the groundwater. The carbon adsorption system shall consist of a single, shop-assembled, field-connected package. The carbon adsorption system shall be shop assembled and tested. The system shall be brought to the site in reasonably sized components which can be field connected using bolted and flanged connections. The carbon adsorption system shall be mounted in the treatment plant building and consist of two carbon adsorption vessels; activated carbon; interconnecting piping and valves; controls for the adsorption system; a carbon eduction system; bulk-back bin carbon storage facilities; and other equipment necessary to provide a complete functional package. The system shall be designed to allow for two-stage or parallel operation for efficient carbon usage and ease of granular activated carbon exchange. The adsorption system piping shall enable the unit(s) to be backflushed when required. The MANUFACTURER shall be responsible for all detail and component design to provide a complete, functional system and for inspection, instruction on operation, start-up supervision, maintenance manuals and all other items as hereinafter called for in the Specifications or shown on the Drawings.

B. Design Parameters:

The groundwater shall be pumped to the granular activated carbon adsorption unit where VOCs and SEMI-VOCs will be removed. The carbon adsorption units shall be operated in series until breakthrough occurs in the first adsorber. Following breakthrough, the first adsorber shall be taken off-line while the carbon is replaced. The flow shall be diverted to the second column during the carbon transfer event. Either adsorber shall be capable of being placed in the lead or lag position. The adsorbers shall be designed for manually-controlled backflushing to remove top surface loading .

C. Seismic Design:

All structural systems shall be designed for Seismic Zone 3 loads in conformance with Division 15.

D. Liquid-Phase Carbon Adsorption System Design:

Design Parameter	Value
Flow Rate, gpm	20
Operation, hr/day	24
Operation, day/yr	365

Contaminants of Concern	Maximum Influent Conc. (µg/L)	"Draft" Effluent Conc. at 20 gpm Flow (µg/L)
Chlorobenzene	20,000	10
Benzene	920	10
2-Chlorophenol	1,300	30
1,2-Dichlorobenzene	1,000	10
2,6-Dinitrotoluene	620	30
2,4-Dinitrotoluene	140	30

Estimated carbon utilization rate - one 2,000 lb. GAC vessel every 8.5 days at 20 gpm flow rate.

1.04 Submittals

The following is a list of submittals required for review by Engineer. Each submittal shall be reviewed, dated and stamped or signed by the Manufacturer and shall be conveyed with a transmittal cover sheet. Equipment and materials will not be admitted to the job site until after approval of all submittals by Engineer. Manufacturer shall provide four copies of all submittals to Engineer and one to Owner.

A. Manufacturer's descriptive data and technical literature showing conformance to design and materials and construction, including activated carbon characteristics.

B. A complete listing of equipment and materials. Drawings showing location and size of piping and valves as required to demonstrate that the equipment has been coordinated with other equipment and will properly function as a unit. Required clearances for maintenance and operation shall be shown on the Drawings.

C. Proposed diagrams, instructions, and other sheets, prior to posting. Approved control diagrams showing the complete layout of the entire system, including equipment, piping, valves, and control sequence, framed under glass or in approved laminated plastic, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

D. Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

E. Six complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment. One complete set at the time the tests procedure is submitted; remaining sets before the contract is completed. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", name and location of the building, name of the Contractor, and contract number. Flysheets shall be placed before instructions covering each subject. Instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. Instructions shall include, but not be limited to, the following:

1. System layout showing piping, valves, and controls.
2. Approved control diagrams.
3. A control sequence describing startup, operation and shutdown.
4. Operating and maintenance instructions for each piece of equipment, including carbon changeout instructions and troubleshooting guide.
5. Manufacturer's bulletins, cuts, and descriptive data; and parts list and recommended spare parts.

1.05 Quality

The Carbon Adsorption System MANUFACTURER shall have a minimum of five years experience in providing granular, activated carbon systems of similar size to treat similar waste flows.

1.06 Delivery, Storage and Handling

Transportation of carbon adsorption system to the owner's facility shall be arranged by Contractor. Engineer shall inspect carbon adsorption system for damage or improper construction. Contractor shall arrange

for unloading and storage per Manufacturer's recommendations. Contractor shall notify carrier regarding damaged or missing items.

Deliver materials to the site to ensure uninterrupted progress of the work.

A. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete in ample not time to delay the work.

PART 2 - PRODUCTS

2.01 Processing Description

The adsorption system shall remove the VOCs and SEMI-VOCs from the extracted groundwater prior to discharge. The granular activated carbon adsorption system will consist of two process vessels (adsorbers) operated in series or parallel. Each adsorber will contain a minimum of 2,000 pounds of granular activated carbon (GAC). By running in series, the first vessel can be loaded to capacity, thereby optimizing the carbon usage. The GAC system is preceded by an oil/water separator, inclined plate clarification system, and a pressure filtration system to remove non-aqueous phase liquids and suspended solids.

Water will enter the lead vessel at the top and flow downward through the carbon bed. An internal underdrain system is provided to collect the treated water. The treated water is then conveyed to the top of the second stage or polish vessel. The treated water will flow downward through the second bed of granular activated carbon and is discharged from the system through the effluent piping.

The adsorption system design will provide for a total contact time of approximately 50 minutes given a groundwater flow rate of 20 gpm. The contact time is calculated on a "superficial" or "empty bed contact time" basis.

When the lead column becomes saturated with contaminants adsorbed from the water, this vessel will be taken out of service to replace the spent granular activated carbon with fresh granular activated carbon. The entire flow will be diverted to the second stage absorber allowing the treatment system to remain in service. The lead vessel will be pressurized to between 15-30 psig with utility air and the spent carbon is displaced into the receiving container (empty bulk-back bin). Fresh carbon can be transferred as a slurry from a full delivery container (bulk-back bin) to the empty adsorber utilizing an eductor system.

After the column has been recharged, the system valving will be adjusted so that the fresh bed is placed in the second stage or polish position. On each subsequent carbon bed replacement, the column receiving the fresh carbon will be placed in the polish position.

Each column will contain appropriate piping to allow backflushing when the bed pressure drop attains a predetermined level. Adsorption beds will be equipped with pressure gages to measure operating pressure loss. Backflushing shall utilize process water at a pressure of 10-30 psi and flow of 125 gpm. Backflush duration will be no longer than 20 minutes.

2.02 Materials/Equipment

A. Adsorption Vessels:

The adsorption equipment provided shall be two adsorber vessels, pre-piped with all process, carbon transfer and utility piping to comprise a complete two-stage adsorption system and mounted on a structural steel skid for unitized shipment and installation. Each vessel shall include two 14" x 18" elliptical manways as well as connections for valves, pipes, and measuring instruments.

1. Dimensions - Each tank shall be sized to treat the 20 gpm flow rate, and as a minimum, the adsorbers shall be 4 ft. diameter cylindrical pressure vessels with flanged and dished ASME Code top and bottom heads. The vessel straight side height shall be nominally 8 feet.

2. Materials of Construction - The vessel shall be constructed using a vinyl ester coated mild steel or other approved resistant material.

   a. The vessels shall be designed, constructed and stamped in accordance with the ASME Code, Section VIII for a design pressure rating of 75 psig at 150 degrees F.

   b. The column shall be equipped with a manway located approximately 4 ft. from grade for maintenance access. The manway shall be an elliptical manway, 14"x18". The top nozzles shall be flanged with 150# lap joint flanges, and side and bottom nozzles shall be 150# pad flanges. The top center nozzles shall be equipped with 1-1/2" diameter polypropylene pipe and a polypropylene full cone spray nozzle.

   c. Columns shall be constructed of carbon steel and shall have all welds and any other sharp edges ground smooth, and all imperfections such as skip welds, delimitations, scabs, slivers and slag corrected prior to abrasive blasting. All surfaces are to be degreased prior to sandblasting. The adsorber internal surface shall be blasted to a white metal surface (SSPC-SP5) to provide an anchor pattern in the metal corresponding to approximately 4 mil film thickness of the coating.

      Immediately after sandblasting, the interior surface shall be coated with the first multi-pass spray coat of an abrasion-resistant protective coating per manufacturer's instructions to produce a 35 to 40 mil dry film thickness. This coating is a vinyl ester resin and inert flake pigment coating which exhibits excellent chemical resistance to a wide range of water solutions, and meets requirements of the U.S. Federal Register, Food and Drug Regulations Title 21, Chapter 1, Paragraph 175.300.

      The second multi-pass spray coat shall be applied per manufacturer's instructions to produce a finished coating of 10 to 12 mil dry film thickness for immersion service.

   d. In the event that coated mild steel is used as the vessel material, vessel exteriors shall be painted per Fed. Spec. TT-E-496, Type II (two coats).

3. Carbon - A minimum of 2,000 pounds of granular activated carbon shall be provided and installed within each adsorber vessel. The activated carbon shall be virgin, granular intended for liquid-phased application, and manufactured from bituminous coal. The activated carbon shall conform to the following specifications:

Iodine No. (minimum)	750
Abrasion No. (minimum)	75
Effective Size	0.8 - 0.9 mm
Screen Analysis	
on 8 mesh (maximum %)	15
through 30 mesh (maximum %)	4
Water Soluble Ash (maximum %)	9
Moisture, as packed (maximum %)	2

The delivered activated carbon must be accompanied by an analysis sheet certifying compliance with the Specifications. Carbon type and supplier shall be approved by the ENGINEER.

4. Carbon Supports - The underdrain distributor system shall be constructed of 3" diameter, Schedule 80 solid PVC pipe with all joints to be solvent cemented. The water shall be collected by a minimum of 15 polypropylene slotted nozzles located in the underdrain piping. These nozzles shall retain the granular activated carbon, allow water flow with a minimum of pressure drop, and be installed in a threaded pipe tap for ease of replacement.

5. Steel Skid Installation - The two adsorbers and associated piping (with the exception of bottom discharge piping) shall be preassembled on a steel skid for unitized shipment and installation. The steel skid shall be constructed of C6x13 channel iron for mounting on a concrete pad. Slots shall be provided in the lower channel flange for permanent installation to anchor bolts in the concrete pad, if required.

6. Carbon adsorption system shall be a Model 4 as manufactured by Calgon Carbon of Pittsburgh, Pennsylvania.

B. Piping:

The process and utility piping on the Adsorption System shall include influent water to the system and treated water (2"), adsorber vent lines (2"), utility water to each adsorber (1-1/2"), compressed air piping (1/2") and granular activated carbon supply and discharge piping (2"). All process piping shall be solid PVC Schedule 80 piping Class 12454-B per ASTM D1785, rated for 150 psig service at 75 degrees F. All joints and fittings shall be of the socket type with solvent cementing for installation.

All valving for the adsorption system shall be PVC regular port ball valves per ASTM D1784, Type 1, Grade 1, with solid PVC body, PVC ball and stem, Teflon seats and Viton seals. The granular activated carbon fill and discharge piping shall be equipped with 2" nylon male "Kamlok" style hose connectors for hose transfer operations.

C. Bulk Back Bin Unloading Stand:

The carbon adsorption system shall be furnished with a bulk back bin unloading stand. The stand shall be capable of receiving standard stainless steel or polyethylene bulk back carbon bins that hold 2,000 pounds of GAC). Bulk back unloading stand shall be as manufactured by Calgon Carbon of Pittsburgh, Pennsylvania, or pre-approved equivalent.

D. Carbon Eduction System

Carbon adsorption system shall be equipped with a water educator facilitate transfer of carbon from bulk back bin into empty adsorber column. Eductor shall at a minimum have the following performance parameters:

Eductor Size: 2 inches		
Back Pressure (Ft. H_2O):	15	40
Water Pressure (psig):	60	85
Motion Water Flow (gpm):	35	40
Carbon Transfer Rate (lbs/min):	85	60
Transfer Time (for 2000 pounds) (min):	25	35
Total Water Employed (gallons):	820	1435

Eductor shall be a two-inch Schutte & Koerting water eductor as supplied by Calgon Carbon of Pittsburgh, Pennsylvania, or pre-approved equivalent.

PART 3 - EXECUTION

3.01 Performance Warranty

The CONTRACTOR shall warrant that the carbon adsorption system will achieve the VOC and SEMI-VOC removal specified, for a "per column" run time at least as long as that specified, based on the loading and flow rate indicated. Measurements will be made using standard U.S. EPA sampling and analytical protocols at the CONTRACTOR'S expense. The testing program to confirm this removal shall be submitted by the CONTRACTOR for the ENGINEER'S approval along with the shop drawings.

It is the responsibility of the carbon adsorption system MANUFACTURER to select and size all components of the system to meet the removal criteria. The component sizes shall meet or exceed those given herein.

3.02 Inspection, Start-Up and Training

A. Factory Tests:

The carbon adsorption system shall be given a factory mechanical test to assure mechanical integrity. If the test indicates that adjustments are necessary to ensure conformance to the manufacturer's standards, such adjustments shall be made prior to shipment.

B. Equipment and Installation Inspection:

The carbon adsorption system MANUFACTURER shall provide the services of a qualified erection supervisor to examine the equipment delivered to the site to see that it is in good condition and in conformance with the reviewed shop drawings, to advise the Contractor with respect to the erection and installation of the various system components, and to inspect the construction as required.

C. Checkout:

After the installation is complete, and other related and required portions of the plant are also available for operation, field testing shall be conducted under the supervision of the carbon adsorption system MANUFACTURER'S qualified personnel. Sufficient tests shall be conducted to demonstrate that all system components are fully operational, that all piping have been tested for leaks, that all control and instrumentation components have been properly calibrated and adjusted and that the entire system is ready for continuous safe operation. The purpose of the checkout shall be to ensure that each individual component has been correctly installed, will operate fully in the manner intended, and is ready to perform its function as part of an integrated system when placed in continuous operation. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted. These tests shall continue until the system passes.

D. Start-up Assistance and Training:

The Manufacturer shall provide the services of a factory-trained technical representative to review the installation, make final adjustment, train the owners personnel in the operation and maintenance of the unit, and place the carbon adsorption system into operation, if requested by the Owner. The price for start-up and checkout services shall not be included in the equipment price but shall be included in the Bid Submittal as a per diem rate (including travel).

3.03 Placing of Carbon

A. Before placing any carbon, the CONTRACTOR shall thoroughly clean the columns and shall remove all foreign matter found therein.

B. Particular care shall be taken to remove all dirt and other foreign matter from the plenum spaces, nozzles, valves, and other appurtenances.

C. After sweeping and brushing as required, the CONTRACTOR shall thoroughly wash down all parts of the vessels with potable water before placement of carbon is started.

D. Place all carbon in conformance with the MANUFACTURER'S recommendations.

E. Once all carbon is placed in the vessel, both the vessel and carbon shall be kept in a clean condition, as determined by the ENGINEER. In the event that the activated carbon or vessel become contaminated for any reason, as determined by the ENGINEER, prior to placing the unit in operation for its intended purpose, the CONTRACTOR shall replace the carbon and/or clean the unit as directed by the ENGINEER.

F. During carbon placement and other vessel-related work activities, the vessel(s) will be inspected by the ENGINEER to ensure that the corrosion-resistant coating has not been physically damaged. If, in the Engineer's opinion, physical damage of the corrosion-resistant coating has occurred, the Contractor will be responsible for repair or replacement of the damaged material.

-- END OF SECTION 13295 --

SECTION 13415

SEQUENCE OF OPERATION

PART 1 - GENERAL

1.01 Description

A. General: This section specifically describes the instrumentation, control and monitoring system (ICM) for the AlliedSignal groundwater treatment system. It is the intent of this section to also supplement as applicable, other sections of Division 13, and therefore information described in this section may amplify, modify, supersede, as the case may be, other sections of this Division. If a conflict should appear the Contractor shall solicit the engineer for written clarification.

B. Control System Configuration: It is the intent to briefly describe each process subsystem so that the contractor is aware of the magnitude of the total ICM system. Certain systems described are supplied as packaged systems furnished under other divisions and are so identified. Interfacing with these systems is a part of the work of this division.

C. Scope: The contractor shall furnish, install, validate, start-up, and test a complete and operable ICM system as indicated on the plans and specified herein.

1.02 Related Sections

Division 13 - Special Construction

Division 15 - Mechanical

Division 16 - Electrical

1.03 Sequence Of Operation

A. The function of the ICM system shall be to provide an efficient interface between plant operations and treatment processes by presenting visual and/or audible information of plant operating parameters equipment status and alarm conditions. It shall provide automatic control of critical parameters or parameter which would require frequent operator attention. The system shall provide for manual override of any automatic function when required and shall permit central start/stop operation of motors and on/off valves as described here and after, that are pertinent to satisfactory process performance. The system shall provide the following described functions in accordance with the process and instrumentation diagram.

B. Included herein are functional descriptions of the process. If the contractor requires other devices than shown on the plans and specified herein to achieve the result required by the system description, provide these devices to obtain the required result.

1.04 Control Philosophy

A. Most process components shall be provided with a local HAND-OFF-AUTOMATIC (H-O-A) selector switch or START-STOP (S-S) push-buttons which shall permit manual control by the operator as required. For testing and troubleshooting purposes, H-O-A switches shall allow equipment operation in the HAND position without verification of other equipment interlocks or permissive conditions.

B. Upon initial setup, flow through the facility shall be continuous and automatic. Process maintenance functions such as sludge thickener decanting, sludge filter press dewatering, carbon adsorber backflushing, granular activated carbon change-out, and replenishment of chemical feeds shall be manual in nature.

1.05 Description Of Operation

1.05.01 Groundwater Extraction Wells

A. A series of submersible extraction well pumps will discharge into a common header to the groundwater treatment plant. The operation of the pumps will be automatically controlled by level sensor(s), which will be provided by the pump vendor. The initiation and shutoff level signals from the level sensor(s) will be field adjustable at the well. No remote monitoring of level at the groundwater treatment plant will be required.

B. For each extraction well pump, both local (in the vault) and remote (at the groundwater treatment plant) indication will be provided for power supply and pump status (red=stop, green=run).

C. An instantaneous flow meter / flow totalizer will be provided at each pump vault with local display. No remote indication will be required.

D. A run-time meter will be incorporated into the power supply connections to each extraction well pump.

E. The extraction well pumps will be controlled with a local H-O-A switch.

F. Operation of all extraction well pumps will be automatically interrupted in the case of a high level alarm in equalization tank T-10.

1.05.02 Oil/Water Separator

A. The groundwater extraction well header will discharge into a gravity oil/water (O/W) separator. Flow into the O/W separator will vary from 2 to 20 gpm.

B. The O/W separator will flow by gravity into equalization tank T-10.

C. Light Non-Aqueous Phase Liquids (LNAPL) captured by the O/W separator will flow over a manually adjustable weir into product storage tank T-101.

D. Solids and Dense Non-Aqueous Phase Liquids (DNAPL) accumulating in the O/W separator will be removed at the discretion of the operator via air diaphragm pump P-110 to sludge thickener tank T-90.

1.05.03 Equalization Tank T-10

A. Equalization tank T-10 receives flow from the O/W separator, overflow from sludge thickener tank T-90, and building sump P-130 discharge (consisting of filtrate, manually decanted supernatant from T-90, and equipment washdown).

B. Provisions will be made in the MCC and status display panels to accommodate the potential addition of a mixer M-10 in Equalization tank T-10 in the future. If this addition were to occur, the addition of a stilling well would be required for proper operation of the level switches.

C. Equalization tank pumps P-10 and P-11 will operate as alternating lead and lag pumps based on level controls in tank T-10. Manual control valves are provided on the discharge of each pump to provide adjustable head necessary for proper single pump operation.

D. Discharge from equalization tank T-10 will flow through Flow Meter FM-14 with panel-mounted instantaneous and totalized flow indication. A flow-proportional signal from the flow meter will control the coagulant feed pump P-27.

1.05.04 Coagulant Feed System

A. Electronic diaphragm metering pump P-27 will provide an proportional feed of coagulant to the process flow by modulating the frequency of stroking proportional to signals from flow meter FM-14. The stroke length of the pump will be manually adjustable at the pump.

B. Coagulant will be discharged to the process flow via an in-line injector at static mixer SM-16 (downstream of pumps P-10 and P-11).

C. The coagulant feed tank T-27 will be mixed by single speed mixer M-27. Operation of M-27 will be manual.

1.05.05 Lime Feed System

A. Dry hydrated lime will be added manually to Tank T-26 and mixed to a 4-percent slurry using Mixer M-26. Lime recirculation pump P-25 (air diaphragm-type) will draw slurry from T-26 into a recirculating feed loop with a bleed-off injection point (an in-line injector) into the process groundwater at static mixer SM-18 (just prior to the flocculation chamber of clarifier CL-20).. Mixer M-26 and lime recirculation pump P-25 will operate continuously to keep the lime slurry in suspension. Flow rate in the recirculation loop will be controlled by the manually adjustable air feed to pump P-25. Lime flow rate through the injection point will be controlled by pneumatically-actuated pinch valve PNV-25B which is, in turn, controlled by the pH detected in CL-20 (via a pH probe, controller, and I/P converter). Controller AC 20 receives the pH signal from CL-20 for modulation purposes, plus it receives a signal from FM-14 such that if process flow reaches 0 gpm, PNV-25B will close entirely.

B. Lime recirculation pump P-26 (air diaphragm-type) will also draw slurry from T-26 into a one-directional feed line to sludge settling tank T-90. Lime recirculation pump P-26 will operate only when manually controlled by the system operator (via the manually adjustable air feed). After dosing lime slurry to a batch of sludge in T-90, the operator must make manual connections to flush the lime dosing line with plant water to prevent lime clogging.

1.05.06 Clarifier

A. The clarifier unit consists of a flocculation chamber which overflows a weir into an inclined-plate sedimentation tank.

B. The flocculation chamber will be agitated by mixer M-20 which is supplied with the clarifier and integrated into the clarifier design by the manufacturer. A local on/off control for M-20, easily accessible by the system operator, will be provided by the clarifier manufacturer.

C. Solids accumulating in the clarifier will be removed via air diaphragm pump P-22 to sludge thickener tank T-90. Operation of P-22 shall be initiated by an adjustable electric timer and an I-P converter on the supply air line to P-22.

D. Overflow from the clarifier will discharge into clearwell tank T-20. Clarifier clearwell pumps P-20 and P-21 will operate as alternating lead and lag pumps off of level controls in tank T-20. Manual control valves are provided on the discharge of each pump to provide adjustable head necessary for proper single pump operation.

1.05.07 Multimedia Pressure Filters

A. Only one filter (either F-30 or F-31) will be actively treating process flow at any specific time. The other filter will be in the midst of a backwash or it will be a cleaned filter in stand-by mode, ready to be brought on-line once the active filter requires backwashing.

B. A filter backwash cycle shall be automatically initiated when the pressure differential across the active filter reaches a selected set-point. The cycle begins by opening electro-mechanical actuated valves to bring the stand-by filter on-line. The loaded filter is then taken off-line. A multi-port valve (provided by the filter manufacturer) is automatically positioned to allow plant water to enter the bottom of the filter and used backwash water to discharge from the top of the filter to a pipeline leading to sludge settling tank T-90.

1.05.08 Acid Feed System

A. Electronic diaphragm metering pump P-28 will provide an proportional feed of acid solution to the process flow by modulating the frequency of stroking proportional to signals from the in-line pH sensor AE40 located between the multi-media filters and the GAC columns. The stroke length of the pump will be manually adjustable at the pump. Sensor AE40 will be provided with a controller and interlocks such that if the pH is approaching the high or low set point, process pumps P-10, P-11, P-20, and P-21 will be shut down.

B. Acid solution will be discharged to the process flow via an in-line injector at static mixer SM-35.

C. The acid feed tank T-28 will be mixed by single speed mixer M-28. Operation of M-28 will be manual.

D. Added hydraulic residence time to buffer changes in pH will be provided by the 3" diameter process pipe between the multimedia filters and the activated carbon vessels.

1.05.09 Granular Activated Carbon Adsorbers

A. Process water shall flow by pressure from the filters to carbon adsorber vessels CA-40 and CA-41 in series. The order may be manually alternated depending on which adsorber vessel had last been changed out with fresh carbon. Differential pressure across each adsorber shall be monitored manually by the operator.

B. In case of excessive head loss through a carbon vessel with significant remaining adsorptive capacity, a manual backflush can be performed. The adsorber system valves can be configured to allow process flow through a single adsorber while the other adsorber receives a reverse flow of plant water. The used backflush water is routed to sludge settling tank T-90.

1.05.10 Treated Water Discharge

A. Process water from CA-40 and CA-41 will be routed through Flow Meter FM-60 and out of the treatment building to the underground drainage system that receives run-off from the landfill cap.

B. Flow Meter FM-60 shall have panel-mounted instantaneous and totalized flow indication.

1.05.11 Sludge Thickener Tank T-90

A. Sludge thickener tank T-90 shall have a gravity overflow line to equalization tank T-10 and valved ports (at lower elevations) for manual decanting of supernatant to the building sump.

B. Sludge thickener tank T-90 will include a mechanical agitator. The agitator consists of a set of bottom scrapers mounted on a center axis, powered by a top-mounted electric motor with geared speed reduction and a local on/off switch easily accessible by the operator.

D. Sludge thickener sludge pump P-90 shall be operated from the filter press control panel.

1.05.12 Sludge Filter Press

A. The sludge dewatering operation shall be initiated at the filter press control panel. Air supply to sludge thickener sludge pump P-90 will be modulated via a pilot-controlled valve connected to an automatic pump control system such that the pumping pressure is varied over the cycle to promote good cake development.

B. Features of the filter press will include a semi-automatic plate separator and collection bins for dewatered sludge cake.

C. When the filter press (recessed plate-type) is completely filled, the sludge feed operation shall be stopped and the filter plates shall be opened permitting sludge cake to drop into a wheeled bin. A full container shall be wheeled out of the building and transferred by truck to off-site disposal. An empty container shall be rolled under the plate filter press in preparation for the next dewatering operation.

1.05.13 Treatment Plant Sump Pump (P-130)

Plant process decant, filtrate and floor drainage shall be routed to a sump with submersible pump P-130. The pump will come complete with an integrated float switch level control system to control the operation of P-130.

1.05.14 Air Compressor System

A. A packaged air compressor system (AC-70) complete with locally mounted controls (HS/PS/PSV-70) shall be provided to supply process air to the equipment.

B. A refrigerated air dryer with inlet air filter shall be provided to supply the instrument air requirements of the filter press.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable

-- END OF SECTION 13415 --

SECTION 13420

INSTRUMENTATION

PART 1 - GENERAL

1.01 Description

A. Provide Field Mounted elements of process instrumentation, auxiliary equipment, and supplies.

B. The requirements of Section 13410, as applicable, apply to this Section.

C. Refer to Attachment A for schedule of instruments.

1.02 Related Sections

Division 13 - Special Construction

Division 15 - Mechanical

Division 16 - Electrical

1.03 Submittals

A. Submit under provisions of Section 01300 and Section 13410 as well as the description below.

B. Manufacturer's Data.

C. Shop Drawings.

D. Certified Test Reports.

E. Operation and Maintenance Manual: Submit under provisions of Section 01110.

1.04 Quality Assurance

A. Manufacturer: Instrumentation and control equipment furnished shall be manufactured by a firm regularly and currently engaged in the design and manufacture of similar equipment. Equipment furnished shall be new and of current design. Except where stated otherwise, the instruments furnished under this Section shall be as manufactured by Fischer and Porter, Foxboro, or equal. Unless otherwise stated, ancillary equipment shall be as manufactured by the above or Rochester Instruments, AGM Electronics, Moore Industries, or equal.

B. Maintainability: Equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation shall comply with the requirements of the referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. Equipment of the same type shall be products of the same manufacturer. Capacities of equipment shall not be less than that indicated on the Drawings or specified.

PART 2 - PRODUCTS

2.01 Pressure And Vacuum Gauges

A. General: Pressure and vacuum gauges shall, unless otherwise specified, conform with the following. Gauges shall be of the stem-mounting type. Pressure gauge range shall be as shown on the schedule.

B. Construction: Gauges shall be of the bourdon tube or bellows type with 270 degrees clockwise pointer travel. Dials shall be white with black numerals. Dial size shall be 4-1/2 inches. Panel-mounted gauges shall have round bezels for flush mounting and rear connection, others shall have a stem-mounting bottom connection. Connections for all gauges shall be male 1/2 inch NPT with square wrench flats. Wetted parts shall be corrosion-resistant, brass or bronze. Cases shall be black phenolic. Accuracy shall be ± 0.5 percent of span.

C. Manufacturers: The gauges shall be as manufactured by Ashcroft, U.S. Gauge, or approved equal.

2.02 Magnetic Flow Meters

A. General: Magnetic meters shall use the principle of electromagnetic induction to produce a dc voltage proportional to the rate of liquid flow. Coil excitation shall be dc. The coils shall generate a magnetic field which in turn induces a voltage in the flowing liquid which is sensed by a pair of electrodes in contact with the liquid.

B. Construction:

1. The coils shall be protected from contact with the liquid. The electrodes shall be made of AISI, Type 316 stainless steel and shall be provided with a minimum preamp input impedance of 10 exp 12 ohms. The meter housing shall be housed in a dust and weather-proof case. The metering tube shall be polyurethane lined to withstand abrasion.

2. The meters shall be designed to operate from a 120 VAC, 60 Hz, single-phase power supply and a 10 percent variation in power line voltage shall not affect the meter output accuracy in excess of 0.1 percent of full scale. Power consumption shall not exceed 35 watts for meters 6 inches and smaller or 5 watts per inch of diameter for meters 8 inches and larger.

3. Each magnetic flow meter system shall have an accuracy within 1 percent of rate over a range as specified in the schedule. Meters shall have a repeatability of 0.1 percent of full scale.

4. Each magnetic flow meter shall be equipped with a signal converter to transmit an analog 4-20 mAdc signal. A frequency and/or a scaled pulse rate to drive totalizing counters shall also be transmitted. The signal shall be linear with flow within the accuracy specified above. Local direct reading digital indicators shall be supplied. The meters shall have automatic zero correction. Interconnecting cable between the meter and signal converter shall be furnished by the manufacturer.

5. The magnetic flow meters shall be of the short-form type with a laying length approximately 1-1/2 times the diameter for line sizes 3 inches and larger. Meters shall be designed with end connections as shown on the Drawings except meters with line sizes less than 3 inches shall have 150-pound ANSI flanges. Field coils shall be either completely

encapsulated in the meter lining material or the meter tube shall be of 304 S.S. with a suitable liner. A suitable protective shield shall be provided at each end of the liner for withstanding fluid scouring velocities.

C. Grounding: A grounding circuit shall be provided for each magnetic meter. Provide grounding rings, grounding electrodes or protective shields to serve as a liquid ground, when the meter is installed in a non-conductive line.

D. Manufacturer: Magnetic flow meters shall be by Fischer & Porter, Foxboro, or approved equal.

2.03 Process Variable Indicators

A. Process Variable Indicators shall be a digital display. The number of digits shall be 4, each 1/2-inch high (nominal). The displayed digits shall be Light-Emitting Diode (LED) type easily visible in a well-lighted control room. The reference accuracy of the display shall be plus or minus 2.0 percent or better. The indicator shall be driven by the output of a solid-state electronic amplifier. Zero and span adjustment shall be provided. Indicator range shall be as shown on the schedule. The process variable indicator shall be as manufactured by Newport, Red Lion, or approved equal.

2.04 Control Stations (AC-20, AC-40)

A. General: Automatic control stations shall compare a process variable input signal with a remote or locally adjusted set point and shall produce a control output signal to correct any deviation of the process variable from the set point by means of a final control element. Manual control stations shall convert a remotely or local manual set point value to an output control signal to control a process variable by means of a final control element.

B. Microprocessor Based Control Stations: Shall have the following features:

1. Auto-Manual Switching: Shall be provided on the front panel of each controller except for controllers with manual control action only or 2-position control action. Switching from automatic to manual control shall be without an intermediate "Balance" position and shall cause no change in the controller output (bumpless transfer).

2. Remote Set Point: A switch for transfer from remote to local and vice-versa shall be mounted on the front of the controller panel.

3. Reference Accuracy: For automatic controllers, shall be at least plus or minus 0.5 percent of span. Automatic controllers shall have provision for manually overriding and adjusting the controller output signal. Adjustable output limiting shall be furnished on all automatic controllers with integral control algorithm.

4. Indicators: Gas, discharge type display. Bar graph display shall depict PV, SP, and output. Digital display of PV and SP in engineering units.

5. Cases: Control stations shall have front dimensions approximately 3 inches wide by 6 inches high.

6. Signals: Process variable, analog remote set point input and control output signals shall be 4 to 20 mAdc except that 2-position and proportional speed floating control output signals shall be contacts rated for 6 amperes at 120 VAC. Signals between units mounted in a single panel shall be 1 to 5 volts dc.

7. Control Algorithms: Shall be available in control stations with the following control actions:

   a. Proportional speed floating (integral).

   b. Gain with manual bias.

   c. Gain plus integral with adjustable output limiting.

   d. Gain plus integral plus derivative with adjustable output limiting.

   e. Manual.

   f. 2-position with adjustable "dead zone."

   g. Feed forward in addition to c or d above.

8. Control Action: Tuning adjustment of the control actions shall be integral to the control station and shall be accessible from the front of the control panel without disconnecting the control station from the process. When provided, control actions shall be continuously adjustable over the minimum ranges listed below:

   a. Proportional speed floating: 0.1 to 25 seconds repetition period, 0-10 percent dead zone, 0-100 speed factor.

   b. Gain: 0.2 to 33.

   c. Integral: 0.02 to 200 repeats per minute.

   d. Derivative: 0.01 to 8 minutes per repeat.

   e. 2-position: 0 to 10 percent dead zone.

   f. Feed forward: 0.5 to 5 gain.

9. Scale range shall be 0-14 pH.

C. Alarm Function: Capability of monitoring process, rate, or deviation as programmed. Output shall be solid state with remote relays provided where required.

D. Controller shall be as manufactured by Fischer & Porter, Model 53MC5000; Foxboro; or approved equal.

2.09 Annunciator

A. System: An annunciator shall be provided as shown on the Drawings and specified herein. Annunciator shall be solid state and include an integral lamp cabinet with logic chassis and a horn. The system operational sequence shall be ISA sequence "A" type as follows:

1. When an alarm condition occurs, the alarm horn shall be activated and the appropriate status point shall flash.

2. The acknowledge pushbutton shall deactivate the horn and cause the visual point to change from flashing to steady on.

3. A return to normal condition shall cause the alarm points to be extinguished.

4. The test pushbutton shall activate the horn and cause all visual status points to start flashing.

B. The annunciator shall include re-transmit contacts to be used for future monitoring purpose.

C. The unit shall operate from a 120 VAC, 60 Hertz power source.

D. Logic Chassis: The logic chassis shall include twin point plug in monitoring modules and a power supply. The power supply shall have an output field contact voltage of 24 VDC.

E. Lamp Cabinet: A lamp cabinet shall be provided as shown on the drawings and specified herein. The lamp cabinet shall be enclosed in a NEMA 1 enclosure and shall have 6 windows with nominal size of 1-7/16 inch by 3-5/6 inch of white plastic with rear lighting by two 28 V lamps. The windows shall be engraved with nominal 1/4 inch size black letters. The lamp cabinet shall be internally wired to the annunciator logic chassis. The lamp cabinet shall include a test and acknowledge pushbutton and a power on indication lamp as shown on the drawings.

F. Horn: Horn shall be Novatone, Model NT2-24D as manufactured by Panalarm or approved equal.

G. Manufacturers: The annunciator shall be series 90 as manufactured by Panalarm or approved equal.

2.10 Control Relays

A. Control relays shall be of the dust cover enclosed, plug-in type with 8 or 11 pin, screw terminal, octal sockets. They shall be rated for 10 amps at 120 VAC and be equipped with neon indicator lamps. Control relays shall be Potter & Brumfield or equal.

2.11 Tilting Float Level Switches

A. General: Tilting float level switches shall use the tilting movement of a float, whose specified weight is less than that of the process liquid, to actuate switches as the level changes. The switch(es) shall be integrally mounted in the float and connected to a waterproof, 20-foot-long electric cable. A movable weight shall be mounted on the cable to allow adjustment of the setpoint(s). The float shall be polyethylene, stainless steel, or other approved material.

B. Specific Requirements: The desired switching action shall be as specified in the Schedule. Manufacturer may utilize either a series of floats or a single float to provide the specified switching action. The pump-up type shall close a contact at a low level and open it at a high level. The pump-down type shall provide the opposite action.

C. Manufacturer: Tilting type level switches shall be as manufactured by Zi-Tech, Hydr-O-Matic Pump Co., Flygt Corp., Healy-Ruff, Consolidated Electric Co., or equal.

2.12 Integrators-Counters-Scalers

A. Analog Integrator-Totalizer: Integrators shall be provided as shown on the drawings. The units shall accept a 4 to 20 mAdc signal and convert it to a pulse train, the frequency of which his proportional to the input. Provision shall be made for adjusting the full-scale pulse rate to scale the output in engineering units shown on the Schedule. The overall conversion accuracy shall be 0.5 percent from 2 percent to 100 percent of full-scale input, with adjustable low signal cutoff. The outputs shall be isolated contacts rated for 1 ampere at 120 VAC. A panel-mounted totalizing counter shall be provided to count the pulse rate output. The counter shall be as described herein below for totalizing counters.

B. Totalizing Indicators: Shall be provided where indicated on the Schedule and shall display the process value in engineering units of an analog voltage or current input as specified in the Schedule. The number of digits shall be 6, each 1/2-inch high (nominal). The displayed digits shall be a light-emitting diode (LED) and easily visible in a well-lighted control room. The display style shall be the choice of the ICM subcontractor, except that all displays shall be of the same style. The accuracy of the display shall be within 1 digit but not less than plus or minus 0.1 percent of analog inputs. Automatic ranging and polarity selection and sign indication shall be provided.

C. Manufacturer: Totalizing indicators shall be by Newport, Red Lion Controls or equal.

2.13 Solenoid Valves

A. Solenoid valves shall be provided as shown on the drawings. Solenoid valves shall be packless construction 3-way, as required, and shall be correctly sized for the application. Valves shall operate as described in Section 13415. Solenoid valves shall include manual operators. Valve bodies shall be forged brass unless otherwise recommended by the manufacturer for a particular application. The solenoids shall be rated for continuous operation of 110 percent of rated voltage. They shall be 120 VAC, 60 Hertz operated. All coils shall be rated for 0-180 degrees F ambient operation and housed in NEMA 4 cases except where explosion-proof (XP) is required with provision for 1/2-inch electrical conduit. Solenoid valves shall be as manufactured by ASCO, Skinner, or equal.

2.14 pH Sensor/Transmitter And Receiver/Analyzer (AE/AIT-20, AE/AIT-40)

A. pH sensor shall measure hydrogen ion activity in the process medium. The pH sensor shall consist of a flow cell, a reference electrode, a pH glass electrode and a temperature compensator. pH sensor temperature limits shall be -5 to 60°C with maximum operating pressure of 50 psig. The measuring range shall be 0-14 pH units. pH sensor shall include integral two-wire transmitter with 4-20 mAdc output. Sensor shall be submersion type for AE-20 and insertion type for AE-40.

B. Receiver/analyzer output signal shall be 4-20 mAdc isolated, capable of transmission into at least 500 ohm load. Receiver shall include 3-1/2 digit LCD capable of displaying measured pH in 0-14 pH units, alarm setpoints and calibration functions. Receiver shall include two independent control setpoints. Setpoints shall be continuously adjustable, 0-100% of full scale. Control deadbands shall be continuously adjustable, 0-50% of full scale. Control relays shall be SPDT, 5A at 120 VAC. Analyzer sensitivity shall be 0.1% of span with stability of 0.1% of span per 24 hrs., non-cumulative. Analyzer repeatability shall be 0.05 mA. Analyzer shall be housed in a NEMA 4X enclosure suitable for front panel mounting.

C. Manufacturer: pH sensor shall be Model 6428PO with Model 60A2F1278 Protector or MH336 (CPVC) tee with aluminum J-box as appreciated. Receiver/analyzer shall be model 670 as manufactured by Great Lakes Instruments or approved equal.

2.15 Current To Pneumatic Transducer (FY-20)

A. Provide current to pneumatic transducers to control pneumatically actuated devices based on a 4-20mAdc electronic signal. Ambient operating temperatures shall be from -40 to 150 degrees F. Accuracy shall be +/- 0.75 % of output signal span.

B. The current to pneumatic transducer shall be enclosed in an aluminum housing. The device shall be provided with internal zero and span adjustments which shall include locking nuts. No additional parts shall be required to reverse the action of the device in the field. The device shall be provided with a bracket for mounting on a 2-inch pipe stand and an integral filter regulator with a 2-inch, 0 to 30 PSIG, gauge.

C. Manufacturer: The current to pneumatic transducer shall be type 546 with a 67 series filter regulator as manufactured by Fisher Controls Co., or approved equal.

2.16 Repeating Cycle Timer (KS-22)

A. Provide a repeating cycle timer capable of continuous alternating operation over 2 separate timing ranges. Each timing range shall be seperately adjustable over six time spans ranging from 1 second to 10 hours. Each timer section shall be provided with an individual pilot light which identifies the timer in operation. A programmable output relay shall be provided with DPDT contacts rated for at least 7 Amperes at 125 vac.

B. The timer shall be suitable for front panel mounting and shall operate at 117 volts, 60 hertz.

C. The timer shall be as manufactured by Automatic Timing and Controls, Inc. Model 342.

PART 3 - EXECUTION

3.01 Installation

A. Field mounted elements shall be installed, calibrated, and started up in strict compliance with the manufacturer's requirements and recommendations. Conflicts between the manufacturer's requirements and recommendations and these Specifications or the Drawings shall be presented to the Owner for resolution before any affected work is started.

B. Connections of instruments to process piping shall include, as close as practical to the point of connection, a tight closing block valve suitable for the maximum process pressure and temperature and for the material involved. If connections are of threaded or welded pipe there shall be a union or flanged connection located to facilitate disassembly of the connection and removal of the instrument without interrupting process operation.

C. Unless specifically intended for such service, instruments shall be protected and isolated from vibration, temperature extremes, radiant heat, rain or falling water, and similar adverse conditions.

D. Impulse lines of pressure differential instruments shall be as short as practical and shall be installed with a minimum slope of 1-inch per foot (1:12) downward toward the instrument in liquid system and upward toward the instrument in gaseous systems. If this preferred direction of slope cannot be maintained, the Contractor shall submit for approval an installation configuration utilizing traps, drains, and/or vents at high and low points which will ensure freedom from mixed phase offset effects and provide ease of purging or draining.

E. Field mounted elements shall be marked with data required for calibration such as location of adjustments, span, off-set, zero suppression, and test voltages. If such data are not provided in permanent markings or on the manufacturer's nameplate, a durable tag or label shall be affixed in a protected location which will become readily visible in the normal course of servicing the instrument.

3.02 Equipment Testing and Calibration

A. Factory Tests and Calibration: All field mounted elements shall be factory-tested by the manufacturer to assure satisfactory performance prior to shipment to the job site. Whenever possible, this shall include calibration to the actual range and conditions of use. Calibration shall be traceable to the National Institute of Standards and Technology (NIST) with an uncertainty not more than 1/2 of the specified or claimed accuracy of the instruments.

B. Field Tests and Calibration: Field mounted elements which were not calibrated to final working values of range, span, and zero suppression at the factory shall be so calibrated prior to or at the time of installation. This calibration shall meet the same requirements of accuracy and traceability required for factory testing above. The Owner shall be given 48 hours notice and the opportunity to witness this calibration.

– END OF SECTION 13420 –

ATTACHMENT A

PRESSURE GAUGE SCHEDULE

TAG NO.	PROCESS FLUID	CHEMICAL SEAL	PRESSURE RANGE (PSIG)	P&ID
PI-1	water	none	0 - 60	I-3
PI-2	water	none	0 - 60	I-3
PI-3	water	none	0 - 60	I-3
PI-4	water	none	0 - 60	I-3
PI-10	water	none	0 - 60	I-3
PI-11	water	none	O - 60	I-3
PI-22	silicone	yes	0 - 30	I-3
PI-20	water	none	0 - 60	I-4
PI-21	water	none	0 - 60	R-4
PI-60	water	none	0 - 30	I-4
PI-70	air	none	0 - 200	I-5
PI-92	silicone	yes	0 - 30	I-5

PROCESS VARIABLE INDICATOR SCHEDULE

TAG NO.	ANALOG SIGNAL SOURCE	INPUT SIGNAL mAdc	SCALE	P&ID
FI-14	FM-14	4-20	0-20 gpm	I-3
FI-60	FM-60	4-20	0-20 gpm	I-4

MAGNETIC FLOW METER SCHEDULE

TAG NO.	METER SIZE	MAX FLOW (INCHES)	PROCESS FLUID (GPM)	LINING	P&ID
FM/FT-14	1	20	WATER	POLYURETHANE	I-3
FM/FM-60	1	20	WATER	POLYURETHANE	I-4

TOTALIZING INDICATOR SCHEDULE

TAG	UNITS	MOUNTING
FQ-14	GALLONS	PANEL
FQ-60	GALLONS	PANEL

FLOAT SWITCH SCHEDULE

TAG	SWITCH ACTION ON LEVEL INCREASE	FUNCTION
LE-10A	Close	Stop
LE-10B	Close	Start Lead
LE-10C	Close	Start LaG and Reset Alarm
LE-10D	Open	High Alarm
LE-20A	Close	Stop
LE-20B	Close	Start Lead
LE-20C	Close	Start Lag & Reset Alarm
LE-20D	Open	High Alarm
LE-60A	Close	Stop
LE-60B	Close	Start & Reset Alarm
LE-60C	Open	High Alarm

SECTION 13440

PANELS AND CONTROL STATION HARDWARE

PART 1 GENERAL

1.01 Description

A. Provide control panel and control room hardware as indicated on the drawings and as specified herein.

B. The requirements of Section 13410, as applicable, apply to this section.

C. Control enclosure to be free standing with rear access door.

1.02 Submittals

The submittal shall be in accordance with Division 1, Section 01300, and Section 13410 as well as the description below.

A. Manufacturer's data.

B. Shop drawings for approval.

1. Dimensional and structural.
2. Interconnection diagrams.
3. Loop diagrams.
4. Electrical ladder drawings.
5. Electrical bill of material.

C. Certificates of compliance.

D. Certified test reports.

E. Operation and maintenance manual.

PART 2 PRODUCTS

2.01 Construction

A. Control panels shall be furnished completely pre-wired, with factory-mounted instruments and controls and factory-tested prior to shipment.

1. Piping and Wiring. Within each panel, piping and wiring shall be grouped and supported to give a neat appearance. Control components not flush-mounted on the front of the panel shall be mounted on fully accessible subpanels or racks within the panels for easy removal. Signal lines leaving the panels shall terminate at bulkhead fittings or terminal blocks and shall be tagged to facilitate field connections.

2. Size and Supports. Panels shall be of sufficient size to adequately enclose instruments designated as panel mounted plus ample interior clearance to allow for installation, general servicing, and maintenance of the instruments. Weight of instruments shall be supported by Unistrut, Famet, Caine, or equal channel supports, both at the front and rear, channels supported by framing to the panel base. Minimum nominal panel size shall be 36" W x 90" H x 24" D.

3. Attachment methods shall be detailed on shop drawing submittals.

4. Control Voltage. The control voltage provided is 120 VAC power, supplied from the power panels shown on the drawings. A separate low-voltage circuit shall be provided within the panel for the indicating lamps or individual transformer type lamps shall be provided. Indicating lamps shall be wired to a master lamp test relay assembly or individual push-to-test lamps shall be provided. In any event, the lamp voltage shall not exceed 30 VAC or DC. Safety interlock switches, not shown in the schematics, shall be provided on access doors for local and foreign voltages as required by safety codes of applicable regulating authorities.

5. Arrangement. Where so indicated, the instruments mounted in the panels shall have the nominal size and general arrangement shown. Panel layouts and nameplates shall conform to the approved shop drawings.

2.02 Steel Panels

A. Control panels sheet steel shall be selected for smoothness and flatness. Panels shall be fully enclosed, including top, with no visible seams on the front. Panel front construction shall be minimum 3/16-inch-thick with stiffener(s) as necessary to maintain a flatness of plus or minus 1/16 of any 2-foot span and plus or minus 1/8-inch over any 8-foot span with equipment installed. Other sections shall be 3/16-inch, except the doors shall be a minimum of 14-gauge and shall maintain the same specified flatness when closed and latched. Doors shall be fully gasketed

B. Cabinets shall be suitable for floor mounting. The cabinet design shall be for read access only.

C. Finish. After fabrication, welds shall be ground smooth, the panel shall be degreased, bonderized, finished smooth with an epoxy filler and sanded. Two coats of a rust-inhibitor primer shall be applied. The finish coat shall be as selected by the Engineer from color chips submitted by the panel manufacturer. Damage to the finish during installation shall be touched up at the job site as approved.

2.03 Panel Hardware

A. Doors shall be equipped with 3-point vault-type key-locking latches in addition to any required screw clamps. Hinges shall be full-length piano type. Handles shall be stainless steel.

2.04 Panel Accessories

A. Relays, timers, and other internally mounted equipment shall be of the types specified in Section 13420.

B. Panel face-mounted equipment shall be of the types specified in Section 13420.

C. Selector, pushbutton switches and pilot lights shall be oil-tight microswitch types PM, PT, and CMC, Allen-Bradley Series 800, Square D Class 9001, or equal. Switches shall be lockable in the off-position.

D. Nameplates shall be white lamicoid with minimum 3/16-inch-high black letters for major area titles, 5/32-inch for component titles, and 1/8-inch for subtitles. Nameplates shall be fastened with a permanent but dissolvable adhesive.

E. Terminals Connections. Terminals on equipment shall be connected by compression spade lugs.

F. Wiring shall be enclosed in plastic wireways, neatly tied with plastic ties, as appropriate. Wiring shall be made with PVC-insulated stranded wire. Terminal blocks shall be sectional barrier type with tubular clamp and white plastic identification strip; Buchanan, miniature type MD, Weidmuller type SAK6N Catalog No. 1932.6 or equal. Provide sufficient terminals for all required tie points and 20 percent spares. Each terminal shall be identified on the marker strip with a number neatly printed in ink. Where wires are terminated on screw terminals, insulated crimped spade lugs shall be used. Wires shall be

color-coded with black for unswitched hot or power, red for switched hot or control, white for neutral, green for ground. Wire size shall be 16 AWG stranded, 600-volt insulation except where larger wire is required for a single load. Wiring shall have permanent markers at each end. Except as otherwise stated herein, division 16 General Electrical Requirements shall apply.

PART 3 EXECUTION

3.01 Installation

In accordance with the manufacturer's instructions and the approved shop drawings.

-- END OF SECTION 13440 --

SECTION 15060

PROCESS PIPING AND PIPE APPURTENANCES

PART 1 - GENERAL

1.01 Description

Requirements specified in the Conditions of the Contract and Division 1 form a part of this Section. Contractor shall furnish all tools, equipment, materials and supplies including all labor required for complete installation, testing, and flushing of piping and appurtenances as shown on the Drawings and specified herein.

1.02 Scope of Work

A. Work Included in This Section. The Work of this Section shall include the furnishing, installation, and testing of pipe, pipe supports, fittings, specials, thrust blocks, and all required appurtenances as shown on the Drawings and as required to make the entire piping system operable. The systems include process plumbing, water, chemical, and drainage. The Work shall include, but not be limited to, the following items:

1. Piping involved in the plant process functions.
2. Piping for the introduction of chemicals and other materials into the systems being treated.
3. Piping for system quality sampling at different stages of treatment.
4. Piping for system services to plumbing specified in other Sections, and to miscellaneous outlets in the plant.
5. Instrumentation piping to gages and pressure switches and all tees, flanges, thread-o-lets, nipples, fittings, etc., as required for process connections to instrumentation except where these are specifically required or integrally with the mechanical equipment.
6. Compressed air piping for process systems.
7. Pump discharge, manifold and branch piping.
8. Inlet and outlet pipelines.
9. Tank drains.
10. Plant drains.

B. Related Work Specified Elsewhere. The following Work shall be included as part of the Work of this Section; provided that such Work shall be performed in accordance with the applicable requirements of the following Sections:

1. Concrete; Section 03300.
2. Plumbing, General Purpose; Section 15400.

3. Valves; Section 15100.

4. Painting; Section 09900.

5. Pipe Insulation and Heat Tracing; Section 15260.

1.03 Contractor Submittals

A. General. Shop and erection drawings, together with other required information specified, shall be submitted in accordance with the requirements of Division 1 of these Specifications and the requirements specified in this Section.

B. Shop Drawings. Shop drawings, complete with material, grade, and class for all pipe, fittings, and couplings and for all joints, coatings, and appurtenances shall be submitted. Detailed catalog and engineering data sheets shall be submitted for all components such as flexible couplings, rubber gaskets, and insulating joints, and a proposed schedule for delivering and installing the piping shall be included.

C. Erection Drawings.

1. General. Complete erection drawings for all buried and exposed piping shall be submitted. The drawings shall show and identify the pipe, pipe joints, fittings, couplings, joint harnesses, wall sleeves with sealant and backup thicknesses, wall castings, hangers, saddles, straps and other supports, and miscellaneous details.

2. Buried Piping. Erection Plans and Profile Drawings for all buried pipe shall show the following information:

a. Location, length, wall thickness, and type of joint for each pipe section and fitting to be furnished and installed;

b. Pipe axis station and elevation at all changes in gradient or horizontal alignment;

c. Within the limits of a horizontal or vertical curve, provide the station and invert or center line elevation to which each pipe section will be laid.

3. Exposed Piping. Erection and elevation drawings for all exposed piping shall show the location of the pipe, joints and couplings, critical clearances, orientation of valves, spacings of hangers and supports, and the location and size of anchor bolts.

D. Erection Procedure. Not used.

E. Protective Coating. A protective coating schedule shall be submitted, showing shop and field surface preparations, materials, methods of application, dry thicknesses and tests for defects, all in conformance with Section 09900 "Painting."

F. Testing Procedures. Procedures for testing the piping, and arrangements for obtaining and disposing of water for the tests shall be fully described. The equipment for testing shall be

itemized. Details of bulkheads, flanges, or caps for the testing of the pipe shall be included with the submittal.

G. Disinfection. Not used.

1.04 Product Handling, Delivery, and Storage

A. General. Pipe shall at all times be handled with equipment designed to prevent damage to the interior or exterior coating of the pipeline.

B. Shipping. When making shipments, all chains, cables and hold-down equipment shall be carefully padded where in contact with the pipe. For steel pipe, when the deformation is projected to exceed one percent of the diameter, each end of the pipe shall be properly braced with approved interior supports or spiders.

C. Unloading. Unloading from the trucks shall be done with care using slings as indicated above for steel pipe or appropriate slings and cables for ductile iron pipe. No pipe shall be allowed to fall from trucks. Pipe shall only be unloaded using a crane or fork lift.

D. Gaskets. Gaskets shall be stored in containers or wrappers which will protect the gaskets from ozone and other atmospheric deterioration.

1.05 Drawings

For purposes of clarity and legibility, the Drawings are essentially diagrammatic to the extent that many offsets, bends, and special fittings and exact locations are not indicated. Contractor shall carefully study the Drawings and determine for himself the extent of the Work and include in his bid all necessary bends, fittings and specials to install the Work in conformance with the Contract Documents.

PART 2 - PRODUCTS

2.01 General

A. General Requirements. All pipe, fittings, couplings, and appurtenant items shall be new, free from defects or contamination, and wherever possible, shall be the standard product of the manufacturer. They shall be furnished in pressure or thickness classes as specified or shown. Unless otherwise indicated the size shown shall be the nominal pipe diameter.

B. Length. All pipe 48 inches and less in diameter shall be furnished in a maximum of 20 foot lengths, unless indicated otherwise.

C. Raised Face Flanges. When carbon steel or stainless steel flanges or flanged valves with raised face will be bolted directly to flat faced FRP, plastic, or cast iron flanged fittings or valves, the raised face shall be removed or spacers approved by the valve or pipe manufacturer shall be installed to allow bearing over 100 percent of the flange area.

D. Joints. All pipes above ground shall have screwed or flanged joints. Welded pipes will be permitted, provided that there are sufficient flanges at valves and equipment to permit easy disassembling. Buried pipes shall have bell and spigot joints, unless welded, flanged or other joints are shown or specified. All bolts and nuts for flanges, joints and couplings shall be galvanized unless specified otherwise.

E. Mechanical Couplings and Expansion Joints. Pipe mechanical couplings and expansion joints shall be provided at locations shown on the Drawings as a minimum requirement.

F. Grooved Fittings. The Contractor, with the Engineer's approval, may provide Victuallic, Gustin Bacon or approved equal grooved end pipe fittings and connections in lieu of screwed or flanged fittings for steel, cast iron or ductile iron pipe. Grooved joints and couplings shall conform to paragraph "Mechanical Couplings" herein.

G. Screwed Flanges. Where pipe is furnished with screwed on flanges, the flange is to be screwed tight on the pipe until the pipe end projects beyond the face of the flange. The flange shall then be faced to give a flush finish of the pipe and flange. The flanges shall then be drilled, after attachment to the pipe, to insure bolt hole alignment.

H. Pipe Schedule. Pipe materials shall conform to the piping schedule included within this Section.

2.02 Black Steel Pipe (For Ordinary Uses)

A. General. Black steel pipe shall be welded and seamless steel pipe conforming to ASTM A120, standard weight or extra strong as indicated in the piping schedule. End finish shall be threaded, plain ended, grooved, welded, or flanged as indicated in the Schedule.

1. Threaded Ends. Conform to ASTM A120.
2. Grooved Ends. Conform to AWWA C606.
3. Flanged Ends and Gaskets. Conform to ANSI B-16.5. 150-pound pressure rating or 300-pound pressure rating as indicated in the Schedule.

Steel flanges shall be welding neck type or double fillet welded, slip-on type. A single fillet weld shall not be used to attach the flange to the pipe. Flanges rated higher than 150-pound shall have faces machined flat for mating with iron-body valves and other equipment items. Flange bolts and nuts shall be high-strength carbon steel with galvanized finish. Gaskets shall be 1/16-inch thick rubber conforming to the requirements of Federal Specification HH-G-156D; except that dimensions shall conform to the requirements of ANSI B-16.21 for Non-Metallic Gaskets for Pipe Flanges.

B. Wall Thicknesses. Unless specifically stated otherwise in the Pipe Schedule in This Section or elsewhere in these Specifications, black steel pipe shall have the following minimum wall thickness:

Pipe Diameter	Wall Thickness	Pipe Diameter	Wall Thickness
1/2"	0.109"	5"	0.258"
1"	0.133"	6"	0.280"
1-½"	0.145"	8"	0.322"
2"	0.154"	10"	0.365"
2-½"	0.203"	12" to 24"	0.375"
3"	0.216"	Greater than 24"	0.500"
4"	0.237"		

The minimum wall thickness specified above shall be for pipe before application of linings and coatings.

C. Fittings and Joints. Provide threaded fittings, welding fittings or grooved fittings as indicated in the Schedule.

1. Threaded Fittings. Black malleable iron conforming to ANSI B-16.3; 150-pound or 300-pound rated as indicated in the Schedule. Malleable iron shall conform to ASTM A-47.

2. Welding Fittings. Forged steel conforming to ASTM A-234, standard weight or extra strong to match pipe.

3. Grooved Fittings. Conform to paragraph "Mechanical Couplings" herein.

4. Welded Joints. Full penetration butt weld conforming to AWWA C206.

D. Buried Steel Pipe. The exterior of buried black steel pipe shall be coated with one of the following systems as indicated in the schedule.

1. Cold-applied Tape Coating. Prime and wrap with a cold applied tape, Type I or Type II conforming to AWWA C209.

2.03 Galvanized Steel Pipe and Fittings (For Ordinary Uses)

A. General. Galvanized steel pipe shall be welded and seamless steel pipe conforming to ASTM A-120 standard weight or extra strong as indicated in the schedule. End finish shall be threaded, plain ended, grooved, or flanged as indicated in the Schedule.

1. Threaded ends. Conform to ASTM A-120

2. Grooved ends. Conform to AWWA C606.

B. Fittings and Joints. Provide threaded fittings or grooved fittings as indicated in the Schedule.

1. Threaded Fittings. Galvanized malleable iron conforming to ANSI B16.3; standard weight for standard weight pipe; extra heavy for extra strong pipe. Malleable iron shall conform to ASTM A-47; galvanizing shall conform to ASTM A-153.

2. Grooved Fittings. Conform to paragraph, "Mechanical Couplings" herein.

C. Buried Galvanized Pipe. The exterior of buried galvanized pipe shall be primed and wrapped with a cold applied tape, Type I or Type II conforming to AWWA C209.

2.04 Copper Tubing and Fittings

A. Copper tubing shall be hard-drawn conforming to the requirements of ASTM Designation B-88-80, Type L or Type K.

B. Fittings shall be compression and hard-solder type as required. Flared type shall be Parker-Hannefin "Triple-Lock," American Brass "Anaconda," Imperial Eastman "High-Seal," or equal. Hard solder fittings shall be wrought copper or cast brass conforming to the requirements of ASTM Designation B 62-74.

2.05 Polyvinyl Chloride Schedule Pipe and Fittings

Pipe and fittings shall conform to the following requirements:

A. Polyvinyl Chloride Pipe. Polyvinyl Chloride Pipe shall be of unplasticized compounds suitable for use with chemicals and sewage, as shown on the Drawings and as specified and shall bear the seal of approval to this effect from an accredited testing laboratory. Pipe shall conform to the requirements of ASTM Designation D1785, Schedule 80, designation 1120, and the fiber stress

for deriving the short-time burst pressure requirement in accordance with Table 6, therein, shall not be less than 6,000 psi at 73.4°F.

B. Polyvinyl Chloride Pipe Fittings. Fittings shall conform to the requirements of ASTM Designation D2467, Class 12454-B for socket type and ASTM Designation D2464 for threaded type.

C. Rigid, Unplasticized Compounds. Compounds for pipe and fittings shall conform to the requirements of ASTM Designation D1784, Class 12454-B.

D. Joints in PVC Pipe and Fittings. Joints shall be the solvent-welded socket or flanged type. Flanges, where shown, shall be 150-pound, and shall be of the same material as the pipe.

E. Bolts. Bolts for use with PVC flanges shall be steel, AISI Type 303, conforming to the requirements of ASTM Designation A320-79a.

F. Gaskets. Gaskets shall be a Teflon envelope with an asbestos or high polymer chloride resin core.

1. Design Load Strength.
2. Internal Diameter, in inches.
3. Name of Manufacturer
4. Date of Manufacture.
5. Letter "T" six (6) inches or more from the end of the pipe to indicate the top of pipe for correct installation when elliptical reinforcing is used.

2.06 Corrugated Metal Pipe

A. Pipe. Not used. The pipe shall be galvanized steel conforming to AASHTO M-36 or aluminum alloy conforming to AASHTO M-196 corrugated pipe of the size and gauge shown on the Drawings. Pipe and couplings shall have full interior and exterior bituminous coating conforming to AASHTO M-190.

B. Coupling Bands. Coupling bands shall be of the same material as the pipe and shall conform to the referenced standards.

2.07 Hose

The multipurpose hose shall have a nominal diameter as indicated on the drawings. Hose shall be suitable for use with lime slurry. Hose shall be made of natural rubber or butyl or other flexible material suitable for a maximum working pressure of 100 psi. Hose shall be fabric reinforced and shall have a weather and sun-resistant covering. Hose shall be provided with brass or bronze long shank couplings. Hose shall be secured to couplings using stainless steel hose clamps. Hose couplings shall have solid male end with swivel female end.

2.08 Polyethylene Pipe

A. Pipe and Fittings. Pipe supplied shall be high performance, high molecular weight, high density polyethylene pipe conforming to Type II, Class C, Category 5, P34 materials as described in ASTM D 1248. Minimum cell classification values of the pipe material shall be 3 4 5 4 3 5 C as referenced in ASTM D 3350 - 84. The fittings shall be fabricated from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe or

shall be manufactured using a polyethylene compound having a cell classification equal to or exceeding the cell classification of the pipe supplied under this specification. Fittings and pipe shall be supplied by the same manufacturer.

B. Physical Properties of Pipe Compound.

1. Density. the density shall be 0./941 - 0.957 gms/cm^3 when tested in accordance with ASTM D 1505.

2. Melt Flow. Mel Flow shall be no greater than 0.15 gms/10 min. when tested in accordance with ASTM D 1238 - Condition E.

3. Flex Modulus. Flexural Modulus shall be 110,000 psi to less than 160,000 psi when tested in accordance with ASTM D 790.

4. Tensile Strength at Yield. Tensile strength at yield shall be 3,000 psi to less than 3,500 psi when tested in accordance with ASTM D 638.

5. ESCR. Environmental Stress Crack Resistance shall be in excess of 5,000 hours with zero failures when tested in accordance with ASTM D 1693 - Condition C.

6. Hydrostatic Design Bassi shall be 1,600 psi at 23°C when tested in accordance with ASTM D 2837.

C. Pipe Dimensions. Pipe supplied under this specification shall a nominal IPS (Iron Pipe Size) OD unless otherwise specified. The SDR (Standard Dimension Ratio) of the pipe supplied shall be as follows:

Nominal Pipe Diameter	SDR Rating
8" and less	17

D. Manufacturer. Polyethylene pipe and fittings shall be manufactured by Phillips Driscopipe, or approved equal.

2.09 Mechanical Couplings

A. Grooved End Couplings. Grooved end couplings shall be as manufactured by the Victuallic Co., Gustin-Bacon, or equal. Couplings shall engage and lock the grooved or shouldered pipe ends allowing some degree of contraction, expansion, and angular deflection. Coupling housing shall be of ductile iron or malleable iron and shall consist of two or more segments held securely together by at least two steel bolts. Sealing gasket shall be of such design that internal pressure in the pipe increases the tightness of the seal and shall be of materials suitable for the intended service. The coupling shall have a rated working pressure not less than the pressure rating of the pipe.

B. Flexible Couplings. Flexible (sleeve) couplings shall be of the full sleeve type, split sleeve type, or flanged adaptor type, as shown on the Drawings, specified herein, or as otherwise permitted by the Engineer. They shall provide the requisite pipe flexibility without jeopardizing pipe joint integrity due to hydraulic thrust, and shall have the same pressure-rating as the pipe. Couplings shall have all metal bearing surfaces and shall be provided with galvanized steel bolts and nuts. Flexible couplings shall be restrained unless the Engineer has given his approval to omit this feature for specific cases.

1. Full Sleeve Type Couplings shall be properly gasketed and shall be of a diameter to fit the pipe. Each coupling shall consist of a steel middle ring, 2 steel followers, 2 gaskets, and the necessary steel bolts and nuts to compress the gaskets. The couplings shall be Dresser Style 38, Smith-Blair Type 411, or equal. Couplings to be installed underground shall have a hot-dipped galvanized sleeve with corrosion resistant bolts conforming to AWWA C-111 (type 316 stainless steel).

2. Split Sleeve Type Couplings shall consist of one gasket, 2 housing clamps, and 2 bolts and nuts to obtain the flexibility for connecting the piping. Steel shoulders shall be provided and welded to the pipe ends to accommodate the couplings. The couplings shall be Kuhns, Ductile Iron Pipe Lock Coupling; M.B. Skinner Seal; or equal.

3. Flexible Flanged Coupling Adaptors shall be of the sleeve type, consisting of steel middle ring, steel followers, gaskets, and steel bolts and nuts to compress the gaskets. The couplings shall contain anchor studs of strength adequate to hold the pipe together under a pull equal to the longitudinal strength of the pipe at a tensile stress of 20,000 psi, and shall be Smith-Blair No. 913, Dresser Style 128, or equal. Couplings to be installed underground shall have a hot-dipped galvanized sleeve with corrosion resistant bolts conforming to AWWA C-111 (type 316 stainless steel).

2.10 Expansion Joints

Expansion joints for cast iron, ductile iron, polyethylene pipe, and steel pipe shall be provided as shown on Drawings and in accordance with the manufacturer's recommendation. The expansion joints shall be Red Valve Co., Redflex, double arch expansion joint, or equal.

2.11 Wall Sleeves

A. Wall sleeves to be installed in dry interior walls shall be Schedule 40 galvanized steel pipe and shall conform to the detail shown on the Drawings.

B. Wall sleeves to be installed in wet walls, slabs and external walls shall be fabricated from Schedule 40 steel pipe and shall have a steel annular ring welded to the middle of the pipe. The ring shall be 1/4 inch thick by 1 inch wide for 3-inch pipe or smaller and 3/8 inch thick by 2 inches wide for 4-inch pipe or larger. The ring shall be secured to the barrel by continuous welds on both sides of the ring. After fabrication, the sleeve and ring shall be hot-dip galvanized.

2.12 Wall Castings

Wall castings shall be flanged cast iron or fabricated steel construction with wall thickness and lining equivalent to the attached pipe, except in no case shall the wall thickness be less than 0.1345-inch. The casting shall incorporate a water stop/thrust reaction ring cast-on or secured to the barrel by continuous welds on both sides of the ring. The ring shall have a minimum width of 7/8-inch and a minimum thickness of 1/4-inch for 4" and smaller barrel size, increasing uniformly to 4-inches minimum width and 1/2-inch minimum thickness for 36-inch barrel size.

2.13 Pipe Hangers and Supports

Pipe hangers, brackets, saddles, clamps, and other supports shall be adjustable type conforming to the requirements of ANSI B31.1, Section 6; shall have ample strength and rigidity to resist the hydraulic thrusts at changes in direction and at dead ends as well as the dead weight loads and the load carried; and shall be hot-dip galvanized, including all bolts, nuts, and threaded

parts. Where not specifically identified or called out on the Drawings, computations showing adequacy of Contractor selected hangers and supports to meet these requirements shall be submitted with the Shop Drawings. Hangers and supports so identified on the Drawings does not relieve the Contractor from meeting all requirements specified herein. Wherever possible, brackets shall be used in lieu of hangers.

A. General. Hangers and supports shall include all hanging and supporting devices of metallic construction shown, specified, or required for pipe lines, apparatus, and equipment other than electrical equipment. The Contractor's working drawings, as required herein, shall show the quantity, type, design, and location of all hangers and supports required under the various Contract items. Hangers and supports shall be painted the same as required for the supported piping.

1. Where specified or shown, bolts, stud bolts, rods, yokes, and nuts of hangers and supports shall be of steel. Bolts shall not be less than 1/2-inch diameter unless otherwise called for on the Drawings.

2. Except where otherwise shown, specified, or required, hangers, supports, anchors and concrete inserts shall be the standard types as manufactured by Elcen Co., Grinnell Co., Fee and Mason Manufacturing Co., or equal meeting the requirements specified herein. Unless otherwise approved by the Engineer, all hangers, supports, and concrete inserts shall be listed with the Underwriters' Laboratory.

B. Design. Hangers and supports shall be adequate to maintain the pipe lines, apparatus, and equipment in proper position and alignment under all operating conditions and have springs where necessary. Hangers and supports shall be of standard design where possible, and be best suited for the service required, as approved by the Owner. Where required, they shall be screw adjustable after installation. Supporting devices shall be designed in accordance with the best practice and shall not be unnecessarily heavy. Sufficient hangers and supports shall be installed to provide a working safety factor of not less than 4 for each hanger, assuming that the hanger is supporting 12 feet of pipe filled with water. On pipes 3 inches in diameter and larger which are covered with heating insulation, hangers and supports shall include proper pipe protection saddles. Hangers and supports shall be designed to resist all enduced thrusts and lateral loads as required for seismic design by Uniform Building Code, 1979 edition as amended by 1981 Supplement.

1. Hangers and supports shall be designed and selected in accordance with MSS Standard Practices: SP-58, Pipe Hangers and Supports - Materials and Design; and SP-69, Pipe Hangers and Supports - Selection and Application.

C. Supports for FRP and PVC Piping. Rigid plastic piping normally shall be supported by the same type of hangers used with steel pipe, except that in no instance will C-clamp, or other point-bearing supports be allowed. Riser clamps, if required, shall be full-circumferential type only. Support spacing shall be based on the plastic pipe manufacturer's recommendations for the service conditions but not more than 5 feet on center. Flexible plastic tubing or rigid plastic pipe operating at temperatures high enough to lower its strength, shall be supported continuously by light metallic angles or channels and special hangers.

D. Saddle Stands. Saddle stands shall be of adjustable type. Each stand shall consist of a length of wrought pipe fitted at the base with a standard screw threaded cast iron flange and at the top

with an adjustable saddle or roll. The base flange shall be bolted to the floor or foundation. Stanchions shall be of similar construction to the saddle stand, except that they shall be fitted at the top with cast iron pipe saddle supports or with pipe stanchion saddles with yokes and nuts. Where adjustable supporting devices are not required, pipe lines 3 inches in diameter and smaller may be supported on approved cast iron, malleable iron, or wrought steel hooks, hook plates, ring or ring plates.

E. Anchors. Anchors shall be furnished and installed where specified, shown, or required for holding the pipe lines and equipment in position or alignment. Anchors shall be designed for rigid fastening to the structures, either directly or through brackets. The design of all anchors shall be subject to approval by the Owner.

1. Anchors for piping shall be of the cast iron chair type with wrought steel strap, except where anchors form an integral part of pipe fittings or where an anchor of special design is required.

F. Inserts. Inserts for concrete shall be furnished galvanized and shall be installed in the concrete structures where required for fastening supporting devices. They shall be designed to permit the rods to be adjusted horizontally in one plane and to lock the rod nut or head automatically. Nail slots shall be provided in the exposed flanges of the insert. Inserts shall be designed to carry safely the maximum load that can be imposed by the rod which they engage.

G. Materials. No use shall be made of wire, straps, chains, etc., for supporting piping nor shall cast expansion shields be used for anchoring bolts. Hangers and supports of metallic construction shall conform to the requirements specified herein and to the following standards:

1.	Structural steel	ASTM A36 and A283
2.	Steel bars (grade 1022)	ASTM A107
3.	Steel castings (grade N-1)	ASTM A27
4.	Iron castings (grade 35)	ASTM A42
5.	Cast iron pipe fittings (class 125)	ANSI B16.1
6.	Malleable iron castings	ASTM A47
7.	Bolting materials, steel	
	a. Bolts, yokes and stud bolts	ASTM A307
	b. Nuts	ASTM A563
	c. Physical requirements	
	(1) Tensile strength	60,000-72,000 psi
	(2) Yield strength	38,000-50,000 psi
	(3) Elongation	27 percent maximum
	(4) Reduction of area	35-55 percent
8.	Bolting materials, silicon bronze	
	a. Bolts, stud bolts, yokes and nuts (alloy A)	ASTM B98

b. Physical requirements:

(1) Tensile strength	70,000 psi minimum
(2) Yield strength	38,000 psi minimum
(3) Elongation	17 percent maximum

9. Bolting materials, stainless steel

a. Bolts, stud bolts and nuts (type 316)	ASTM A276

b. Physical requirements:

(1) Tensile strength	75,000 psi minimum
(2) Yield strength	30,000 psi minimum
(3) Elongation	35 percent maximum
(4) Reduction of area	45 percent maximum

10. Where specified or shown, bolts, stud bolts, rods, yokes and nuts of hangers and supports shall be of silicon bronze or stainless steel as specified above with dimensions, threads and sizes equivalent to those specified in steel. Where submerged in process fluids or where located in covered manholes, bolts, stud bolts, rods, yokes and nuts of hangers and supports shall be of silicon bronze, unless otherwise noted.

H. Supports for Piping. Brackets for support of piping from walls and columns shall be made of welded wrought steel and shall be designed for three maximum loads classified as follows:

1.	Light	750 pounds
2.	Medium	1,500 pounds
3.	Heavy	3,000 pounds

When medium or heavy brackets are bolted to walls, back plates of adequate size and thickness shall be furnished and installed to distribute the load against the wall. When used on concrete walls the back plates shall be cast in the concrete. Where the use of back plates is not practicable, the brackets shall be fastened to the wall in such a manner that the safe bearing strength of the wall will not be exceeded. Pipe rolls or chairs shall be of the cast iron type. Pipe rolls shall be provided with threaded rods.

I. Spacing of Hangers. Pipe support spacing requirements are indicated on the Drawings or elsewhere in these Specifications. See Section 15094, Pipe Hangers and Supports.

J. Where concentrations of valves, fittings, and equipment occur, closer spacing of supports will be required. In no case shall any total hanger load (weight of piping, insulation, and contents) exceed the following load carrying capacities for hot rolled steel rod ASTM A36-77a):

Nominal Rod Diameter - Inches	Maximum Safe Load - Pounds Max. Temp. 650°F
1/2	1,130
5/8	1,810
3/4	2,710
7/8	3,770
1	4,960

Nominal Rod Diameter - Inches	Maximum Safe Load - Pounds Max. Temp. 650°F
1-1/8	6,230
1-1/4	8,000
1-3/8	9,470
1-1/2	11,630

K. Support of Vertical Pipes. Where vertical pipe runs exceed 15 feet, and a support system is not indicated on the Drawings, provide carbon steel riser clamps for support and steadying of the pipe. Where possible, riser clamps shall be fitted and bolted below a coupling, flange, or hub. Maximum spacing of clamps shall be 15 feet.

2.14 Piping Insulation

See Section 15260.

2.15 Insulation Fittings

Insulation couplings, flanges, fittings, and unions shall be the products of F. H. Maloney Company, Cor Ban Products Company, or equal. Fittings utilizing insulating bushings shall not be used.

2.16 Pipe Sleeve Sealing Materials

A. Pipe Sleeve Sealant. The sealant shall be one of the following approved materials which will bond securely to concrete and steel, be watertight under continuous submergence, and will not contaminate water in any way. The material shall not harden materially when exposed to weather, and shall be suitable for application by calking, knife, or gun. Certified test reports shall be submitted by the manufacturer on the actual batch of compound material furnished, showing compliance with the specifications before sealant is delivered. The several types shall conform to the following:

1. Lead. Lead shall be 99.73 percent minimum pure pig lead used for calking bell and spigot cast-iron joints, conforming to the requirements of Federal Specifications QQ-C-40, Type 1, Grade AA.

2. Polyurethane Compound. The compound shall be a polyurethane polymer that cures at ambient air temperature to a firm, flexible, tear-resistant rubber designed for bonding to continuously submerged surfaces. It shall have cured physical properties meeting the requirements of ANSI A115.1 and Federal Specification TT-S-00227E; shall develop a Shore "A" hardness of between 22 and 40 after 7 days submergence in water; shall have 150-psi minimum tensile strength and 500 percent minimum elongation when tested in accordance with ASTM Designation D 412 at 75 degrees F.; and shall be provided in gray color for nonsubmerged use and black for submerged use.

B. Joint Filler. The joint filler shall be glass fiber roping, formed neoprene, butyl, or polyurethane type as recommended by the sealant manufacturer.

C. Bond Breaker Material. Bond breaker material shall be polyethylene tape, masking tape or other product recommended by the sealant manufacturer.

D. Modular Wall Seal. Where indicated on the Drawings or approved by the Owner, a modular wall seal shall be furnished and installed.

1. Seals. Seals shall be modular mechanical type consisting of interlocking solid synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and the wall opening, capable of, and guaranteed to be water-tight with up to forty (40) feet of hydrostatic pressure differential. The seal shall be constructed to provide dielectric insulation between the pipe and the wall opening.

2. Wall Opening. The Contractor shall provide the wall opening sized as recommended by the seal manufacturer to assure a water-tight joint. The wall opening casing shall be steel wall sleeve with embedded wall flange and shall meet requirements of Steel Pipe specified herein.

3. Materials.

   a. Rubber Links. EPDM synthetic rubber, ASTM D-1418.

   b. Pressure Plate. Delrin plastic.

   c. Bolts and Nuts. Stainless Steel, Type 304.

4. Submittal. The Contractor shall submit marked manufacturer's catalog cuts and materials information for each modular wall seal in accordance with these Specifications.

2.17 Pipe Material Schedule

The pipe material schedule is presented as Table 1 at the end of this Section. Pipe shall be as indicated in the schedule unless otherwise shown on the Drawings or specified otherwise. Pipe material listed therein shall conform to Specifications presented in Part 2 of this Section.

PART 3 - EXECUTION

3.01 General

A. Care and Handling of Materials. All materials shall be carefully handled in all steps of fabrication, storing, loading, transporting, unloading, storing at the site, and installation, using the means and following the procedures submitted with the approved shop drawings. All steel pipe over 12-inch size shall be fitted after fabrication with internal bracing and stulls at both ends as a protective measure against deformation and injury to mortar lining. Pipe slings used during handling, and tie-down straps during transit shall be not less than 4-inch wide flat fiber or plastic straps. During storage and in transit, pipe 8-inches and larger shall be rested on saddles or on another support system approved by the Engineer, which will insure freedom from damage of the barrel, interior lining, and exterior coating. Not less than 3 saddles or other longitudinal pipe supports shall be used during transit.

B. Installation.

1. The different kinds of piping (buried and exposed) shall be installed in accordance with the Drawings and the procedures and methods submitted with the approved shop and erection

Drawings. Such procedures and methods shall conform to or exceed the minimum requirement of the pipe manufacturer, and shall be as supplemented by the provisions specified herein. The interior of pipe, fittings, and couplings shall be clean and free from contamination when installed and effective means shall be taken to prevent the entrance of foreign matter during progress of the work. The types and sizes of pipes and fittings to be used shall be as specified herein and as shown on the Drawings. Where fittings are omitted from the Drawings, they shall be the same size as the piping and in all cases shall conform to the plumbing code requirements.

2. All pipe shall be carefully placed and supported at the proper lines and grades and where practicable shall be sloped to permit complete drainage. Piping runs shown on the Drawings shall be followed as closely as possible, except for minor adjustments to avoid architectural and structural features. If relocations are required, they shall be approved by the Owner.

C. Joints. In erecting the pipe, a sufficient number of screw unions, flanged joints, or mechanical couplings shall be used to allow any section or run of pipe to be disconnected without taking down adjacent runs. Screw unions may be employed on pipelines 3 inches in diameter and under. Flanged joints or mechanical couplings shall be employed on pipe 4 inches in diameter or larger unless otherwise shown on the Drawings. Dielectric unions must be installed at the junction of dissimilar metals.

D. Storage and Handling. During storage, handling, and transporting, every precaution shall be taken to prevent injury to pipe. Pipe shall be handled only by means of approved hooks on ends of sections, by means of fabric slings, or other methods approved by the Engineer for the pipe used. Mortar lined pipe shall be kept sufficiently moist to prevent drying out of the mortar lining prior to installation.

E. Verification of Dimensions. All dimensions essential to the correct location of the pipe, or fit of piping at equipment and valves, or to the proper location and orientation of pipe sleeves and wall castings, or to the avoidance of obstructions or conflict with other improvements, shall be accurately determined by the Contractor prior to fabrication of the piping involved. All required changes from the nominal locations shown on the Drawings shall be made by the Contractor and shall be included as a part of the work hereunder and be approved by the Owner.

F. Pipe Sleeves. All piping which will pass through walls, slabs, footings, or beams shall be provided with specified pipe sleeves with annular space sealed or with wall castings. The Contractor shall provide the wall sleeves and castings for insertion in the concrete work covered in Section 03300, "Cast-in-Place Concrete," and shall verify their correct setting prior to concrete placement. The sleeve sealant shall be either polyurethane, or lead caulking. No pipe joint will be allowed to occur in the sleeve. The seal on both ends of the sleeve shall be flush with the concrete surfaces on completion of work and drying of sealant. Caulking and sealing of wall sleeves shall conform to the following requirements:

1. Preparation for Sealing. The annular space between the pipe and sleeve shall be cleaned of all loose particles and contamination, and shall be dry prior to sealing. Tape or other recommended protection shall be applied on the structure surfaces to preclude contamination by the sealant, and any contamination which occurs shall be removed immediately, followed by a thorough washing of the surfaces with solvent. Prepared

compound not used during the application time limits designated by the manufacturer of such compound shall be discarded.

2. Application of Compound Sealant. The sealing shall be performed after any required primer has been applied and backup material placed. The work shall be performed in accordance with the submitted erection drawing detail and procedure, and all grooves shall be solidly filled. The application shall be made in clean, straight lines free of wrinkles, be tooled as required and finished with a convex surface just sufficient to provide the required flush surface upon drying. Work shall not be performed when the air temperature is below 50 degrees F.

3. Application of Lead Caulking. The annular space shall be packed and ends shall be calked as required for bell and spigot joints in AWWA Standard C600.

3.02 Buried Piping

A. Buried Pipe Installation. Buried piping shall be laid to the grades and alignment shown on the Drawings, and all trenching, bedding, and backfilling shall conform to the applicable requirements of Division 2; other work shall conform to the following sections of AWWA Standard C600.

Section 2, "Inspection, Receiving, Handling and Storage";

Section 3.1, "Alignment and Grade";

Section 3.3, "Pipe Installation";

Section 3.4, "Joint Assembly";

Section 3.6, "Valve and Fitting Installation";

Section 3.8, "Thrust Restraint";

The foregoing requirements shall govern the work, regardless of the type of pipe installed unless a more stringent requirement is specified. When the work is not in progress, open ends of pipe and fittings shall be securely closed. The piping shall be placed when trench and weather conditions are suitable. No pipe shall be laid in water, and responsibility for the diversion of drainage and dewatering of trenches during construction, including meeting all safety requirements, shall be borne by the Contractor. All pipe in place shall be approved as to line, grade, bedding, and proper joint construction before backfilling. In all backfilling operations, the Contractor shall be responsible for preventing damage to or misalignment of the pipe.

B. Joint Installation. Installation of joints and couplings for buried piping shall conform to the following requirements:

1. Joints for pipe 4-inch diameter and over, shall comply with the supplementary requirements specified herein, and joints of all sizes shall conform to the applicable requirements specified hereinafter for aboveground piping. Care shall be taken to keep pipe in correct alignment when making joints. Friction or lever pullers or other approved means of insuring straight pulling shall be used on pipe larger than 8 inches and also on smaller sizes where damage to the end might occur. The "popping-on" of joints will not be permitted. The fitting of piping to valves, hydrants, and wall castings shall be worked out in advance of installation to ensure correct orientation of the mating ends and bedding of approach piping.

2. Restrained type joints shall be provided at all joints of pipe with specials and fittings in piping of lower pressure rating. Welding and qualifications of welders shall conform to the requirements of AWWA Specification C206, with welding procedure and welders to be qualified for the specific type of welding within each section of pipe.

3. The interior mortar lining of pipe at joints shall be smoothly continuous and of full thickness. Flanges, galvanized flange bolts, and other exterior surfaces of restrained joints and flanged couplings shall be given two coats of a coal tar base coating suitable for the purpose. Where coatings of pipe and valves or appurtenances do not lie in the same plane, the offset shall be filled gradually with a suitable epoxy putty to provide a smoothly continuous joint.

4. Sleeve type couplings installed underground shall be coated with a 20 mil bituminous coating before backfilling. Cover with sand before backfilling.

5. Silver solder shall be used for soldered joints in buried tubing.

C. Thrust Blocks. On all pressure pipelines 4 inch and larger with bell and spigot joints, concrete thrust blocks shall be provided at all fittings and dead-ends, and at bends greater than 22.5 degrees. The concrete shall conform to the requirements for 3,500-psi concrete as specified in Section 03300, "Cast-in-Place Concrete," and shall be placed against properly dampened, undisturbed soil, centered on the thrust resultant line. The concrete shall be free of joints, and any mortar contaminating the joints shall be removed.

D. Coverage. Unless otherwise shown on the Drawings, all buried piping shall have a coverage of at least 24 inches between the top of the pipe and the finished surface. Variations from the pipeline grade and alignment may be allowed to accommodate fabrication with the approval of the Engineer. All changes of grade shall require the approval of the Engineer on the installation drawings.

3.03 Above Ground Non-Buried Piping

A. Pipe Installation. All piping shall be installed in accordance with the erection drawings and the erection procedure submitted with the approved shop or erection drawings. The horizontal piping shall be run parallel to the building walls and shall be level except where otherwise shown or specified; parallel lines shall be grouped on the same horizontal or vertical plane wherever possible. Vertical piping shall be plumb, and the entire piping configuration shall allow adequate clearances for convenient access for painting and preventive maintenance of valves. Piping shall clear obstructions, preserve headroom, and keep openings and passageways clear. If structural difficulties or other work prevent the running of pipes or the setting of equipment at the point indicated on the Drawings, the necessary minor deviations therefrom, as determined by the Contractor and approved by the Owner, will be allowed, and shall be shown on the erection drawings to be furnished. Except as otherwise shown or specified, piping installation work shall conform to the requirements of the printed or written recommendations of the manufacturer of the product involved for the given conditions, as approved.

B. Joint Installation. Installation of joints and couplings shall conform to the following requirements:

1. Joints and Couplings. Joints and Couplings shall be made in accordance with the specified requirements made part of the erection procedure submitted by the Contractor.

2. Steel Pipe with Welded Fittings. Joints in welded piping shall be made by oxyacetylene or electric arc process in accordance with AWWA Standard C206.

3. Pipe Threads. Pipe threads shall be in accordance with the requirements of ANSI B2.1, and shall be cut full and free from torn or ragged surfaces. No more than three threads on the pipe at any joint shall remain exposed after installation. Threaded joints shall be established with Teflon tape applied to the male ends only. The use of thread cement or calking of threaded joints to stop or prevent leakage will not be permitted. Sharp-toothed pipe wrenches or similar wrenches shall not be used in making up copper or brass pipe.

4. Flanged Joints. Flanged joints shall be made with gaskets centered in the joint. Bolts, studs, and nuts shall be lubricated with graphite and oil so that the nuts can be turned by hand. Care shall be taken to prevent excessive initial tension to the bolt and studs and so that the tension applied is as nearly uniform as possible. The rust preventive compound applied to the faces of flanges before shipment shall be removed before installation. Where slip-on flanges are used, they shall be fillet welded to the pipe on both front and back sides.

5. Tubing. Tubing which is to be soldered shall be cut square, and all burrs shall be removed. Both the inside of the fitting and the outside of the tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent annealing of fittings or hard-drawn tubing when making connections. Joints for soldered fittings shall be made with a non-corrosive, paste flux and solid string or wire solder composed of 40 percent tin and 60 percent lead. Soft solder or cored solder will not be permitted. Tubing to be coupled with flared compression type fittings shall conform to the applicable provisions of the Joint Industry Conference (JIC) Standards and the recommendations of the manufacturer.

6. Mechanical Coupling Type Joints of the sleeve, grooved mechanical, split sleeve, and flanged coupling adapter types shall be made in accordance with the printed instructions of the manufacturer. The pipe ends to receive the couplings shall be finished to the outside diameter and surface finish required by the coupling manufacturer. Prior to assembly, all surfaces which will be inaccessible after installation shall be given protective coating.

7. Joint Harnesses shall be provided at sleeve type coupling joints on pressure pipelines and at all pump discharge piping. The harnesses shall be tightened just sufficiently to preclude displacement of the downstream piping under hydraulic thrust.

8. Electrical Insulation joints shall be provided at all connections between dissimilar metals and ferrous and non-ferrous pipe except where the nonferrous pipe is an electrical non-conductor. The joints shall be tested after completion to verify non-conductivity.

9. PVC Pipe Joints at fittings and couplings to valves and equipment shall be made in accordance with the manufacturer's printed instructions.

3.04 Installation of Steel Pipe

Steel pipe shall be installed as shown on the Drawings. Horizontal and vertical pipe shall be anchored securely by means of pipe hangers or supports. Sufficient unions shall be provided to facilitate taking down pipe. Pipe ends shall be reamed to the full bore of the pipe. Threads

shall conform to the requirements of ANSI B2.1-1968. In making up threaded joints, Teflon tape shall be applied to the male ends only.

3.05 Installation of PVC Pipe

A. Laying. Plastic pipe shall be installed where and as shown on the Drawings. The trench for buried plastic piping shall be excavated to four inches below the bottom of the pipe and filled to the proper grade with coarse sand, thoroughly tamped. After the pipe is laid the trench shall be backfilled with sand to 6 inches above the top of the pipe. The remainder of the trench shall then be backfilled in accordance with Section 02200.

B. Fittings. Fittings for plastic pipe shall be flanged or of the socket type using the solvent weld process. Transition from plastic to steel pipe shall be by flanges or by threaded slip joint plastic adapter or fitting. No plastic pipe shall be threaded. No solvent shall be used on threaded end of plastic adapters or fittings.

C. Anchorage. All line valves and fittings at downpipes shall be anchored to the wall in a manner to prevent stress and rotation of the pipe.

D. Joints. Joint material for plastic pipe shall conform strictly to the printed recommendations of the pipe manufacturer. Solvent weld connections shall be made as follows:

1. Joints shall be wiped clean and a solvent supplied by the manufacturer applied to both male and female connections.
2. Two applications of the solvent shall be made.
3. The treated surfaces shall be forced together as soon as the pipe material becomes soft or tacky and given 1/4 turn as recommended by the manufacturer.

3.06 Installation of Corrugated Metal Pipe

Corrugated metal pipe shall be laid on a prepared trench bottom. Annular corrugated pipe shall be laid in the trench with the outside laps of circumferential joints upgrade with longitudinal laps positioned other than in the invert. The separate sections shall not be more than 1.5 inches apart. Corrugations or projections on the coupling shall properly engage the pipe corrugations before bolts are tightened. After pipe has been laid and coupled, the trench shall be backfilled with sand to 12 inches above the top of the pipe.

3.07 Installation of Polyethylene Pipe

A. Handling of Pipe. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking should be in accordance with the pipe manufacturer's recommendations. The pipe should be handled in such a manner that it is not damaged by being dragged over sharp objects or cut by chokers or lifting equipment.

B. Repair of Damaged Sections. Segments of pipe having cuts or gouges in excess of 10% of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method.

C. Pipe Joining. Section of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment

used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment and fusion pressure.

D. Handling of Fused Pipe. Fused segments of pipe shall be handled so as to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable-type chokers should be avoided. Nylon slings are preferred. Spreader bars should be used when lifting long fused sections . Care should be exercised to avoid cutting or gouging the pipe.

3.08 Installation of Pipelines Through Concrete Structures

A. Whenever a pipeline or any material terminates or extends at or through a structural wall or sump, the Contractor shall install, in advance of pouring the concrete, the fitting or special casting required for the particular installation. Otherwise, prepare and submit shop/erection drawings of other installation methods and obtain approvals in advance of commencement of work.

B. Whenever any run of pipe is installed per approved shop/erection drawings subsequent to placing of concrete, the Contractor shall accurately position the opening in the concrete for such pipelines. Unless otherwise required, all pipes penetrating fluid containing or earth supporting portions of the structure shall be ring flanged.

1. Opening shall be of sufficient size to permit a perfect final alignment of pipelines and fittings without deflection of any part and to allow adequate space for satisfactory packing where pipe passes through wall to insure water tightness around openings so formed.

2. The boxes or cores shall be provided with continuous keyways to hold the filling material in place and to insure a watertight joint.

3. Boxes or cores shall be filled with nonshrink grout or nonshrink concrete.

   a. Non-Shrink Concrete. All non-shrink concrete shall contain one (1) pound of Embeco Aggregate per pound of water that is in excess of two gallons per sack of cement.

   b. Non-Shrink Grout. Non-shrink grout shall be made with the following proportions:
   1 part Type I Portland Cement (1 bag)
   1 part Embeco Aggregate (100 lbs.)
   1 part clean, well graded concrete sand (100 lbs.)
   Approximately 5.5 gallons of water per bag of cement.

3.09 Changes in Line Grade

In the event that obstructions not shown on the Drawings are encountered during the progress of the work which will require alterations to the Drawings, the Owner shall have the authority to change the Drawings and order the necessary deviation from the line or grade. The Contractor shall not make any deviation from the specified line or grade without approval by the Owner. Should any deviations in line or grade be permitted by the Owner in order to reduce the amount of rock excavation or for other similar convenience to the Contractor, all additional costs for thrust blocks, valves, blowoff assemblies, extra pipe footage or other additional costs shall be borne by the Contractor.

3.10 Welding

A. The Contractor shall be responsible for the quality of work performed by his welding organization. All welding operators shall be qualified under the Standard Qualification procedure of the American Welding Society. All welds shall be made by an electric shielded arc method of welding. Field welding of all joints shall be in conformance with AWWA C206.

B. The Owner shall have the right at any time to call for and witness the making of test specimens by any welder in accordance with these Specifications, and the expense of such tests shall be borne by the Contractor.

C. Welds considered by the Owner to be deficient in quality, or made contrary to any mandatory provision of these specifications, shall be removed throughout its depth to expose clean base metal, but in case of a strictly local deficiency, the weld need not be removed throughout its entire length, provided that sufficient amount shall be removed to insure that sound weld metal, only, remains. A cracked weld shall be removed throughout its length.

3.11 Identification of Piping

A. Piping Systems. Identification of piping systems shall conform to the requirements of ANSI A13.1, "Scheme for the Identification of Piping System," unless otherwise specified herein.

B. Color Identification. All exposed and or unburied pipe, including tubing, galvanized pipe, polyvinyl chloride pipe, fiberglass reinforced pipe, and stainless steel pipe, shall be identified by color to show its use function. Color bands of an approved taped type may be used on PVC, FRP, and stainless steel pipe and all other pipe not readily susceptible to painted finish. Markers shall be adhesive type with extra strength and suitable for continuous duty at 250 degrees F. All markers shall have a protective silicone film. Colors shall be as specified in Section 09900.

Both the direction of fluid flow, and the name of the fluid in the pipe shall be stenciled on all pipe at least once every twenty-five (25) feet and at every change of direction. Color bands shall be spaced at fifteen (15) foot intervals and every change in direction. The size of the letters and color bands shall be as specified in the table below:

Outside Diameter of Pipe or Covering	Width of Color Band	Height of Legend Letters
¼ to 1-¼	1	1/2
1-½ to 2	1	3/4
2-½ to 6	6	2
8 to 10	6	2-½
Over 10	6	3-½

All dimensions are given in inches.

C. Color Schedule. Conform to Section 09900.

D. Labeling. After the painting of process piping is complete, the Contractor shall stencil the tag numbers of all valves numbered on the P and ID Drawings, on the pipe adjacent to the valve for pipe 2 inches and over. Characters shall be one inch high minimum and shall be oriented to be

visible from the valve operating position. When the valve has extended operator shaft or chain operator, the number shall be placed both at the operating position and at the valve if the valve cannot be seen from the operating position. The latter requirement does not apply if the valve is buried. Valves in pipes under 2 inches shall have characters as large as the pipe will permit, or at the Owner's option, on an adjacent surface. Characters shall be preferably white, however, if this would not provide sufficient contrast to the pipe, the Owner may select another color. Paint used shall be of the same type and quality as used for painting the pipe.

3.13 Protective Coatings

Painting and coatings shall conform to the applicable requirements of Section "Painting and Protective Coatings", and the schedule submitted with the shop and erection-drawings. It shall be the Contractor's responsibility to fully coordinate the protective coating requirements with the foregoing color code identification requirements to ensure compatibility of materials used.

3.14 Testing

The Contractor shall perform hydrostatic, leakage, and operational tests as specified herein. The Contractor shall perform all excavation and other work required to locate and repair leaks and correct other defects which may be disclosed or develop under tests; the Contractor shall replace all coating, painting, backfill, or other permanent work removed in locating or repairing leaks and correcting defective piping. All gages and control devices connected to lines being tested must be disconnected for the duration of the test. Water shall not be used in testing air lines, chlorine lines, nitrogen lines, or other gas carrying pipes. High pressure air testing of PVC or FRP pipe in exposed or above ground installations is not permitted. The Contractor shall furnish and install a chart type recording meter for the pressure tests. The Contractor shall submit to the Owner before and after the test the gage and meter used so that these devices may be tested by the Owner.

B. Testing Requirements.

1. Gravity Sewer Pipes or Other Pipelines Having Free Surface Flow Except Storm Drainage Pipelines. Contractor shall use the low pressure air and leakage test as specified herein.

2. Pressure Pipe, Flanged or Welded Joints. PVC, FRP, steel, cast iron, ductile iron or other pipe material, with solvent welded, welded, treaded, flanged, grooved end or flexible couplings and joints shall be pressure tested as specified herein. No leakage shall be permitted.

3. Gravity Storm Drainage Pipe. No special pressure or leakage testing is required. Leakage shall be minimized by installed in a workmanlike manner with no visible sources of leakage in accordance with the manufacturer's recommendations.

4. Pressure Air and Gas Piping. All piping carrying air or other gasses under pressure shall be given a pressure test as specified herein. No leakage is permitted. Low pressure air piping shall be tested pneumatically. Air pressure of 20 pounds per square inch shall be applied to piping and fittings. High pressure air piping shall be tested to 200 psi. There shall be no drop in pressure in a 24-hour period. Leaks shall be located and repaired to the satisfaction of the Owner. Pressure drops due to thermal contraction are acceptable if the pressure returns to the original test pressure after 24 hours.

C. Pressure Tests.

1. General. All piping, including valves, shall be field-tested at a hydrostatic pressure of 50 psi above the pipe pressure class (unless specified otherwise in the Testing Schedule), corrected to the elevations of the test gage, with duration of two hours minimum, for each pressure test, except as otherwise specified in Testing Schedule. Piping conveying liquids between process tankage, not subject to pumping, shall be tested to the maximum possible pressure that can be obtained under static conditions. Air piping shall be tested using air or nitrogen.

2. Joint Exposure. All exposed pipe, fittings, valves, hydrants, and joints shall be carefully inspected before being cast in concrete and/or during the open trench tests. All defects discovered shall be corrected by removal and replacement, as approved by the Owner, and the work then retested to demonstrate satisfactory performance. Where practical, no concrete encasement or backfilling of pipe joints will be permitted prior to the satisfactory completion of the tests in any given section.

3. Thrust Blocks. Temporary or permanent thrust blocks shall be placed as required prior to tests, and the Contractor shall provide all necessary braces, plugs, thrust blocks, caps, flanges, and other materials to permit proper performance of the pressure testing; tests shall not be conducted until the concrete thrust blocks are capable of withstanding the loads produced.

D. Leakage Tests.

1. General. Leakage tests shall be conducted concurrently with pressure test. The lowest pressure during the leakage test shall be no less than 5 psi below the pressure used in the pressure test. The allowable leakage for pipes conveying liquids between process tankage (not subject to pumping) shall be determined in accordance with AWWA C-600 Section 4.2 where in the equation, P is the maximum pressure occurring anywhere in the pipeline. The duration of the test shall be not less than two hours, and measurement shall be made by means of a calibrated suction tank showing the amount of water required by the test pump to accurately maintain the specified test pressure. Tests shall be performed only in the presence of the Owner, or, if scheduling of tests is such that the Owner cannot attend due to conflicting commitment, tests may be performed without the Owner's presence if the Contractor obtains written permission to do so from the Owner prior to initiation of testing. No test report will be accepted unless proof of compliance with the foregoing requirement accompanies the test report.

PIPE TESTING SCHEDULE

Pipe Designation	Operating Condition	Test Fluid	Test Pressure	Remarks
GI	Pressure	Water	100 psi	
PPT	Pressure	Water	100 psi	
OWP	Pressure	Water	100 psi	
EP	Pressure	Water	100 psi	
CP	Pressure	Water	100 psi	
FP	Pressure	Water	100 psi	
GFE	Pressure	Water	100 psi	
BSP	Low Presure	Water	50 psi	
OF	Pressure	Water	100 psi	
SDF	Pressure	Water	100 psi	
DS	Pressure	Water	100 psi	
PET	Pressure	Water	100 psi	
SS	Pressure	Water	100 psi	
LF	Pressure	Water	100 psi	
LFR	Pressure	Water	100 psi	
CF	Pressure	Water	100 psi	
AF	Pressure	Water	100 psi	
PW	Pressure	Water	150 psi	
HPA	High Pressure	Air	150 psi	
Sewer	Low Pressure	Water	50 psi	
Gas	Low Pressure	Air	50 psi	

3.15 Flushing

A. General. All piping shall be flushed clean of all dirt and foreign material following completion of the hydrostatic and leakage test. Air and gas piping shall be purged with air or inert gas as directed by the Owner.

B. Equipment and Supplies. The Contractor shall provide all equipment, and supplies for performing the work, and shall waste the water at locations or by procedures approved by the Owner. The Contractor shall be responsible for furnishing fittings and all special pipe taps required for injecting any required sterilizing solution.

TABLE 1
PIPE MATERIAL SCHEDULE

Service	Line Identification	Application	Pipe Material	Joints and Fittings*
Groundwater Influent	GI	Exposed, Buried	HDPE	Fused
Process Pressure Tap	PPT	Exposed	Galv. Steel	Threaded
Oil/Water Separated Water	OWP	Exposed	PVC	Solvent Weld
Equalized Process Water	EP	Exposed	PVC	Solvent Weld
Clarified Process Water	CP	Exposed	PVC	Solvent Weld
Filtered Process Water	FP	Exposed	PVC	Solvent Weld
GAC-Treated Final Effluent	GFE	Exposed, Buried	PVC	Solvent Weld
Building Sump Process Water	BSP	Exposed	PVC	Solvent Weld
Overflow	OF	Exposed	PVC	Solvent Weld
Sludge Decant/Filtrate	SDF	Exposed	PVC	Solvent Weld
Dilute Sludge	DS	Exposed	PVC	Solvent Weld
Petroleum/Solvent	PET	Exposed	PVC	Solvent Weld
Settled Sludge	SS	Exposed	PVC	Solvent Weld
Lime Feed	LF	Exposed	PVC	Solvent Weld
Lime Feed Return	LFR	Exposed	PVC	Solvent Weld
Coagulant Feed	CF	Exposed	PVC	Solvent Weld
Acid Feed	AF	Exposed	PVC	Solvent Weld
Plant Water	PW	Exposed	Copper (inside)	Soldered
		Buried	Steel (outside)	Welded
High Pressure Air	HPA	Exposed	Galv. Steel (Stnd. wt.)	Threaded
Sewer	S	Exposed, Buried	Steel	Welded
Gas	G	Exposed	Black Steel	Threaded

*Unless otherwise shown or required to connect to fittings and appurtenances

-- END OF SECTION 15060 --

SECTION 15094
PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 Description

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to design, furnish, and install all hangers, supports, and appurtenances necessary to complete the Work.

B. Related Sections:

1. Section 03300, Cast-in-Place Concrete.
2. Section 09900, Painting. (Specifications for surface preparation and shop priming required under Section 15094 are under Section 09900.)
3. Division 15, Sections on Piping, Valves, and Appurtenances.

1.02 Quality Assurance

A. Each type of pipe hanger or support shall be the product on one manufacturer.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. The Manufacturers Standardization Society of the Valve and Fittings Industry:
   a. MSS SP-58, Pipe Hangers and Supports - Material Design.
   b. MSS SP-69, Pipe Hangers and Supports - Selection and Application.
2. Federal Specification, FS W-H-171, Hangers and Support, Pipe.
3. ASTM A 575, Merchant Quality Hot-Rolled Carbon Steel Bars.
4. Underwriters' Laboratories, Inc. Standard UL-203-Pipe Hanger Equipment.

1.03 Submittals

A. Shop Drawings: Submit for approval the following:

1. Detailed Drawings showing all hangers and supports for each piping system specified. Shop Drawings shall show location, installation, and material of all hangers and supports.
2. Submit and coordinate these with Shop Drawings required for all piping systems.

B. Product Information: Submit manufacturers' catalogs, literature, and engineering data on all hangers and supports. Load ratings, materials, and installation shall be consistent with the recommendations of the MSS SP-58, MSS SP-69, and Federal Specification WW-H-171.

1.04 Product Delivery, Storage, and Handling

A. Deliver equipment to the site to insure uninterrupted progress of the Work.

1. Deliver pipe hanger inserts which are to be embedded in cast-in-place concrete in ample time not to delay that Work.

B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

C. Store materials in covered storage off the ground and prevent condensation.

PART 2 - PRODUCTS

2.01 General Requirements

A. Hangers and supports shall meet with the following requirements:

1. Standard and fabricated hangers and supports shall be furnished complete with necessary inserts, bolts, nuts, rods, washers, and other accessories.
2. Run piping in groups where practicable and parallel to building wall generally. Provide minimum clearance of 1 inch between pipe and other work.
3. Install hangers or supports at all locations where pipe changes direction.
4. All hangers and supports shall be capable of adjustment after placement of piping.
5. Different types of hangers or supports shall be kept to a minimum.
6. Support vertical piping at each floor and between floors by stays or braces to prevent rattling and vibration.
7. Hanger rods shall be straight and vertical. Chain, wire, strap, or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.
8. Maximum support spacing unless otherwise shown or approved for standard weight steel pipe shall be as follows:

Pipe Size (in.)	Spacing (ft.)
Up to 1-1/2	6
2 through 3	10
3-1/2 and greater	12

9. Maximum support spacing unless otherwise shown for plastic pipe shall be one-half of the values specified for steel pipe.
10. Where proper hanger or support spacing does not correspond with joist or rib spacing, structural steel channels may be attached to joists or ribs and pipes suspended therefrom.
11. Prevent contact between dissimilar metals when supporting copper tubing, by use of copper plated, rubber or vinyl coated, or stainless steel hangers or supports.

2.02 Hangers and Supports

A. Hangers and supports where shown shall be in accordance with detail drawings. Hangers and supports not shown shall be in accordance with MSS SP-58.

B. Product Manufacturer: Provide hangers and supports as manufactured by one of the following:

1. ITT Grinnel Co.
2. Elcer.
3. Or equal.

2.03 Accessories

A. Hanger rods shall be made from ASTM A 575, with square head nut on top and running thread on bottom end.

B. Concrete Inserts:

1. Concrete inserts shall be MSS SP-58 malleable Type 18.

2. Manufacturer: Provide concrete inserts of one of the following:

a. Unistrut Corporation, Wayne, Michigan.

b. Elcan Metal Products, Company, Franklin Park, Illinois.

c. Or equal.

C. Steel Beam Clamps:

1. Steel beam clamps shall be of malleable iron and conform to MSS SP-58.

D. Inserts for Pipe Insulation:

1. Insulated pipe, larger than 1-1/2 inches in diameter, shall be supported by a rigid insert to protect the insulation. A steel metal saddle of sufficient gauge to carry the weight of the pipe and its fluid without deforming shall extend 2-inches minimum on each side of the rigid insert. The joints between insert and insulation shall be sealed before saddle is installed. Sizes up to 6-inches IPS shall be MSS SP-58 Type 40 and for sized over 10 inches shall be MSS SP-58 Type 39.

2.05 Painting

A. Clean and prime ferrous metal surfaces in the shop in accordance with the requirements of Section 09900.

B. Field painting is under Section 09900.

PART 3 - EXECUTION

3.01 Installation

A. Locate hangers, supports, and accessories to support piping, valves, and at all concentrated loads.

B. Locate hangers, supports, and accessories within maximum span lengths specified to support continuous pipeline runs unaffected by concentrated loadings.

C. Locate hanger, supports to prevent vibration or swaying and to provide for expansion and contraction.

1. Temperature differential specified in this Section.

2. Support piping independently so that equipment is not stressed by piping weight or expansion.

3. For Uninsulated Copper Pipe or Tubing: Clamps and supports, electroplated copper finish. Instrumentation tubing shall be supported in steel or aluminum troughs with covers. All tubing layout and connections shall be as approved by the manufacturer of the equipment.

4. Uncoated Hangers, rods, and Supports: Dip in zinc chromate primer before installation.

5. Maximum spacing for horizontal piping:

   a. Steel 1 inch and Smaller: 7 ft.

   b. Steel 1-1/2 inch and Larger: 10 ft.

   c. Brass or Copper 3 inch and Smaller: 7 ft.

   d. Brass or Copper 4 inch and Larger: 10 ft.

   e. Additional supports at:

      1) Change in direction.

      2) Branch piping and runouts over 5 ft.

      3) Concentrated loads due to valves, strainers, and other similar items.

   f. Maximum support spacing for plastic pipe at ambient temperatures shall be one-half the above values.

6. Hanger types for horizontal piping, except as noted and shown on Drawings:

   a. Forged steel adjustable clevis type, rod support for all service.

   b. Slide Bases:

      1) Pipe stand, brackets, trapeze or other equivalent structural support.

      2) For piping 2 inches or larger.

   c. For pipe and covering provide:

      (1) Saddles for rolles or slide bases.

      (2) Protective shields or saddles for all other types of supports.

   d. Threaded Steel Rods:

      (1) 2 inch vertical adjustment with two nuts each end for positioning and locking.

      (2) Size hanger rods according to the schedule below unless otherwise noted on the Drawings:

Nominal Pipe (Inches)	Rod Diameter (Inches)
2 and less	3/8
2-1/2 to 3-1/2	1/2
4	5/8
6	3/4
8 through 12	7/8
14 through 18	1
20 through 30	1-1/4

      (3) For Double Rod Hangers: One size smaller than above.

      (4) Connection to Structural for Piping to 2 inches: Concrete inserts, or expansion shields in shear into sides of beams.

(5) Connection to Structural for Piping 2-1/2 inch or larger: Concrete inserts, beam clamps or suitable bridging.

7. Vertical Piping:
   a. Base Support: Base elbow or welded equivalent.
      (1) Bearing plate on structural support.
   b. Guides not to exceed:
      (1) 25 ft. for piping to 2 inches.
      (2) 36 ft. for piping 2-1/2 inches or larger.
   c. Top Support:
      (1) Special hanger or saddle in horizontal connection.
      (2) Provisions for expansion.
   d. Intermediate Supports:
      (1) Bolted and welded to pipe.
      (2) Extension ends bearing on structural steel or bearing plates.
   e. For Multiple Pipes: Coordinate guides, bearing plates, and accessory steel.
8. Insulated Piping:
   a. Horizontal Pipe Shields at Supports:
      (1) Minimum 120 degree arc.
      (2) Length equal to diameter of insulation 12 inch minimum.
      (3) To 6 inch pipe size: No 18 USSG galvanized steel.
   b. Vertical Pipe Shields at Guides:
      (1) Full 360 degree arc, securely banded.
      (2) Length equal to diameter of insulation, 12 inch minimum.

D. Install items to be embedded before concrete placement.

E. Fasten embedded items securely to prevent movement during concrete placement.

F. Install hangers and support units on piping systems in accordance with manufacturer's recommendations.

G. Adjust hangers and supports and place grout for concrete supports to bring pipelines to specified elevations.

H. Bring all pipe systems up to operating pressures and temperatures. Cycle systems to duplicate operating conditions. Correct all support malfunctions.

-- END OF SECTION 15094 --

SECTION 15100

PROCESS VALVES, REGULATORS, AND MISCELLANEOUS COMPONENTS

PART 1 - GENERAL

1.01 Description

Requirements specified in the Conditions of the Contract and Division 1 form a part of this Section. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to furnish and install all valves and appurtenances as indicated on the Drawings, and specified herein.

1.02 Scope of Work

A. Work Included in This Section. The Work of this Section shall include the furnishing, installation, and testing of all valves and required appurtenances as specified herein, shown on the Drawings and as required to make the entire facility operable except for those valves and appurtenances required to be provided in other Sections of these Specifications. Items to be provided include but shall not be limited to the following:

1. Valves
2. Check Valves
3. Manual Operators, floor stands and valve boxes
4. Control Valves

B. Related Work Not Included in This Section.

1. Plumbing
2. Process piping
3. Concrete anchors and supports
4. Painting and protective coatings on exposed surfaces

1.03 Submittals

Provide the following in conformance with applicable requirements contained in Conditions of Contract and Division 1.

A. Shop Drawings. Submit shop drawings for process valves, regulators, and miscellaneous components. Shop drawings shall be complete with bill-of-materials showing kind and class of materials, and catalog and engineering data showing compliance with the specified requirements.

B. For each type and model of valve provide:

1. Assembly instructions and spare parts list, and
2. Preventative/corrective maintenance instructions, and
3. Certificate of seat compatibility with entailed fluid exposure.

C. For each motor driven actuator provide motor currents at the specified voltage for each actuator, corresponding to locked rotor, maximum seating torque, average running load and speed. Supplier shall give full information concerning actuator dimensions and weights.

D. Erection Drawings. Erection drawings shall include the procedures to be used in setting, supporting, and/or anchoring the valves, the fitting of line pipe to the valves for proper coupling, and for adjusting and testing all valve assemblies.

E. Certificates. Where specified or otherwise required by the Engineer, submit test certificates.

1.04 Product Delivery, Storage, and Handling

A. Deliver materials to the site to insure uninterrupted progress of the Work.

1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete in ample time to not delay that Work.

B. Handle all valves and appurtenances very carefully. Valves which are cracked, dented, or otherwise damaged or dropped will not be acceptable.

C. Store materials to permit easy access for inspection and identification. Keep steel members and packaged materials from corrosion and deterioration.

D. Store all mechanical equipment in covered storage off the ground and prevent condensation.

1.05 Valve Schedule

Valves shall be of the type shown on the Drawings or of the rating and construction as specified in the following Sections. All valves of the same type shall be of the same make unless otherwise approved and shall be specified herein.

PART 2 - PRODUCTS

2.01 Materials

A. General:

1. Valves shall have manufacturer's name and working pressure case in raised letters on valve body.

2. Manual valve operators shall turn clockwise to close unless otherwise specified. Valves shall indicate the direction of operation.

3. Unless otherwise specified, all flanged valves shall have ends conforming to ANSI B16.1, Class 125.

4. All bolts and studs for buried valves embedded in concrete and studs required for wall pipe shall be of stainless steel.

5. All other bolts, nuts, and studs shall, unless otherwise approved, conform to ASTM A 307, Grade B; or ASTM A 354.

6. Bolts and nuts shall have hexagon heads and nuts.

7. Gasket material and installation shall conform to manufacturer's recommendations.

8. Identification: Identify each valve 4 inches and larger with a brass or stainless steel nameplate stamped with the approved designation. Nameplate shall be permanently

fastened to valve body at the factory. Stencilled designations are acceptable for buried valves.

B. Bronze Valves. All bronze valves Class 125 psi and 150 psi shall comply with ASTM B62. All stems shall be silicon bronze 80,000 psi tensile strength.

C. Iron Body Valves. Except as otherwise specified, iron body valves shall comply with ASTM A126 Class B.

D. Pressure Rating. All process valves shall be rated for a working pressure equal to or more than the pressure rating of the connecting piping unless specifically shown otherwise on the Drawings or specified in other Sections of these Specifications.

E. Process Air Supply Valves. All valves on plant air shall be suitable for continuous operation at 180°F. Valve manufacturer shall submit certification with valve submittal indicating material, seals and seats are suitable for that condition.

2.02 Valve Appurtenances

A. Operators

1. General. The operators shall be sized based on the maximum expected torque as per valve manufacturer's recommendations. The responsibility for proper operation shall reside with valve supplier.

2. Manual Operators. Manual operators, except where otherwise shown or specified, shall be worm-gear type, Limitorque HBC, E-I-M Type MG, Dezurik, or equal and shall include AWWA input limit stops when indicated. The axis of the worm shaft shall remain fixed during operation. A handwheel shall be provided except where an extension stem and floor stand or valve box, tee wrench and street box are required. Extension stems and accessories shall be sized for valve manufacturer's recommendations.

   a. Gate and Globe Valves. All gate, globe and angle valves shall be fitted with cast iron handwheels of suitable size or gear operators in accordance with the manufacturer's recommendation.

   b. Butterfly Valves. All butterfly valves 4-inch and smaller in size shall be lever operated and valves 6-inch and larger in size shall be equipped with handwheel actuators. The operators shall be furnished by the manufacturer of the valve, who shall be responsible for the compatibility and adequacy of both the valve and operator. Valve operators shall be sized for the maximum torque developed by the maximum pressure in the pipeline in which the valve is to be for the service and all exposed nuts, bolts, springs, washers shall be stainless steel.

   c. Plug and Ball Valves. All plug and ball valves 3-inch and smaller in size shall be lever operated and plug valves 4-inch and larger in size shall be provided with a totally enclosed oil water and dust tight handwheel operated gear actuator, unless otherwise shown or specified. Gear actuator shall be mounted on an extension neck to allow for adjustment of valve packing with removal of actuator.

   d. Chainwheel Operator. All valves six feet or more above the floor level shall be provided with chainwheel operators in lieu of the handwheel operator and shall be the

valve manufacturer's standard, with galvanized chain to be furnished in the length required for operation.

e. Wrench Nut Operation. An AWWA nut or shaft key, as applicable shall be provided in lieu of handwheel where required for connection to extension stem and floor stand or as indicated on the Drawings. Nut shall be constructed of cast iron. No submerged or buried operator shall require maintenance following installation. Suitable gaskets, O-rings, and other features shall insure permanent watertightness.

B. Strainers

1. Wye strainers shall be installed where indicated and as specified herein. Strainers shall be Fisher, Muessco, or equal. Strainers shall be suitable for 100 pounds per square inch working pressure. Strainers shall have cast iron body. Strainers shall be furnished with Type 304 or 316 stainless steel strainers with 1/32-inch perforations.

2. Basket strainers shall be installed where indicated and as specified herein. Basket strainers (dual basket, non-interrupt operation) shall be supplied by Hayward Plastics or equal. Strainers shall be manufactured from PVC and shall contain baskets manufactured from type 304 or 316 stainless steel.

C. Pressure Gauges. Pressure gauges shall be Solfrunt gauges as manufactured by U.S. Gauge Division of Ametek, Inc., Ashcroft, or equal, conforming to the following requirements:

1. General. Pressure gauges for working pressures of 15 psi or less shall be actuated by a bellows or diaphragm. For working pressures greater than 15 psi, gauges shall be actuated by a Bourdon tube. All gauges shall be provided with cleanout plugs or flushing connections.

a. Diaphragm Seats. Pressure gauges installed on any pipe line carrying solids in concentrations greater than 500 mg/l shall have a diaphragm seal between the process fluid and the pipe line and the seal shall be equipped with a flushing water connection.

b. Pulsation Dampeners. Pressure gauges without diaphragm seals shall have a pulsation dampener installed between the process fluid and the pressure gauge.

c. Shut-off Cock. Pressure gauges shall be installed with a shut-off cock between the process fluid and the diaphragm seal or pulsation dampener.

2. Construction. Pressure gauges shall be 4-1/2 inches dial size. Cases shall be back-flanged aluminum, except they shall be front-flanged where mounted in panels. Rings shall be flat threaded aluminum. Glass shall be shatterproof. All cases shall have rear rupture discs. Connectors shall be 1/2-inch bottom male. Bourdon tubes, bellows or diaphragm, and socket and tip shall be of Type 316 stainless steel. Diaphragm seals shall be Mansfield and Green Type AG, Ashcroft, or equal. Diaphragm and bottom housing shall be Type 316 stainless steel. Flushing connection shall be provided with 1/4-inch close nipple and 1/4-inch cock. Pulsation dampeners shall be stainless steel, Ashcroft Catalog Number 1106-S, Ray Pressure Snubbers, or equal. Gauge cocks shall be 1/4-inch Tee handle cocks good for 300 psi working pressure; Catalog Number 1092 as manufactured by Ashcroft, Powell, or equal.

D. Valve Tags. All valves shall be provided with a valve tag heavily stamped or engraved to duplicate the valve symbol shown on the P and ID Drawings, including hexagons and/or circles with notations, as applicable. The tags shall be fabricated of minimum 3/32-inch thick brass or minimum 18 gauge type 302 stainless steel and a minimum of 1-1/4 inch diameter. Valve tags shall be secured to valves with 18 gauge type 304 stainless steel wire or stainless steel chain through a hole in the tag.

2.03 Gate Valves

A. 2-1/2 inches Diameter and Smaller: Valves shall be bronze, solid wedge, rising stem, union bonnet type with screwed ends suitable for 150 psi service.

1. Product and Manufacturer: Provide one of the following:

   (a) Fig. 47-U, as manufactured by Jenkins Brothers.

   (b) Fig. 431-UB, as manufactured by Crane Company.

   (c) Or equal.

B. 3 Inch Diameter and Larger:

1. Valves shall be iron body, bronze mounted, non-rising stem and in conformance with AWWA C500.

2. Unless otherwise shown or specified, exposed valves shall have flanged ends conforming to ANSI B16.1, Class 125 and buried valves shall be mechanical joint ends conforming to ANSI A21.1.

3. Exposed manually operated gate valve shall be equipped with hand wheels. Gate valves located more than five feet above the operating floor shall be provided with chainwheels, sprockets, and aluminum chain. The chain shall extend to three feet above the operating floor.

4. Shop Paint:

   (a) Interior metal surfaces of cast iron valves except finished or bearing surfaces shall be shop painted with two coats of an approved two component coal tar epoxy coating applied in accordance with the manufacturer's recommendations.

   (b) Exterior surfaces of the valves shall be shop painted as specified hereinafter under Section 09900, Painting.

5. Manufacturer: Provide gate valves of one of the following:

   (a) Mueller Company.

   (b) Dresser Manufacturing Division, M&H Division.

   (c) Or equal.

2.04 Ball Valves

A. PVC Ball Valves

1. General:

(a) All PVC bodied ball valves shall be non-lubricated, with bodies and balls constructed of PVC with Teflon seats and EPDM seals. Valves shall be rated for a minimum working pressure of 50 psi.

(b) Valves shall have tru-union type socket welded ends.

2. Product and Manufacturer: Provide equipment as manufactured by:

(a) Hayward Industrial Products.

(b) Or equal.

2.05 Globe Valves

A. Provide PVC globe valves of non-rising stem design with socket welded ends for throttling service for each pump discharge. Install PVC unions upstream and downstream of each globe valve.

2.06 Ball Check Valves:

A. 4-Inch Diameter and Smaller: Valves shall be ball type spring loaded.

1. Seals shall be Teflon-coated Viton.

2. PVC shall be Type 1, Grade 1, in accordance with ASTM D 1784, and shall be dark gray in color.

3. Manufacturer: Provide ball check valves of one of the following:

(a) Asahi/America.

(b) Or equal.

2.07 Needle Valves

Needle valves shall be gland-type construction needle valves of globe or angle pattern, and shall be of bronze construction, rated at 100 psi working pressure; valve ends shall be threaded; valve stems shall be bronze. Regulation handwheel shall be of cast bronze construction, shall have a graduated serrated periphery, and shall be provided with a spring ratchet which engages the set serration to hold the valve setting. Valves shall be as manufactured by Lunkenheimer, Crane, or equal.

2.08 Eccentric Plug Valves

Valves shall be of the non-lubricated eccentric type, Class 150, with resilient faced plugs and end connections as indicated and specified herein. Flanged valves shall be faced and drilled in accordance with ANSI B16.1-1975, Class 125. Screwed ends shall conform to National Pipe Thread standards as required for correct jointing with connected piping. Valve bodies shall be of cast iron, conforming to paragraph 5.1 of AWWA C507-73. Plugs and shafts shall be cast iron, conforming to paragraph 6.1 of AWWA C507-73. Plugs shall be faced with neoprene or ethylene-propylene terpolymer elastomer. Valve body seat in 3 inch and larger shall be corrosion-resistant metallic seat conforming to paragraph 7.2 of AWWA C507-73. Valve shaft

seals shall be per Section 10 of AWWA C507-73. All bolts, nuts, springs, washers, and like fittings shall be stainless steel. The valve shall be DeZurik Model 118, or equal.

2.09 Small Diameter Isolating Valves

Provide all small diameter valves and cocks for shutting off process connections to instrumentation and other miscellaneous uses. These shall be gate valves and plug cocks of the same material and pressure rating as the adjacent process piping. Shutoff valves to instrumentation shall be coordinated with Division 13 and shall be not less than 1/2 NPT unless otherwise specified.

2.10 Hose Bibbs and Hose Valves

One inch and 3/4-inch hose faucets (hose bibbs) shall be Crane 58, or equal. Hose valves of 1-1/2-inch and 2-1/2-inch size shall be Crane 117 angle type, or equal. Each 2-1/2-inch hose valve shall be equipped with a cap and chain. Where mounted on exterior walls with concealed piping, hose bibbs shall have a suitable wall flange. All exterior hose valves shall be antifreezing compression hydrants as manufactured by Clow, Jay R. Smith, or equal. Hose bibbs connected to potable water lines shall be 3/4-inch and shall be equipped with vacuum breaker. Hose bibbs connected to process water on process-city water shall be 1-inch size.

2.11 Solenoid Valves

All required solenoid valves on sealing water lines and all others which are not specified with the equipment shall be supplied. Solenoid valves shall be packless construction two-way, three-way or four-way as required, and shall be correctly sized for the application. They shall be for normally energized or deenergized operation as required. Valve bodies shall be forged brass unless otherwise recommended by the manufacturer for a particular application. The solenoids shall be rated for continuous operation at 110 percent of rated voltage. They shall be 120V AC, 60 Hz operated. All coils shall be housed in NEMA 4 cases with provision for 1/2-in. electrical conduit. Solenoid valves shall be as manufactured by ASCO, Skinner, Magnetrol, or equal.

2.12 Totalizing Flow Meters

Totalizing flow meters shall be furnished as indicated in Drawings. Flow meters shall have a normal operating range of 0.5 to 30 gpm with a minimum test flow of 0.25 gpm. Flow meter casings shall be fabricated of bronze. Totalizing flow meters shall be a Model FTB6107X flow meters as manufactured by Omega of Stanford, CT, or pre-approved equal.

PART 3 - EXECUTION

3.01 Installation

Shall be in conformance with Section 15060 and the following requirements.

A. Valves and Valve Boxes shall be set in true alignment and grade in accordance with the procedures submitted with the shop and erection drawings, and the valves mounted as shown. All adjustments and operating settings of valves and appurtenances shall be made in accordance with procedures and detailed instructions furnished with the erection drawings.

B. Buried Valves shall be firmly supported in place by the foundations to preclude strain on the pipe connections. The valve boxes shall be checked for centering plumb over the wrench nut to ensure that the box cover is flush with the finish grade. Earth backfill shall be carefully tamped

around each valve box to a distance of 4 feet on all sides of the box, or to undisturbed trench face if less than 4 feet. Valves shall have their interiors cleaned of all foreign matter before installation. The valves shall be inspected in opened and closed positions to ensure that all parts are in working condition.

C. Aboveground Valves shall be rigidly held in place using supports and hangers as shown on the drawings and as specified. The stem orientation of valves in elevated piping shall be as approved by the Owner for accessibility, but no valve shall have stem in the downward direction. Saddle type valve supports shall be provided for all valves in vaults. Supports shall be of rugged construction providing at least 120 degrees under-support for the valve body, shall be constructed of steel as specified in Division 5, and shall be anchored to the foundations using galvanized or stainless steel anchor bolts.

3.02 Tests

A. Field Tests. Test all valves and appurtenances for proper operating adjustments and settings and for freedom from vibration, binding, scraping, and other defects. The testing of the hydraulically and electrically controlled valves shall be supervised by a representative of the manufacturer who shall verify proper installation, adjustments, and performance. The adequacy of all pipe hangers and supports and valve supports to meet specified requirements shall be verified. All defects found shall be corrected as approved.

3.03 Coordination with Instrumentation

It shall be the responsibility of the Contractor to coordinate with Section 13420 regarding the requirements of control valves.

3.04 Coordination with Other Mechanical Suppliers

The installation and operation of the valve and motorized actuators shall be the unit responsibility of the valve supplier.

3.05 Air Actuated Valves

Install air filter-regulators, install air shut off valve on the air supply to each valve actuator.

3.06 Cleaning

All valves and appurtenances shall be flushed clean of all foreign matter together with the piping as specified in other sections.

– END OF SECTION 15100 –

SECTION 15260

PIPE INSULATION AND HEAT TRACING

PART 1 - GENERAL

1.01 Summary

A. Furnish and install insulation and pipe heat trace on exterior piping only. Pipe insulation, sealed aluminum jacket, and pipe heat tracing shall include any valve, bend, linear section, screen, or any other fitting that may directly or indirectly subject piping to undesirable conditions; includes thermostat installation and provision at independent heat tracing lines as well as aluminum wrapping per cable; and includes end kits at heat tracing ends. The work will be performed and executed with all required materials as specified in the section and as shown on drawings. The work requires coordination with trades directly and indirectly related to this section.

1.02 Related Sections

1. Division 11 - Equipment
2. Division 15 - Mechanical
3. Division 16 - Electrical

1.03 References

The Publications listed below form a part of this section to the extent referenced and must be compiled with:

A. Insulation

1. American Society for Testing and Materials (ASTM)
   a. ASTM, D 579, C916, C1136
   b. ASTM E 84, E 96
2. National Fire Protection Association (NFPA)
   a. NFPA 220
3. New York State and Local Building Codes
4. Military Specification for Glass Fiber MIL-1-22344C

B. Heat Tracing

1. UL Listed
2. Factory mutual approved
3. CSA certified

1.04 System Description

A. Description

1. Contractor shall furnish and install all materials, equipment, hardware, and incidentals required to provide a weathertight, dry, insulated enclosure for exposed piping where indicated in this section or as shown on the contract drawings.

B. Performance Requirements

1. Thermal-insulation system materials shall be noncombustible, as defined by NFPA 220, unless otherwise indicated. Adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, except cellular elastomers, shall have a flame-spread classification (FSC) of 25 and a smoke-developed classification (SDC) of 50. These maximum values shall be determined in accordance with ASTM E 84. Adhesives, coatings, and sealants shall be nonflammable in their wet state.

2. Adhesives, coatings, and sealants shall have published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

3. The following shall be submitted in accordance with Section 01300, "Submittals" in sufficient detail to show full compliance with the specification:

4. Manufacturer's Catalog Data shall be submitted for the following items:

   a. Adhesives
   b. Coatings
   c. Insulating Cement
   d. Insulating Materials
   e. Jacketing (Aluminum)
   f. Tape Materials (Aluminum)
   g. Heat Tracing Cable
   h. Wrapping (Aluminum, for heat tracing cable)

5. Installation Drawings for Pipe Insulation and Heat Tracing shall be in accordance with the adhesive manufacturer's written instructions for installation.

PART 2 - PRODUCTS

2.01 Manufacturers

A. Provide materials from respective manufacturer or pre-approved equal, as follows:

1. Pipe Insulation

   a. Owens-Corning Foam Urethane Insulation

2. Jacket

   a. Micro-LOK AP-T plus jacket (Pressure sensitive lap sealing system)

3. Heat Tracing

   a. Chromalox Heat Tracing, Inc.

2.02 Materials

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attach surfaces to which applied in either the wet or dry state. Materials shall be asbestos free.

A. Adhesives

1. Vapor-Barrier Material Adhesives

a. Adhesives for attaching laps of vapor-barrier materials and presized glass cloth and for attaching insulation to itself, to metal, and to various other substrates, shall be solvent-base, synthetic-rubber type and shall conform to the requirements of ASTM C 916, Class 2, for attaching foam urethane insulation to metal surfaces. Solvent shall be nonflammable.

B. Coatings

1. Outdoor Vapor-Barrier Finishing

a. Coatings for outdoor vapor-barrier finishing of insulation surfaces such as fittings and elbows shall be nonasphaltic, hydrocarbon polymer, solvent-base mastic containing a blend of nonflammable solvents. Coatings shall conform to the requirements of MS MIL-C-19565.

C. Insulating Cement

General purpose insulating cement shall conform to ASTM C 195 or as specified by the manufacturer. The composite shall be rated for 1,800 degrees F service and shall have a thermal-conductivity maximum of 0.85 Btu per hour per square foot for each degree F temperature differential at 200 degrees F mean temperature for 1 inch thickness.

D. Caulking

Caulking used with specified insulation materials shall be an elastomeric joint sealant in accordance with ASTM C 920, Type S, Grade NS, Class 25, Use A, as recommended by pipe insulation manufacturer.

E. Corner Angles

Corner angle piping insulation shall be nominal 0.016 inch aluminum 1 inch by 1 inch with factory applied draft backing. Aluminum shall be in accordance with ASTM B 209.

F. Insulation Materials

Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the specified maximum shall either be replaced or augmented by an additional thickness to bring it to the required maximum conductance and a complete finishing system.

G. Jacketing

1. Aluminum Jackets

a. Aluminum sheet shall be accordance with ASTM B 209 and shall be 0.016 thick with factory-applied vapor barrier on the insulation side. Aluminum shall be made from smooth, polished, Temper H14 H16, Alloy 5005.

b. Elbow jackets shall 0.016-inch-thick, deep drawn, die-shaped, two-piece components for long-radius, butt weld elbows manufactured from the same materials as specified for jackets, with factory-attached-vapor-seals on underside of the aluminum. Preinsulated, voidless, jacketed components conforming to these specifications shall

be used, unless otherwise specified. Preinsulated fittings shall have a 2-inch overlay beyond route for weld bead.

c. Pipe jackets shall have not less than 2-inch longitudinal and circumferential lap.

d. Sealant for longitudinal and butt joints of aluminum jacketing shall be an aluminum-pigmented, butyl, polymer sealant with high-butyl solids.

e. Insulation to be weatherproofed with cut and rolled 0.016-inch thick smooth aluminum jacketing with 2" overlaps at both longitudinal and circumferential locations.

f. Longitudinal laps to be at "4:00 o'clock" and all joints sealed with joint sealant to prevent penetration of water and moisture and as specified by manufacturer.

g. Jacket to be secured with 1/2 inch stainless steel strapping at 12" on center.

h. All joints to be sealed with manufacturer recommended joint sealant compatible with the insulation and jacket.

2. Tape

The tape lagging shall be an aluminum tape specifically suitable for continuous spiral wrapping of insulated pipe bends and fittings and shall product a smooth, tight, wrinkle-free surface.

2.03 Equipment

A. Insulation

All exterior insulated piping to be PVC (HDPE) pipe and will include the following, as shown on contract drawings:

4" Diameter Groundwater Extraction Line (Containing 1.5" HDPE Transfer Piping) - 1.5" thick foam urethane insulation.

B. Heat Tracing

1. All lines noted above are to be protected with electric heat tracing cable.

2. The heat tracing cable is selected according to pipe size and insulation thickness and thus corresponds to the following:

Size Pipe (Nominal)	Specification Code
4" Diameter Groundwater Extraction Line (Containing 1.5" HDPE Transfer Piping)	SRL8-1CT

3. Must be self regulating low temperature (SRL) cable rated for 120 or 240 volts.

4. Construction of cable must include:

a. Tinned braid and TPE Jacket (-CR)

b. Twin 16 AWG copper buss wires

5. All values and appurtances to be double wrapped with heat tracing.

6. Provide and install thermostat for heat tracing cable.

7. Provide end boxes for termination points.

8. Coordinate work with adjacent trades directly or indirectly related to pipe insulation and heat tracing.

PART 3 EXECUTION

3.01 Installation of Insulation Systems

Contours on exposed work shall be smooth and continuous. Cemented laps, flaps, bands, and tapes shall be smoothly and securely pasted down. Adhesives shall be applied on a full-coverage basis, unless otherwise indicated.

Insulation shall be applied only to system or component surfaces that have been tested and approved.

Material shall be applied in conformance with the recommendations of the manufacturer, except as otherwise indicated.

Surfaces shall be clean and free of oil and grease before insulation adhesives or mastics are applied. Solvent cleaning required to bring metal surfaces to such condition shall be provided.

A. Foam Urethane Insulation with Aluminum Jacket

1. Piping shall be covered with foam urethane pipe insulation.

2. Fittings and valve bodies shall be covered with pipe-fitting insulation of the same thickness as the pipe barrel insulation. The fitting insulation shall be secured temporarily in place with light cord ties.

   The vapor barrier shall be continuous over all surfaces, including areas inside sleeves, hangers, pipe supports, and other concealment.

   The piping insulation shall be applied to both sides of pipe supports. Junctions shall be insulated as specified by manufacturer.

   Jacket laps, flaps, and bands shall be secured in place with aluminum jacket sealant. jacketing bands for butt joints shall be 6 inches wide.

   Joints, wherever possible, shall be lapped against the weather so that the water will run off the lower edge. Laps shall be accordance with the pipe drainage ditch. Longitudinal laps on horizontal lines shall be located 45 degrees below the horizontal centerline and alternately staggered 1 inch. The jacketing material shall be lapped a minimum of 2 inches, circumferentially sealed and strapped to provide a waterproof covering throughout. Straps shall be located 8 inches on center and shall be pulled up tight to hold jacketing securely in place. Screws shall be used in addition to straps when necessary to obtain a waterproof covering. Extra straps shall be placed on each side of supporting devices and at openings. Where flanging access occurs, a chamfer sheet shall be strapped to the pipe at jacketing.

   Exposed longitudinal edges of aluminum jacketing shall be stiffened by bending a 1-inch hem on one edge.

Expansion joints shall provide for maximum and minimum dimensional fluctuations.

B. Heat Tracing Cable

1. Shall be installed according to manufacturers specifications and recommendations or as approved by the engineer.
2. Cable shall be applied parallel to the pipe longitudinally and shall be wrapped at valves and other appurtenances for effective heat tracing.

-- END OF SECTION 15260 --

SECTION 15400

PLUMBING, GENERAL PURPOSE

PART 1 - GENERAL

1.01 Description

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to perform plumbing installation as described herein or shown on the Contract Drawings.

A. Work included in this section:

1. Potable water supply system.
2. Gas distribution system.
3. Sanitary drainage waste and vents.
4. Plumbing fixtures.
5. Hot water storage tank.

1.02 Submittals

Shop drawings shall be submitted for approval. Submittals shall include a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Shop drawings shall also contain complete schematic and piping diagrams and any other details required to demonstrate that the plumbing system has been coordinated and will properly function as a complete plumbing system. Drawings shall show proposed layout and anchorage of the system and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation. Manufacturers descriptive data, installation instructions, and field tests. Reports shall be submitted as the work is completed and accepted.

PART 2 - PRODUCTS

A. Potable Water Supply System Components

1.0 Copper Pipe and Fittings:

1.1 Above ground copper tubing shall conform to ASTM B 88, Type L hard-drawn for horizontal and exposed vertical lines, annealed for concealed vertical lines.

1.2 Underground copper tubing shall conform to ASTM B 88, Type K seamless. No joints shall be permitted in underground copper piping unless specifically approved. Fittings for connection to corporation cocks shall be cast bronze, flared type, conforming to ASME B16.26. Underground joints shall be brazed.

1.3 Fittings and unions shall be 150 pounds per square inch gage (psig) working steam pressure (wsp), wrought-copper solder joint conforming to ASME B16.22.

1.4 Solder shall be acid flux, 95-5 tin-antimony, alloy Sb5, conforming to AWS-02. Brazing rod shall be classification BCP-5, conforming to AWS A5.8.

1.5 Copper tubing systems may be installed using mechanical pipe couplings of a bolted type with a central cavity design pressure responsive gasket. Copper pipe and fittings are to be grooved in accordance with the coupling manufacturer's specifications. Threaded nipples shall be standard weight Schedule 80 with molded threads.

2.0 Valves and Specialities:

2.1 Gate Valves:

Valves shall be designed for a minimum of 150 psi. Valves shall have screw joints. Valves smaller than 3 inches shall be all brass and shall conform to MSS SP-80, Type I. Valves 3 inches and larger shall be iron-body, brass-mounted, conforming to AWWA C500.

2.2 Vacuum and Relief Valves:

Vacuum and relief valves shall be size and type to relieve pressure and prevent the formation of a vacuum. Valves shall automatically remove air from the lines when the lines are being filled and admit air into the lines when water is being withdrawn in excess of the inflow.

2.3 Hose Faucets:

Hose faucets shall be constructed with 1/2-inch male inlet threads, hexagon shoulder, and 3/4-inch hose connection, conforming to ANSI A112.18.1M. Hose-coupling screw threads shall conform to ASME B1.20.7. A vandalproof, atmospheric-type vacuum breaker shall be provided on discharge.

2.4 Globe Valves:

Valves shall be 125-psi, bronze body, conforming to MSS SP-80. The disk shall be free to swivel on the stem. Composition seating surface disk construction may be substituted for all-metal disk construction. Packing shall be a woven non-asbestos material, impregnated with not less than 25 percent, by weight, tetrafluoroethylene resin.

2.5 Check Valves:

Standard check valves in sizes 2 inches and smaller shall be 125-psi swing check conforming to MSS SP-80.

Check valves in sizes 2-1/2 inches and larger shall be cast iron, bronze trim, swing type. Valve bodies shall be cast iron, conforming to ASTM A 126, Class A. Valve ends shall be flanged in conformance with ASME B16.1. Swing-check pin shall be AISI Type 304 corrosion-resistant steel. Valves shall have bolted and gasketed covers.

Grooved end check valves may be used provided that the manufacturer certifies to the performance requirements of MSS SP-80.

2.6 Backflow Prevention Devices:

Backflow preventers reduced pressure principle assemblies, double check valves assemblies, atmospheric non-pressure type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed by the Foundation for Cross-Connection Control & Hydraulic Research. Backflow preventers with intermediate atmospheric vent shall be in accordance with ASSE 1012 or AWWA C506. Hose connection vacuum

breakers shall be in accordance with ASSE 1011. Pipe applied atmospheric type vacuum breakers shall be in accordance with ASSE 1001.

Devices 2 inches and smaller with moving components defined in AWWA C506, shall be constructed of nonferrous metals. Nonmetal components of such devices shall be rated for the applicable service temperature.

Bodies of devices 2-1/2 inches and larger shall be corrosion-resistant ferrous material or bronze, with flanged connections. Metallic operating components and trim shall be nonferrous. Nonmetallic parts shall be rated for the applicable service temperature.

External surfaces of devices used in conjunction with equipment with polished or chrome-plated surfaces shall be similarly finished.

External surfaces of devices may be rough castings where these devices are used outside of the building or in equipment rooms. Devices shall be protected from freezing and shall be installed, tested, and used in strict conformance with the manufacturer's instructions.

Air gaps shall be at least two times the supply pipe diameter, but not less than 1 inch, as measured vertically, from the flood rim of the supplied device.

Atmospheric Vacuum Breakers (AVB) shall be used only where no back-pressure may occur. Atmospheric vacuum breakers will only provide protection against back-siphonage of nontoxic pollutants. The AVB shall be installed downstream of the last shutoff valve and at least 12 inches above the highest outlet. Under no circumstances shall the AVB be installed where it will be under continuous pressure for more than 12 hours in any 24-hour period. The AVB shall be installed in an accessible location.

Type PVB pressure vacuum breaker devices used only where there is no possibility of back-pressure. The PVB shall be installed in an accessible location to facilitate inspection and servicing. The PVB shall be installed a minimum of 12 inches above the highest outlet, shall conform to ASSE 1010, and shall have tightly closing shutoff valves on each end, and be fitted with properly located test cocks. PVB devices may have pressure on downstream side and may be used for back-siphonage only, against pollutants or contaminants.

2.7 Corporation Stops:

Corporation stops shall have waterworks standard thread on the inlet end, with flanged-joint couplings or wiped joints for connections to goosenecks.

2.8 Goosenecks:

Copper tubing for gooseneck connections shall conform to ASTM B 88, Type K, annealed.

2.9 Service Stops:

Service stops shall be waterworks ground-key type, oval flowway, T-handle, without drain. Pipe connections shall be suitable for the type of service pipe used. Parts shall be cast red brass having a nominal composition of 85 percent copper, 5 percent tin, 5 percent lead, and 5 percent zinc, with female connections designed for a minimum pressure of 200 psi.

2.10 Valve Boxes:

Valve boxes shall be cast iron complete with tamper resistant covers. Cast-iron boxes shall be the extension type with screw adjustments and flared bases. The word "WATER" shall be cast in the cover. Boxes shall be installed over each gate valve. Boxes shall be of such a length as can be adapted, without full extension, to the depth of cover required over the pipe at the valve location.

2.11 Water-Hammer Arresters:

Water-hammer arresters shall be commercially manufactured products consisting of bellows arranged to absorb the energy of pressure waves generated by valve closure in a line in which water is flowing. Arresters shall be nonferrous construction, shall be rated as to capacity, and shall be certified in accordance with PDI WH 201.

B. Storage-Type Water Heaters (see Section 15445)

C. Plumbing Fixtures and Trim

Vitreous-china and enameled cast-iron plumbing fixtures shall be white, and shall be the product of the same manufacturer, unless otherwise indicated.

Exposed traps and double-cone supply tubes for fixtures and equipment shall be connected to rough-piping at the wall, unless otherwise specified. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chromium-plated or nickel-plated brass with polished, bright surfaces.

Supplies and wastes for lavatories shall be to wall, unless otherwise indicated on the drawings. Sleeves are not required at penetrations.

1.0 Fixture Supports:

Wall-hung fixtures shall be supported by ferrous-metal carriers suited to the particular installation conditions. Carriers may be combination type with adjustable fittings. Water closet shall be a floor mounted unit. Lavatories shall be supported from the wall by wall-carriers with concealed arms.

2.0 Lavatory:

Lavatory shall be vitreous china wall mounted unit. Shelf back width 19 inches, front to back 17 inches, back height 3-1/2 inches, depth shall be manufacturer's standard. Lavatory faucets shall be single type. Faucets shall have replaceable seats and crown type handles. Faucet handles shall be cast, formed, or drop forged polished, chrome-plated copper alloy. Faucet shall be provided with metal replaceable cartridge type control units or metal cartridge units with diaphragm which can be removed and replaced without special tools. Cartridge type units shall be designed to prevent dripping and replacement of washers. Valves and handles shall be copper alloy. Drains and jam nuts shall be cast wrought copper alloy. Waste traps and hexagonal nut slip joints shall be copper alloy. Strainer shall be copper alloy or corrosion-resisting steel. Escutcheons shall be corrosion-resisting steel or copper alloy. Fixtures shall be supported by wall hangers.

Supply piping shall be chrome-platted brass and threaded in accordance with the requirements of ANSI A112.19.2M.

3.0 Service Sinks:

Service sinks and fittings shall conform to ANSI A112.19.1M, ANSI A112.19.2M, and ANSI A112.19.3M.

Service sink shall be single bowl brushed stainless steel counter mounted. Sink shall be 28 inches long by 16 inches in width with an overall dimension of 31 by 22 inches. Depth shall be 12 inches.

Sink shall have integral rim for mounting under counter top. Combination sink fitting shall be with gooseneck spout and serrated nozzle and shall be copper alloy chrome plated. Faucet shall have all replaceable operating parts that are subject to wear. Faucet handles shall be four arm type with plastic indicator buttons signifying by color and letters the service controlled. Faucet handles and escutcheons shall be copper alloy chrome plated, or corrosion-resisting steel.

4.0 Water Closets:

Water closet shall be office and industrial type, elongated bowl with flush valve, siphon, jet, and floor outlet, in conformance with ANSI A112.19.5, constructed for quiet operation. Seat shall be elongated, open-front, solid-molded, high-impact, polystyrene, white, with check hinge, less cover. Flush valve shall be exposed flushometer, large diaphragm and piston, side oscillating handle with vacuum breaker and screwdriver stop, constructed for quiet operation.

D. Sanitary Drain, Waste, and Vent System (DWV)

1.0 DWV Piping Polyvinylchloride (PVC):

Polyvinylchloride drain, waste, and vent piping-system materials shall be manufactured from Type I normal impact resins in conformance with ASTM D 2665 and with ASME B16.12. Material shall be gray and specifically suited for joining socket interfaces into a homogeneous mass by solvent-cement welding.

Fittings shall be molded to produce upon insertion of pipe an interference fit at two-thirds depth of socket. No thread cutting shall be permitted. Vent extensions through the roof shall be extra-heavy type HSCI.

E. Gas Distribution Pipe, Fittings, and Associated Materials

1.0 Steel Pipe:

Steel pipe shall conform to ASTM A 53, Grade A or B, Type E or S, Schedule 80; or API Spec 5L seamless or electric resistance welded, Schedule 80; black, as specified in NFPA 58. Furnace buttwelded pipe may be used in sizes 1-1/2 inches and smaller.

2.0 Fittings, 1-1/2 Inches and Smaller:

Fittings 1-1/2 inches and smaller shall conform to ANSI B16.11. Flanged fittings shall conform to ANSI B16.5, Class 150.

3.0 Flanged Gaskets:

Gaskets shall be non-asbestos compressed material in accordance with ANSI B16.21, 1/16 inch thick, full face or self-centering flat ring type. The gaskets shall contain arimid fibers

bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR), suitable for maximum 600 degrees F service and meeting applicable requirements of NFPA 58. NBR binder shall be used for hydrocarbon service.

4.0 Pipe Threads:

Pipe threads shall conform to ANSI B1.20.1.

5.0 Sealants for Steel Pipe Threaded Joints:

Joint sealing compound shall be as listed in Underwriters Laboratories, Gas and Oil Equipment Directory, Class 20 or less. Tetrafluoroethylene tape shall conform to MIL-T-27730.

6.0 Insulating Joint Materials:

Insulating joint materials shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrolytic action. Joint materials shall be suitable for maximum 200 degrees F service. Joints for threaded pipe shall be steel body nut type dielectric type unions with insulating gaskets. Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts and insulating washers for flange nuts.

7.0 Valves:

Valves shall be suitable for shutoff or isolation service. Steel valves 1-1/2 inches and smaller installed aboveground shall conform to MSS SP-84, carbon steel, 316 stainless steel trim, grafoil stem packing, socket weld or threaded ends with handwheel or wrench operator.

8.0 Pressure Regulators:

Pressure regulators for individual service lines shall have ferrous bodies and shall have characteristics as follows: Regulator shall be capable of reducing distribution line pressure (psi) to pressures required for users (inches of water column). Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulators for liquified petroleum gas shall be adjusted to 10 to 12 inches of water column. Pressure relief for liquified petroleum gas shall be set at 16 inches of water column. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions.

PART 3 - EXECUTION

A. General Requirements:

Piping shall be installed in accordance with the National Plumbing Code, manufacturer's recommendations, and as specified herein. The plumbing system shall be installed complete

with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be connected to the exterior service lines. Sewer and water pipes shall be laid in separate trenches. Utilities shall be installed below the frostline. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means.

Soil, Waste, Drain, and Vent Piping: Pipes passing through roofs, fire walls, or fire partitions shall be an approved pipe suitable for the application and extending a minimum of one foot on either side of walls and below roofs, unless otherwise specified. The extended height above the roof shall be in accordance with the National Standard Plumbing Code. Vent lines for corrosive waste systems shall be the same material as the corrosive waste system.

B. Water Pipe, Fittings, and Connections:

The piping shall be extended to fixture, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shut-off valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, and flush valves shall be anchored to prevent movement.

C. Cutting and Repairing:

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, pipeline, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

D. Protection to Fixtures, Materials, and Equipment:

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated.

E. Mains, Branches, and Runouts:

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Care shall be taken not to weaken structural portions of the building. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Unions shall be installed at all appliances, regulators, valves, pumps, and any other items requiring removal or replacement, except items that are flanged. Supply pipes, valves, and fittings will be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or prevent flexible movement of the lines. No water pipe shall be buried in floors unless specifically indicated. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted. Bent pipe, kinks, wrinkles, flattening, or other malformations will not be acceptable.

F. Pipe Drains:

Pipe drains shall consist of 3/4-inch hose bibb with renewable seat and gate valve ahead of hose bibb. At other low points, 3/4-inch brass plugs or caps shall be provided. Disconnection of the

supply piping at the fixture is an acceptable drain. Backflow devices and relief valve drains shall be routed unrestricted to discharge to the building exterior or interior drains as indicated on the drawings.

G. Expansion and Contraction of Piping:

Allowance shall be made throughout for expansion and contraction of hot water supply and return piping. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

H. Commercial-Type Water Hammer Arresters:

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as recommended by the manufacturer and sized in compliance with the schedule on drawings. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall be in accordance with PDI WH-201.

I. Joints:

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Threaded joints shall have American Standard taper pipe threads conforming to ANSI B1.20.1. Only male pipe threads shall be coated with graphite or approved graphite compound, or shall have a polytetrafluoroethylene tape applied. Unions and flanges shall not be concealed in walls, ceilings, or partitions. A dielectric union or flange shall be installed at the junction of dissimilar metals on pressure piping systems. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

J. Copper Tube:

Joints for copper tubing shall be made with soldered or brazed fittings. Tube shall be cut square with burrs removed. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Care shall be taken to prevent annealing of tube and fittings when making connections. Solder joints shall be made with flux and wire form or paste-type solder. The flux for 95/5 solder shall be mildly corrosive liquid or petroleum-based paste containing chlorides of zinc and ammonium. Core solder shall not be used. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-frame torch.

K. Dissimilar Pipe Materials:

Connections to water heaters shall be made with dielectric unions or flanges. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

L. Corrosion Protection for Pipe and Fittings:

Exterior surfaces of metallic pipe and fittings, except copper, and cast iron that are installed underground shall be thoroughly cleaned of foreign matter by wire brushing and solvent

cleaning. Using tape conforming to AWWA C203 and primer as recommended by the tape manufacturer, the pipe shall be primed and immediately wrapped with the tape, applied with a 50 percent overlap. Joints and fittings shall be covered with the same primer and tape. Fittings shall be coated and wrapped after piping has been tested. Pipe shall be coated and wrapped during installation.

M. Pipe Sleeves and Flashing:

Pipe sleeves shall be furnished and set in their proper and permanent location.

N. Sleeve Requirements:

Pipes passing through concrete or masonry walls or concrete floor or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4-inch clearance all-around between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe, or plastic pipe.

O. Pipe Support Installation:

Supporting elements shall be provided as required, in accordance with Section 15094.

Piping shall be supported from building structure only. Piping shall not be supported from roof deck or from other pipe.

Piping shall run parallel with the lines of the building unless otherwise indicated. Piping and components shall be spaced and installed so that a threaded pipe fitting may be removed between adjacent pipes and so that there shall be no less than 1/2 inch of clear space between the finished surface and other work and between the finished surface of parallel adjacent piping. Hangers on different adjacent service lines running parallel with each other shall be arranged to be in line with each other and parallel to the lines of the building.

Piping support elements shall be installed at intervals not more than 3 feet from the ends of each runout, and not over 1 foot from each change in direction of piping.

The load rating for pipe-hanger supports shall be based on insulated weight of lines filled with water and forces imposed. The deflection per span shall not exceed slope gradient of pipe. Supports shall be in accordance with Section 15094.

Vibration isolation supports shall be provided.

All PVC piping shall be supported at intervals of no more than four feet.

Vertical risers shall be supported independently of connected piping, whenever practicable, with fixed or spring supports at the base and at intervals to accommodate system range of thermal conditions. Risers shall be guided for lateral stability. For risers subject to expansion, only one rigid support shall be provided at a point approximately one-third down from the top. Clamps shall be placed under fittings.

P. Valves:

1.0 Valves shall be provided in piping mains, on branches, and at equipment locations. Valves shall be provided to permit isolation of branch piping and each equipment item from the balance of the system. Riser and downcomer drains above piping shutoff valves in piping 2-1/2 inches and larger shall be provided. Shutoff valve body shall be tapped and fitted with a 1/2-inch plugged globe valve. Valves unavoidably located in furred or other normally inaccessible places shall be provided with adequately sized access panels approved for the location.

2.0 Relief Valves:

No other valves shall be installed between the relief valve and the water heater. The relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the valve shall be installed directly in a tapping in the tank or heater. When heaters are not provided with a relief valve tapping, the valve shall be installed in the hot-water outlet piping. A discharge pipe the size of the valve outlet shall be connected to the valve outlet and terminated at a safe location.

Q. Pipe Cleanouts:

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 9-degree branch drainage fittings with cast brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanouts on pipe concealed in partitions shall be provided with chromium-plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs, and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

R. Fixtures and Fixture Trimmings:

1.0 Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded or sweat inlets, shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed piping connections from the shut-off or stop valve to the fixture shall be polished chromium-

plated copper tubing. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Exposed fixture trimmings and fittings shall be chromium-plated or nickel-plated brass, with polished bright surfaces. Plumbing fixtures and accessories shall be installed within the space shown.

2.0 Fixture Connections:

Connections between earthenware fixtures and flanges on soil pipe shall be made absolutely gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural-rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distances from wall to make a first-class joint with the gasket and fixture used.

3.0 Flush Valves:

Flush valves shall be mounted on toilet and adequately secured to prevent movement.

4.0 Height of Fixture Rims Above Floor:

Lavatories shall be mounted with rim 36 inches above finished floor. Installation of fixtures for use by physically handicapped shall be in accordance with ANSI A 117.1.

5.0 Fixture Supports:

Fixture supports for off-the-floor lavatories, and other fixtures of similar size, design, and use, shall be of the chair carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall.

6.0 Backflow Prevention Devices:

No plumbing fixture, equipment, or pipe connection shall be installed that will provide a cross connection or interconnection between potable water supply and any source of non-potable water. The backflow prevention device shall be installed where indicated and located so that no part of the device will be submerged. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

7.0 Traps:

Each fixture and piece of equipment requiring connections to the drainage system shall be equipped with a trap. Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps for acid-resisting waste shall be of the same material as the pipe.

S. Escutcheons:

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

T. Hot Water Heater Clearances:

Clearances for heating appliances, flue pipes, and vent connectors shall conform to NFPA 54 for gas fired units. Hot water heater flue gas piping shall be 20 GA. galvanized sheet metal.

PART 4 - TESTS, FLUSHING, AND STERILIZATION

A. Plumbing System:

The plumbing system shall be tested in accordance with the NAPHCC National Standard Plumbing Code.

B. Defective Work:

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. No caulking or screwed joints of holes will be acceptable.

C. System Flushing:

After tests are completed, potable water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until discharge water shows no discoloration. System shall be drained at low points. After flushing and cleaning, system shall be prepared for service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building, due to the Contractor's failure to properly clean the piping system, shall be repaired by the Contractor. When the work is complete, the hot-water system shall be adjusted for uniform circulation. Flush valves and automatic control devices shall be adjusted for proper operation.

D. Sterilization:

After pressure tests and flushing, the entire domestic hot- and cold-water distribution system shall be sterilized. The chlorinating material shall be liquid chlorine conforming to AWWA B301 or hypochlorite conforming to AWWA B300. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through the use of a solution-feed chlorinator. The chlorine residual shall be checked at intervals to insure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being sterilized shall be opened and closed several times during the contact period to insure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. During the flushing period each valve and faucet shall be opened and closed several times. From several points in the system the contractor will take samples of water in properly sterilized containers for bacterial examination. The sterilizing shall be repeated until tests indicate satisfactory bacteriological results have been obtained. Report results of all tests to the Engineer assuring compliance with specifications.

-- END OF SECTION 15400 --

SECTION 15410

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Valves.

C. Sanitary sewer piping system.

D. Domestic water piping system.

E. Natural gas piping system.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals.

B. Section 02200 - Earthwork.

C. Section 09900 - Painting.

D. Section 15094 - Pipe Anchors and Supports.

E. Section 15430 - Plumbing Specialties.

F. Section 15440 - Plumbing Fixtures.

G. Section 15445 - Plumbing Equipment.

1.03 REFERENCES

A. ANSI B31.9 - Building Service Piping.

B. ASME - Boiler and Pressure Vessel Code.

C. ASME Sec. 9 - Welding and Brazing Qualifications.

D. ASME B16.3 - Malleable Iron Threaded Fittings.

E. ANSI/ASME B16.5 - Cast Iron Threaded Fittings, Class 125 and 250.

F. ASME B16.18 - Cast Bronze Solder-Joint Pressure Fittings.

G. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings

H. ASME B16.32 - Cast Copper Alloy Solder-Joint Fittings for Sovent Drainage Systems.

I. ASTM A47 - Ferritic Malleable Iron Castings.

J. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

K. ASTM A74 - Cast Iron Soil Pipe and Fittings.

L. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

M. ASTM B32 - Solder Metal.

N. ASTM B88 - Seamless Copper Water Tube.

O. ASTM B302 - Threadless Copper Pipe (TP).

P. ASTM B306 - Copper Drainage Tube (DWV).

Q. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

R. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.

S. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

T. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

U. AWWA C651 - Disinfecting Water Mains.

V. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

W. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

X. NFPA 54 - National Fuel Gas Code.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Record actual locations of valves and piping.

1.06 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.07 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Welding Materials and Procedures: Conform to ASME Code [and applicable state labor regulations.]

C. Welders Certification: In accordance with ASME Sec 9.

D. Maintain one copy of each document on site.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum three years documented experience.

1.09 REGULATORY REQUIREMENTS

A. Perform Work in accordance with BOCA plumbing code.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Accept valves on site in shipping containers with labelling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding are wet or frozen.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING

A. Cast Iron Pipe (under finished floor): ASTM A74 extra heavy weight.

1. Fittings: Cast iron.
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

B. Cast Iron Pipe (above finished floor): CISPI 301, hubless, service weight.

1. Fittings: Cast iron.
2. Joints: ASTM C564, neoprene gasket system.

2.02 WATER PIPING (DCW, DHW)

A. Copper Tubing: ASTM B88, Type K, hard drawn.

1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA.

2.03 NATURAL GAS PIPING

A. Steel Pipe: ASTM A53 Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234, forged steel welding type.
2. Joints: NFPA 54, threaded or welded to ANSI B31.9.

2.04 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size under 2 1/2 Inches

1. Ferrous pipe: 150 psig (1 034 kPa) malleable iron threaded unions.
2. Copper tube and pipe: 150 psig (1 034 kPa) bronze unions with soldered joints.

B. Pipe Size 2 1/2 inches or larger:

1. Ferrous pipe: 150 psig forged steel slip-on flanges conforming to ANSI B16.5; 1/16 inch thick preformed neoprene gaskets.

2. Copper tube and pipe: 150 psig slip-on bronze flanges; 1/16 inch thick preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.05 GATE VALVE

A. Manufacturers:

1. Watts Regulator Model WGUS-1 or equivalent.

B. Up to and including 2 Inches : Brass body, rising stem, handwheel, inside screw, solder or screwed ends.

2.06 PLUG VALVES

A. Manufacturers:

1. DeZurik or equivalent.

B. Up to and including 2 1/2 Inches: Bronze body, bronze tapered plug, non-lubricated, teflon packing, threaded ends.

C. Over 2 1/2 Inches: Cast iron body and plug, non-lubricated, teflon packing, flanged ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

I. Provide support for utility meters in accordance with requirements of utility companies.

J. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Section 09900.

K. Install bell and spigot pipe with bell end upstream.

L. Install valves with stems upright or horizontal, not inverted.

M. Provide one plug valve wrench for every ten plug valves sized 2 inches and smaller, minimum of one. Provide each plug valve sized 2-1/2 and larger with a wrench with set screw.

N. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

3.03 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Provide plug valves in Natural gas systems for shut-off service.

3.04 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

B. Slope water piping and arrange to drain at low points.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

– END OF SECTION –

SECTION 15430

PLUMBING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleanouts.

B. Hose bibs.

C. Backflow preventers.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals.

B. Section 15410 - Plumbing Piping.

C. Section 15440 - Plumbing Fixtures.

D. Section 15445 - Plumbing Equipment.

1.03 REFERENCES

A. ANSI A112.21.1 - Floor Drains.

B. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

C. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

D. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 FLOOR DRAINS

A. Manufacturers:

1. Smith 2147 Series or equivalent.

B. FD: ANSI A112.21.1; Cast iron two piece body with double drainage flange, weep holes, and sediment bucket.

2.02 CLEANOUTS

A. Manufacturers:

1. Smith 4220 Series or equivalent.

B. Exterior Surfaced Areas (CO): Round cast iron top non-skid cover; no hub type connection.

2.03 HOSE BIBS

A. Manufacturers:

1. Normal: Watts Regulator Model SC-2 or equivalent.
2. Frost-proof: Watts Regulator FH-1 or equivalent.

B. Interior: Brass soldered connection, hose thread spout, with handwheel.

C. Frost-proof: Brass, threaded connection, hose thread spout, with handwheel.

2.04 BACKFLOW PREVENTERS

A. Manufactuers:

1. Watts Regulator Model 909 or equivalent.

B. Reduced Pressure Backflow Preventers: Bronze body with bronze and plastic internal parts and stainless steel springs; two independently operating, spring loaded check vales threaded end connections.

PART 3EXECUTION

3.01 PREPARATION

A. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

– END OF SECTION –

SECTION 15440

PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Lavatories.

C. Service sinks.

D. Emergency Shower.

E. Emergency Eye Wash.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals.

B. Section 07900 - Joint Sealers: Seal fixtures to walls and floors.

C. Section 15410 - Plumbing Piping.

D. Section 15430 - Plumbing Specialties.

E. Section 15445 - Plumbing Equipment

1.03 REFERENCES

A. ANSI/ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use.

B. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.

C. ANSI/ASME A112.19.1 - Enameled Cast Iron Plumbing Fixtures.

D. ANSI/ASME A112.19.2 - Vitreous China Plumbing Fixtures.

E. ANSI/ASME A112.19.4 - Porcelain Enamelled Formed Steel Plumbing Steel.

F. ANSI/ASME A112.19.5 - Trim for Water-Closet, Bowls, Tanks, and Urinals (Dimensional Standards).

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Installation Instructions.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01700.

B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.01 WATER CLOSET (WC)

A. Bowl

1. Manufacturer: American Standard Model 2168.100 or equivalent.
2. ANSI/ASME A112.19.2; floor mounted, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.

B. Flush Valve Provided by Manufacturer with WC.

C. Seat

1. Manufacturer: American Standard Model 5324.019 or equivalent.
2. Solid white plastic, stainless steel bolts, with cover.

2.05 LAVATORY

A. Basin

1. Manufacturer: American Standard Model 4300.042 or equivalent.
2. ANSI/ASME A112.19.1; porcelain enamelled cast iron wall-hung lavatory 19 x 17 inch minimum, wih 4 inch high back, drillins on 3 inch centers, rectangular basin with splash lip, front overflow and soap depression.

B. Wall Mounted Carrier Supplied by Manufacturer.

2.06 SERVICE SINK (SS)

A. Bowl

1. Manufacturer: Crane Plumbing Model FSB-2424 or equivalent.
2. 24 x 24 x 10 inch high white molded stone, floor mounted, with one inch wide shoulders, stainless steel strainer.

B. Service Faucet

1. Manufacturer: Crane Plumbing Model 830 A-A or equivalent.

2. Shall be wall mounted with integral vacuum breaker. Body inlets shall be 8" center to center, and include a 3/4 inch hose thread or spout.

2.07 EMERGENCY EYE AND FACE WASH

A. Manufacturer:

1. Bradley Model S19-310 or equivalent.

B. ANSI Z358.1; Free standing, self-cleaning, non-clogging eye and face wash with stay open ball valve, ABS eye wash receptor, twin eye wash heads and flag valve handle.

2.08 EMERGENCY SHOWER (ES)

A. Manufacturer:

1. Bradley Model S19-310 or equivalent.

B. ANSI 358.1; Free standing 10 inch diameter plastic deluge shower head with elbow, one inch full flow valve with pull chain and 8 inch diameter ring, one inch interconnecting fittings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated on drawings.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components level and plumb.

C. Install and secure fixtures in place with wall carriers and bolts.

D. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900, color to match fixture.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01700.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

A. Clean work under provisions of 01700.

B. At completion clean plumbing fixtures and equipment.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500.

B. Do not permit use of fixtures.

3.07 FIXTURE HEIGHTS

A. Install fixtures to heights above finished floor as indicated.

B. Water-Closet

1. Standard 17 1/4 inches to top of bowl rim.

C. Lavatory

1. Standard 31 inches to top of basin rim.
2. Handicapped 32 inches to top of basin rim.

D. Emergency Eye and Face Wash

1. Standard 38 inches to receptor rim.

E. Emergency Shower

1. Standard 84 inches to bottom of head.

3.09 FIXTURE ROUGH-IN SCHEDULE

	Hot Water	Cold Water	Waste	Vent
Lavatory:	1/2 inch	1/2 inch	1-1/2 inch	1-1/4 inch
Service Sink:	1/2 inch	1/2 inch	3 inch	1-1/2 inch
Water Closet (Tank Type):		1/2 inch	4 inch	2 inch

END OF SECTION

SECTION 15445

PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 Section Includes

A. Water Heaters.

1.02 Related Sections

A. Section 01300 - Submittals.

B. Section 15094 - Pipe Anchors and Supports.

1.03 References

A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

1.04 Submittals

A. Submit under provisions of Section 01300.

B. Shop Drawings:

1. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

C. Product Data:

1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Provide electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions.

1.05 Operation and Maintenance Data

A. Include operation, maintenance, and inspection data, replacement part numbers and service depot location and telephone number.

1.06 Quality Assurance

A. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. National Sanitation Foundation (NSF).

2. National Electrical Manufacturers' Association (NEMA).

3. Underwriters Laboratories (UL).

1.07 Regulatory Requirements

A. Conform to ANSI/NFPA 70 and ANSI/UL 174 requirements for water heaters.

1.08 Delivery, Storage, and Handling

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 Warranty

A. Provide five year warranty.

B. Warranty: Include coverage of domestic water heaters.

PART 2 PRODUCTS

2.01 Gas-Fired Hot Water Heater

A. Design Conditions: Each gas-fired water heater shall comply with the minimum conditions as shown in the schedule below:

GAS-FIRED HOT WATER HEATER SCHEDULE

Size	30 gallons
Gross Input, BTU/HC	150,000
Recovery GPH @ 100 degrees Rise	140
Entering Water Temperature	40 degrees F
Leaving Water Temperature	140 degrees F
Fuel	Natural Gas
Flue Diameter	6-inches

B. Manufacturer: Provide products of one of the following:

1. State Industries, Inc.
2. Rheem Water Heater Div.

C. Type: Hot water heater shall be of commercial gas fired, quick recovery energy efficient design. Provide certification of design by AGA tests for commercial water heater for delivery of 140 degrees F.

D. Construct for working pressure of 150 psi, boiler type and hole cleanout. Magnesium anode rod, 3/4" tapping of relief valve, glass lining on interval surfaces exposed to water.

E. Safety controls consists of an automatic gas shutoff device to shut off entire gas supply in event of excessive temperature in tank and pilot safety shutoff.

F. Water heater provided with AGA certified draft hood.

G. Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with backed enamel finish over bonderized undercoating.

H. Provide brass drain valve, 3/4" pressure and temperature relief valve and radiant floor shield.

I. Provide gas pressure regulator, electronic gas regulator, thermostat, and temperature limit control.

PART 3 EXECUTION

3.01 Installation

A. Install hot water heaters and accessories in accordance with manufacturer's installation instructions.

B. Provide all supporting steel, brackets, saddles, etc., required to support water heaters.

C. Install temperature and pressure relief valves in accordance with ANSI Z21.22.

D. Pipe all relief valve drain lines to nearest floor drain.

E. Make final service connections:

1. Potable hot and cold water supply.
2. Gas piping.
3. Vent piping.
4. Drain piping.
5. Temperature and pressure, pressure relief valves.

3.02 Testing and Flushing

A. Flushing: After piping, valves, and accessories are connected, but prior to startup and testing, flush heater under full system pressure.

B. Startup and Testing:

1. Startup: After flushing, drain heater, refill, and startup unit in accordance with manufacturer's operating instructions.
2. Operations: Test:
   a. Test heater after field adjustments have been made.
   b. Retest until specification requirements have been met.

3.03 Adjust and Clean

A. Adjust:

1. Adjust thermostat to desired water outlet temperature (140°F).
2. Adjust burner for maximum flame efficiency.
3. Adjust circulating pump to provide desired tank water temperature.

B. Clean: Upon completion of testing and adjusting, clean all parts of heater unit to remove grease, sludge, and foreign matter.

– END OF SECTION –

SECTION 15450

COMPRESSED AIR SYSTEM

PART 1 - GENERAL

1.01 Summary

A. Section Includes:

1. Contractor shall provide all labor, material, equipment, and incidentals as shown, specified, and required to provide a compressed air system.

2. Includes, but is not limited to, the following components:

   A. Air cooled rotary screw air compressor

   B. Regenerative air dryer

   C. Compressed air filters

B. Related Sections:

Section 11312 Air Diaphragm Pumps

Section 11360 Plate and Flame Filter Press

Division 16 Electrical

1.02 Refrigerated Standards

Certify with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. NFPA 70, National Electrical Code

2. ASME Standards

1.03 System Description

Contractor shall furnish and install all materials, equipment, controls, and incidentals required to provide a compressed air system consisting of an air-cooled rotary screw air compressor, refrigerated air dryer, and coalescing filter. The compressed air system shall be manufactured by Ingersoll-Rand Model EP40SE, or pre-approved equal. The refridgerated dryer shall be a Model HRM42 as manufactured by Ingersoll-Rand, or pre-approved equal.

1.04 Submittals

A. Provide product data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialities, and accessories. Indicate dimensions, required clearances, methods of assembly of components, and piping and wiring connections for the following:

1. Air compressor.

2. Air dryer.

3. Accessories.

B. Wiring diagrams for each item of equipment with electric power supply. Include ladder-type wiring diagrams for interlock and control wiring required for final installation. Differentiate between portions of wiring that are factory-installed and field-installed.

C. Certificates of shop inspection and data report as required by the ASME Boiler and Pressure Vessel Code.

D. Coordination drawings for compressed-air systems equipment and piping, including relationship to other services that serve same work areas.

E. Maintenance data for inclusion in Operating and Maintenance Manuals as specified in Division 1.

1.05 Quality Assurance

Qualification data required:

1. Provide a list of installations with a record of satisfactory service, in projects of similar magnitude, for a period of not less than five (5) years. List dates of completion and name, address and telephone number of the responsible representative of the Owner and/or the Engineer. The units listed shall have been manufactured in the present production facility; not by a predecessor company in a different facility.

2. Multiple equipment units that comprise a system shall be identical. Similar components of each unit shall be the product of a single manufacturer.

1.06 Delivery, Storage, and Handling

A. Deliver materials to the site to insure uninterrupted progress of the work.

B. All approved materials shall be protected from damage prior to packing for shipment. Heavy or plastic foam sheets shall be placed between equipment pieces to eliminate abrasion during handling.

C. Store materials to permit easy access for inspection and identification. Keep all items in covered storage off the ground, using pallets, and other supports.

1.07 Project Conditions

A. The air compressor system shall be specially designed, constructed, and installed for the services intended and shall comply with the following conditions.

Design Conditions

Location:	Interior
Use:	Provide compressed air to sludge filter press, air diaphragm pumps, GAC vessels during change-out, and pneumatic valves.
Design Air Flow Rate:	153 scfm @ 125 psi (Regenerative dryer sized for only 27 scfm @ 125 psi)

1.08 WARRANTY

A. If within a period of one (1) year from date of completion (or 14 months after delivery), the compressed air system or any part thereof shall prove to be defective in material or workmanship upon examination by the manufacturer, the manufacturer will supply a replacement part of repair the defective component.

PART 2 - PRODUCTS

2.01 Manufacturers

A. Acceptable Compressed Air System Manufacturers:

Ingersoll Rand air compressors of Davidson, NC or pre-approved equal. Other manufacturers desiring to be considered for pre-approval shall submit qualification data ten (10) days prior to the bidding date to provide evidence of experience and conformity. Any supplier whose pre-qualification has been accepted shall be notified in writing by the Engineer.

2.02 Materials

A. Air-cooled rotary screw air compressor:

The air cooled rotary screw air compressor shall be an Ingersoll-Rand model EP 40/SE 40 HP unit or pre-approved equal. The unit shall have the following contents:

1. Inlet Air Filter

   An inlet filter shall be mounted to the compressor frame which is 99.9% efficient at 10 microns and above. A maintenance indicator shall be provided to indicate filter blockage.

2. Airend

   An airend consisting of two asymmetric profile, oil flooded, forged steel rotors in a cast iron housing shall be included. The rotors shall be fitted with cylindrical roller bearings at the drive end and duplex tapered roller bearings at the discharge end.

3. Drive Motor

   The electric motor shall be a squirrel cage induction motor with class F insulation, and supplied with a 460V open drip proof motors.

4. Belt Drive

   The airend shall be mounted over the motor on a rigid single piece platform. Transmission from the motor to the airend is through two sheaves and multiple V-belts.

5. Coolant Filter

   A coolant filter containing a 10 micron element with internal pressure bypass shall be included with the rotary screw air compressor.

6. Separator

   A separator shall be provided to remove coolant from the compressed air and act as a sump or reservoir for the coolant. The separator shall have the following features:

   - Pressure relief value
   - Coolant drain cap
   - Coolant sight level

- Scavenge line to airend
- Minimum pressure/check value

7. Coolers

   The compressor shall have air-cooled radiators and air-cooled aftercoolers. The coolers shall be side-by-side tube and fin and rated for ambient air temperatures from 35°F to 115°F. The aftercooler has a 15°F CTD. The cooling fan which forces air through the coolers will be driven by the main motor.

8. Thermostatic Control Valve

   A thermostatic control valve shall be provided to proportion of coolant which passes through the oil cooler and the bypass line.

9. Capacity Control

   Compressors shall be supplied with online/offline and upper range modulation capacity control.

10. Base

    The compressor shall be mounted on a fabricated steel sub-base.

11. Enclosure

    The complete unit shall come standard as a base mounted unit. A sheet metal, noise attenuating enclosure shall be included to reduce the sound level to 78 dBA.

12. Starter

    A star delta starter shall be mounted and wired to the compressor in a NEMA 1 starter box. The system will include a 115V control circuit transformer.

13. Electronic Control Panel

    A microprocessor based controller shall be provided which offers a finger touch panel for control of all primary compressor functions. The controller shall constantly monitor prime compressor operating parameters including: high discharge, air temperature, discharge air pressure, and low oil pressure (if required). In the event one of these parameters should deviate from its pre-programmed limit, the controlled shall automatically warn the user or stop the compressor.

B. Regenerative Air Dryer

The regenerative air dryer shall be a Ingersoll-Rand model HRM42 unit or pre-approved equal. The unit shall have the following components/design conditions:

1. General

   HRM42 air dryer capable of reducing the dew point temperature of 22 scfm of moisture saturated air at 100 psig to a NFPA Recommended Standard T3, 27.2 dew point (-40°F) when operating in an 100°F ambient temperature, 100% relative humidity.

C. Compressed Air Filter

The compressed air filter shall be an Ingeroll-Rand model IR200C or pre-approved equal. Compressed air filter to remove liquid water, solid particulates, liquid oil and oil mists from 200 scfm of air at 100 psig shall have a theoretical efficiency greater than 99.9999% and be capable

of removing particles as small as 0.01 micron. Filter elements shall consist of a polypropylene support core and multiple layers of polyester and borosilicate coalescing medium which remove progressively smaller particles. Element shall also include a drain layer, which shall drain coalesced oil mists and droplets to the sump area. Initial (dry) pressure drop of filter at 100 psig and rated flow shall not exceed 1.0 psi. Filter shall include a maintenance indicator for indication of element replacement. Housing shall consist of a cast aluminum alloy head, complete with threaded inlet and outlet connections, and threaded to accept a bottom bowl incorporating a manual drain and means to provide an audible signal should bowl be inadvertently loosened while filter is pressurized. Direction of air flow shall be from inside to outside of element. Maximum pressure shall be 250 psig, and element core shall withstand pressure surges up to 30 psi differential. The minimum element burst pressure shall be 100 psid. Maximum operating temperature shall be 150°F.

PART 3 - EXECUTION

3.01 Installation

A. Install air compressor equipment in complete accordance with the manufacturer's instructions.

B. Furnish and install all required oil and grease for initial operation.

3.02 Field Quality Control

A. After Contractor and owner's Engineer have mutually agreed that the equipment installation is complete and ready for continuous operation, Contractor shall conduct a running test and a sound test of the compressor and controls in the presence of Engineer to demonstrate that the system will function correctly, and that sound levels do not exceed maximum limits.

1. Running Test:

   a. All compressor units together shall be field tested. Tests shall demonstrate to Engineer that each part and all parts together function in the manner intended.

2. Sound Tests:

   a. Perform an overall sound-pressure level test on the compressor. Test results shall be rated in decibels in accordance with ANSI Standard S5-1.

   b. Take the overall sound pressure level at points evenly spaced around the compressor system and motor assembly and at three feet from the nearest part of the units. Sound level shall not exceed 84 decibels at three feet distances measured on the A-weighted scale.

   c. Contractor shall provide all instruments, necessary labor, tools, and materials to conduct the field tests.

-- END OF SECTION 15450 --

SECTION 15500

HEATING AND VENTILATION SYSTEMS

PART 1 - GENERAL

1.01 Section Includes

A. The work covered by this section consists of furnishing labor, materials, equipment, and services necessary to install the following:

1. Roof Exhaust Fan.
2. Wall Exhaust Fans.
3. Indoor Make-up Air Handler.
4. Motorized Dampers.
5. Damper Operators.

1.02 Related Sections

A. Section 01300 - Submittals.

B. Section 15858 - Indoor Make-up Air Handler.

C. Section 15990 - Testing, Adjusting, and Balancing of Heating and Ventilation Systems.

1.03 References

A. AMCA 99 - Standards Handbook.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

D. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

E. ANSI/AFBMA - Load Ratings and Fatigue Life for Ball Bearings.

1.04 Quality Assurance

A. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300.

C. Fabrication: Conform to AMCA 99.

1.05 Submittals

A. Product Data: Manufacturers' descriptive data and technical literature showing conformance to design and materials and construction.

B. Shop Drawings: A complete listing of equipment and materials. Drawings showing location and size of connections.

C. Operation and Maintenance Manuals.

D. Certificate of Compliance.

1.06 Warranty

A. Provide manufacturer's Standard warranty.

B. Equipment manufacturer shall issue the Standard warranty under Owner's name.

C. The effective date of the Standard warranty shall be from equipment start-up date by the Contractor or an authorized manufacturer's representative.

1.07 Delivery, Storage, and Handling

A. Deliver, store, protect and handle products to site as to assure proper operation upon installation.

PART 2 - PRODUCTS

2.01 Roof Exhaust Fan

A. Power roof ventilators shall be as manufactured by Trane, Penn Ventilator, Greenheck, Acme or approved equal.

B. Centrifugal Power Roof Ventilator: Power roof ventilators shall be the spun aluminum centrifugal type. Aluminum base shall be one piece with deep-spun aluminum venturi and curb mounting flange. Hood shall be of spun aluminum. The centrifugal wheel shall be aluminum, with an extruded aluminum hub. It shall be non-overloading, and shall be statically and dynamically balanced.

C. The drive mechanism shall incorporate a variable pitch V-belt drive with an adjustable cast iron pulley.

D. Motors shall be 2 speed, dual winding, NEMA standard open drip-proof construction. Motor support shall be adjustable to facilitate belt tensioning. Motor and bearing assembly shall be supported by steel angles, resiliently mounted using heavy-duty neoprene isolators. All bolts shall be cadmium or zinc plated. Units shall be equipped with birdscreens.

E. The fan bearings shall be heavy duty, self-aligning ball conforming to ANSI/AFBMA L 10 with a median rating life of 100,000 hours.

F. Provide belts of non-static, oil resistant with minimum life expectancy of 24,000 hours.

G. Sloped roof curb 12 inch high self-flashing with continuously welded seams, one inch insulation and curb bottom, and factory installed nailer strip.

H. Disconnect Switch: Provide non-fusible safety disconnect switch with thermal overload protection mounted inside fan housing, factory wired through an integral aluminum housing.

I. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required RPM is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

J. Backdraft Dampers: Provide counter-balanced, parallel blade backdraft dampers suitable for mounting in curb base.

K. Ratings: Provide CFM and static pressure rating per AMCA 210.

2.02 Wall Exhaust Fans

A. Wall Mounted Ventilators shall be manufactured by Trane, Penn Ventilator, Greenheck, Acme or approved equal.

B. Wall Mounted Ventilators shall be constructed of aluminum. It shall be non-overloading, and shall be statically and dynamically balanced.

C. The fan shall be mechanically connected to the driving motor.

D. Motors, speed as shown on the Fan Schedule.

E. The fan bearings shall be heavy duty, self aligning ball conforming to ANSI/AFBMA L10 with a median rating life of 100,000 hours.

F. Disconnect Switch: Provide non-fusible safety disconnect switch with thermal overload protection mounted inside fan housing.

G. Backdraft Dampers: Provide counter-balanced parallel blade backdraft damper suitable for wall installation.

H. Ratings: Provide CFM and static pressure rating per AMCA 210

2.03 Motorized Dampers

A. General: Except as otherwise indicated, provide manufacturer's standard dampers where shown, of size, shape, capacity, and type indicated, constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide adjustable dampers that have the minimum free area as indicated in the damper schedule. Dampers shall have leakage less than 2 cfm per square foot of damper area when closed.

C. Dampers will be equipped with actuating motors capable of operating the dampers from full open to full closed position.

D. Substrate Compatibility: Provide dampers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support for weatherproof installation. Refer to general construction Drawings and specifications for types of substrate which will contain each type of damper.

E. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

F. Damper Screens: On inside face of exterior dampers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dampers which may be incorporated in the Work include; but are not limited to, the following:

1. Airline Products Co.
2. American Warming & Ventilating, Inc.
3. Arrow United Industries, Inc.
4. Ruskin Mfg. Co.

2.04 Damper Operators

A. Unit shall be manufactured by Barber-Colman or equivalent.

B. Size each motor to operate dampers with sufficient reserve power to provide 2-position action as specified.

C. Provide permanent split-capacitor or shaded pole type motors with gear trains completely oil-immersed and sealed. Equip spring-return 120 volts motors, where indicated on Drawings or in operational sequence, with integral spiral-spring mechanism. Furnish entire spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

D. Equip motors for outdoor locations and for outside air intakes with "O ring" gaskets designed to make motors completely weatherproof, and equip with internal heaters to permit normal operation at -40 degrees F.

E. Furnish non-spring return motors for dampers larger than 25 sq. ft., and for valves larger than 2-1/2 inch, sized for running torque rating of 150 inch-pounds, and breakaway torque rating of 300 inch-pounds. Size spring-return motors for running torque rating of 150 inch-pounds, and breakaway torque rating of 150 inch-pounds.

2.05 Thermostat

A. Refer to Control Wiring Diagram for thermostat wiring. Provide thermostats as shown on drawing with the following features:

1. 120 volt line voltage.
2. Coiled copper tube sensing element.
3. Single Pole Double Throw (SPDT).
4. Minimum of 20 to 90 degrees Fahrenheit temperature range.
5. Honeywell T631C or an approved equal.

2.06 Indoor Make-up Air Handler

A. See Section 15858.

PART 3 - EXECUTION

3.01 Installation

A. Install equipment in accordance with the approved shop drawings and the manufacturer's installation instructions.

3.02 Equipment Testing

A. After completion of the Work, test and regulate heating and ventilating equipment to the requirements of Section 15990.

-- END OF SECTION 15500 --

SECTION 15858

HIGH EFFICIENCY INDOOR MAKE-UP AIR HANDLER

PART 1 - GENERAL

1.01 Related Documents

A. Scope: CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to furnish and install one high efficiency indoor make-up air handler complete with motor, all controls, and appurtenances.

B. Related Sections:

1. Division 1, General Requirements.
2. Section 9L, Painting (surface preparation and shop painting is under this section).
3. Section 15240, Vibration Isolation.
4. Section 15290, Duct Insulation.
5. Section 15515, Piping, Valves, and Accessories.
6. Section 15910, Ductwork and Accessories.
7. Section 15951, Automatic Temperature.
8. Section 15990, Testing, Adjusting, and Balancing of HVAC Systems.
9. Division 16, Electrical.

1.02 Quality Assurance

A. Testing Agencies: Fans and coils shall conform to the latest edition of the following standards:

1. Fans: Air Conditioning and Refrigeration Institute (ARI) Standard 430-74.
2. ASHRAE 52-76 Method of testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter.

B. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.

1. Permits: CONTRACTOR shall obtain and pay for all required permits, fees and inspections by authorities having jurisdiction.
2. Local and State Building Codes and Ordinances.
   a. Underwriter's Laboratories, Inc.
   b. National Electric Code (NEC).
   c. Local and State Building Codes and Ordinances.
3. National Fire Prevention Association.

C. Reference Standards:

1. Air Moving and Conditioning Association (AMCA).
2. American Society of Heating, Refrigeration and Air Conditioning Association (ASHRAE).

3. National Electrical Manufacturer's Association (NEMA).

4. Air Conditioning and Refrigeration Institute (ARI).

1.03 Submittals

A. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Dimensions and data, all accessories.

2. Materials of construction.

3. Performance data, fan curves, noise data, equipment weights.

4. Method of support.

5. Manufacturer's literature, illustrations, specifications, and engineering data.

6. Other technical data related to the specified materials and equipment requested by ENGINEER.

B. Operation and Maintenance Data:

1. CONTRACTOR shall furnish in accordance with requirements of Division 1, operation and maintenance manual prepared by the manufacturers of all items of equipment furnished under this Section. The manual shall include maintenance instructions, copies of approved shop and installation drawings for all equipment, and manufacturer's recommended lubricant and spare parts lists.

C. Test Reports: Submit from the following applicable test certifications for approval:

1. ARI Label.

2. UL Label.

3. AMCA Label.

1.04 Product Delivery, Storage and Handling

A. Delivery of Material:

1. Units shall be protectively crated or mounted on skids with substantial wood members.

2. Units shall be equipped with a minimum of four lifting lugs.

3. Spacer bars shall be used in lifting units to prevent damage to casing.

4. Comply with manufacturer's recommendations for rigging of units.

5. Units shall be structurally designed to withstand stresses of hoisting.

B. Storage of Material:

1. Store units in a clean, dry area, out of the weather.

2. Cap all pipe connections and duct connections.

3. Unit shall remain in original crate until time of actual installation.

4. Unit shall be tightly covered to protect against dirt, water, mechanical injury or chemical damage.

1.05 Job Conditioning

A. Protection:

1. Make provisions to protect the units at site from vandalism, rain, snow, corrosion, or physical damage prior to the installation.

PART 2 - PRODUCTS

2.01 Design Conditions

A. Minimum performance data for each unit shall be as scheduled on the Drawings. Equipment furnished shall not exceed scheduled horsepower, outlet air velocity, and air or water pressure drops for accessories.

B. Product and Manufacturer: Provide units as made by one of the following:

1. Trane Company.
2. McQuay.
3. Or equal.

C. Capacity: As shown on the Drawings.

2.02 Details of Construction

A. Type:

1. Factory Assembled.
2. Modular in design
3. Horizontal as shown on Drawings.
4. Draw-thru type.
5. Suitable for indoor location as shown on Drawings.

B. Components:

1. Fan section.
2. Face dampers.
3. Access section, access doors and panels
4. Motor.
5. Belts, pulleys, drives.
6. Belt guard.
7. Vibration Isolation.
8. Air filter mixing box with dampers.
9. Internally lined metal panels.
10. Control Panel

C. Fan Section:

1. Construction:

   a. Frame: Welded steel angle or channel frame.

   b. Panels: Heavy gage reinforced galvanized steel, 15 gage minimum thickness.

   c. Insulation: One inch thick, 3/4 pound density fiberglass with metal sandwich panel.

   d. Fan Shaft: Shall be accurately turned, ground and polished hot rolled steel. Shafts will be swaged, stub in tube, or solid as designed by the unit manufacturer. Shafts shall not pass through their first critical speed as unit comes up to rated rpm. Shafts will be coated with a preservative prior to shipment for corrosion protection.

   e. Fan Wheel: Aluminum or steel with corrosion resistant paint.

2. Fan Type: The centrifugal fan shall be belt driven forward curved, statically and dynamically balanced with a double inlet. The blower wheel shall be fixed on a keyed shaft, supported with inshear vibration isolators, and ball bearing secured.

3. Balancing: Fan wheel, shaft, motor, drives, and belts shall be dynamically balanced as a complete assembly at the factory.

4. Bearings: Bearings shall be sized for an average life of 200,000 hours at specified operating conditions. Externally mounted bearings shall be flange type and all internally mounted bearings shall have grease lines extended to the exterior of the unit.

5. All surfaces, including fan panel and accessories shall be chemically cleaned, phosphatized, washed and dried and coated with enamel finish on both inside and outside (factory painted).

6. Motors:

   a. ODP, three phase, with magnetic starter, 1800 rpm.

   b. Motors shall be in accordance with all current applicable standards of NEMA, IEEE, AFBMA, NEC, and ANSI.

   c. Motors shall be normal starting torque, normal slip, squirrel cage induction type.

   d. Motors shall be capable of carrying full load current continuously without injurious temperature rise in an ambient temperature of 40° C.

   e. Motors mounted out of the airstream shall be ODP with 1.15 service factor unless otherwise scheduled on Drawings.

   f. Motors shall be of sufficient size so that there will be no overload on the motor above related nameplate horsepower under any condition of operation from shut-off to zero head.

   g. Motor thrust bearings shall be adequate to carry continuous thrust loads under all conditions of fan operation from zero head to shut-off.

   h. Locked rotor currents shall be as specified in NEMA standards.

   i. Lubrication may be grease or oil type.

j. Characteristics:

1. 1/2 Horsepower and Larger: 480 volt, 3 phase, 60 hertz.

8. Drive:

a. All drives shall be factory installed, tensioned, and aligned using a matched set of belts except when motor is shipped loose.

b. Fans shall have belt drives selected for a minimum 1.2 service factor.

c. Drives shall be variable pitch type and suitable for adjustment within plus or minus 10 percent of specified rpm but not to exceed the maximum rpm of the unit.

9. Belt Guard: Expanded metal cover with tachometer holes. Belt guard shall conform to OSHA Standards.

10. Access Doors: Provide gasketed removable panels or access doors with quick opening compression handles for access to internal components.

D. Dampers:

1. Dampers shall be of the opposed blade type, constructed of galvanized steel with neoprene nylon bushings, blades to be mechanically interlocked.

Optional low leak dampers shall be of the opposed blade type, construction of galvanized steel with neoprene nylon bushings and vinyl blade edge seals, blades to be mechanically interlocked.

2. Outside Air/2-Position Motor/Spring Return - Units with outside air or return air only shall be provided with a damper, two-position spring return damper motor and controls. The motor shall power the damper fully open when the unit is on and fully closed when the unit is off.

E. Access Sections:

1. Construction:

a. Frame, Panels, and Insulation: As specified for fan section.

b. Doors: Heavy gauge steel, insulated.

c. Locks: Compression latch with inside and outside handle.

d. Gasket: Neoprene gasket all around door.

F. Air Filters and Filter Box (Located as shown on Contract Drawings):

1. General:

a. Filter efficiency and weight arrestance shall be determined in accordance with ASHRAW Standard 52-76, air cleaning devices used in general ventilation for removing particulate matter.

2. Throwaway Filters:

a. Throw-away type filters shall have a 2-inch thick fiberglass medial contained in a rigid, angular "V" frame. Filters shall have a metallic supporting maze across both the entering and leaving faces of the media. Filters shall be sized so as not to exceed scheduled face velocities. Filters shall be UL Class I. Average arrestance shall be 82

percent with dust holding capacity 75 grams per square foot at 0.25 inch wg resistance. Clean resistance shall be 0.12 inch wg at 300 fpm using AFI static test method. Dust spot efficiency shall not be less than 20 percent.

3. Filter Box:

   a. Filter box shall be able to accept the specified type of filters. Filters shall fit snugly to prevent air bypass.

   b. The filter box frame shall be factory fabricated and finished in the same finish as the air handling unit casing. The filter box frame shall have a flanged connection on both the inlet and outlet sized to match the air handling unit with the necessary fastener holes prepunched. The assembly shall be provided with all bolts, screws, and fasteners required for assembly by the unit manufacturer.

   c. The filter box shall be provided with quick opening hinged access doors providing access to all filters for filter removal. All filter boxes, 48 inches in height or less, shall be furnished with a single hinged access door. Filter boxes in excess of 48 inches in height shall have individual hinged filter access doors. Removable panels will not be acceptable.

G. Supply Air Firestat:

   1. If the temperature reaches the setpoint, the unit will close all gas valves, return the dampers to their normal position, and shut down the blower. Automatic reset.

H. Manual Blower Switch:

   1. Hand off automatic control provided with make-up air handler control panel.

I. High/Low Gas Pressure Limit Switches:

   1. A high pressure and a low pressure interlock switch and shutoff valve shall be provided for each furnace section. High/low gas pressure limits disengage heating upon detecting either high line pressure or low manifold pressure.

J. Status Indicator Lamps (Electrical Cabinet):

   1. Status indicator lamps shall include power on, blower on, and one lamp per stage of heat mounted in the electrical cabinet.

K. Manual Reset High Limit Switch:

   1. The unit shall be provided with a manual reset, high-limit switch wired in series to the lead furnace high limit. If the setpoint is reached, the gas valve will close and the blower will continue to run until the sensed temperature is below the set point.

L. Interlock Relay - 24/115 Coil DPDT 10A:

   1. This relay has a selectable coil voltage of 24 or 115 volts and double-pile, double-throw 10 amp contacts. Utilized as an auxiliary relay for general purpose duty.

M. Control Panel

   1. Control panel furnished with the air handler system shall include but not be limited to the following: enclosure with starter for two speed motor, disconnect switch, HOA, indicator lights, control interlocks as shown on the drawings.

2.03 Tools and Spare Parts

A. Spare Parts:

1. Provide one spare set of replacement filters.
2. Provide one spare set of belts for each V-belt drive.

2.04 Painting

A. All surfaces of central station air handling unit housing, supports, motors, and drives shall be coated as specified.

PART 3 - EXECUTION

3.01 Inspection

A. Examine supports to receive unit for proper location and dimensions.

3.02 Installation

A. Mount unit on supporting steel and/or concrete pads as shown on the Drawings.

B. Make final connections of ductwork, piping, and control wiring as detailed on the Drawings and approved Shop Drawings.

3.03 Adjustment

A. Adjust belts for proper tension.

B. Adjust pulleys for proper fan speed.

C. Adjust damper linkages for proper operation.

3.04 Cleaning

A. Clean tar cement and other debris from exterior of unit.

B. Remove debris and waste materials resulting from installation.

C. Replace filters used during start-up and adjusting with new filters.

-- END OF SECTION 15858 --

SECTION 15890

DUCTWORK

PART 1 - GENERAL

1.01 Work Included

A. Heating ventilating unit HV-1.

1.02 Related Work

A. Section 01300 - Submittals.

1.03 References

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

1. ASHRAE - Handbook 1993 Fundamentals; Chapter 32 - Duct Design.
2. ASHRAE - Handbook 1992 Equipment; Chapter 16 - Duct Construction.
3. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
4. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
5. NFPA 90A - Installation of Air conditioning and Ventilating Systems.
6. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
7. SMACNA - HVAC Duct Construction Standards; Metal and Flexible, 1985 Edition.
8. UL 181 - Factory-Made Air Ducts and Connectors.

1.04 Definitions

A. Duct Sizes: Inside clear dimensions.

B. Downstream: The direction to which air is flowing. For supply systems, downstream is toward the discharge (away from the fan). For exhaust or return system, downstream is toward the fan.

C. Upstream: The direction from which air is flowing. For supply systems, upstream is toward the fan. For exhaust or return system, upstream is away from the fan.

1.05 Regulatory Requirements

A. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.06 Submittals

A. Submit shop drawings and product data under provisions of Section 01300.

B. Indicate duct fitting particulars such as gages, sizes, welds, and configuration.

1.07 Delivery, Storage, and Handling

A. Deliver products to site under provisions of Section 01600.

B. Store and protect products under provisions of Section 01600.

PART 2 - DUCTS

2.01 Ductwork

A. General: All ductwork shall be rectangular or circular as indicated on the contract drawings.

B. Material:

1. Make-up Air Handler: Galvanized steel sheet metal; ASTM A 527.
2. EF-2: Eisen-Heiss coated.
3. EF-3: Aluminum sheet metal.
4. Supply Air System: Galvanized steel sheet metal.

C. Construction: Drive sup; single wall.

D. Rectangular ductwork shall be constructed in accordance with SMACNA Metal Duct Construction Standards.

2.02 Bonding Material

A. Duct Sealant: UL classified with a flame spread rating of 25 or less and smoke developed rating of 50 or less when applied to galvanized steel.

B. Metal Cements: UL classified with a flame spread rating of zero and smoke developed rating of zero. All joints in standing seam or spot welded fittings shall be sealed with metal cement formulated for bonding metal to metal joints.

2.03 Fittings

A. General: All fittings shall be rectangular as indicated on the contract drawings.

B. Material: Galvanized sheet metal; ASTM A 527.

C. Construction: Drive sup, single wall.

D. Rectangular fittings shall be constructed in accordance with SMACNA Metal Duct Construction Standards.

2.04 Joint Construciton

A. All rectangular supply system sections shall be provided with slip couplings.

1. All fitting ends shall be sized to slip inside mating duct sections. No additional coupling shall be required for duct-to-fitting joints.
2. Duct-to-duct joints shall be by means of a slip coupling that fits inside both mating duct sections (fitting size).

2.05 Hanger and Supports

A. Hangers and hanger straps shall not be screwed to the ducts.

B. Hanger rod size, strap size and hanger spacings shall be in accordance to SMACNA Metal Duct Construction Standards for all ducts.

PART 3 - EXECUTION

3.01 Installation

A. All single wall duct and fittings shall be installed in accordance with the manufacturers instructions.

B. Conform to NFPA 90A and SMACNA standards.

C. Provide mounting and supporting of ductwork and accessories as indicated and as recommended by manufacturer's printed instructions.

3.02 Building Penetrations

A. General Penetration Requirements: Provide properly sized, fabricated, located, and trade coordinated sleeves and prepared openings, for duct mains, branches, and other item penetrations, during the construction of the surface to be penetrated. Provide framed openings for round and square or rectangular duct. Sleeves, except as otherwise specified or indicated, shall be 20-gauge, 0.0396-inch thick mill galvanized sheet metal.

B. Framed Opening: Provide framed openings in accordance with the drawings.

C. Clearances: Provide a minimum one inch clearance between penetrating and penetrated surfaces. Fill clearance space with bulk fibrous glass or mineral wood or foamed silicone and seal and close.

D. Tightness: Penetration shall be weathertight. Penetrations shall be fireproof where fire rated surfaces are penetrated.

E. Sealants: Sealant shall be elastomeric type or foamed silicone type specified under paragraph entitled "Sealants," in this section. Apply to oil free surfaces to a minimum 3/8-inch depth.

3.03 Installation of Supports

A. Selection of duct and equipment support system shall take into account the recommendations and requirements of SMACNA location and precedence of work under other sections; interferences of various piping and electrical work; facility equipment; building configuration; structural and safety factor requirements; vibration and imposed loads under normal and abnormal service conditions.

B. Securely attach supporting elements to building structural steel or structural slabs. Do not hang ductwork or equipment from piping, or other ducts or equipment. Attach supports to structural framing member and concrete slab. Install supports on both sides of all duct turns, branch fittings, and transitions. Cross-brace hangers sufficiently to eliminate sway. Perforated strap hangers are prohibited.

3.04 Cleaning

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

B. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

-- END OF SECTION 15890 --

SECTION 15950

AUTOMATIC TEMPERATURE CONTROLS

PART 1 - GENERAL

1.01 Description

A. Scope: Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install an electric/electronic system of automatic temperature controls complete with all appurtenances required for a complete operating system.

1.02 Related Sections

A. Section 15858 - Indoor Make-up Air Handler

1.03 References

A. Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.

1. National Fire Protection Association (NFPA).
2. Local and State Building Codes and Ordinances.
3. Underwriters Laboratories Incorporated (UL).
4. National Electric Code.

1.04 Submittals

A. Submit under provisions of Section 01300.

PART 2 - PRODUCT

2.01 Manufacturer

A. Manufacturer: Provide products made by one of the following:

1. Honeywell Incorporated
2. Trane
3. Or equal

2.01 Thermostats

A. Type: Single Stage Room Thermostat

1. Low voltage (24 v)
2. 40° F to 90° F range
3. Fan - HI-LOW-ON switch
4. System HEAT-OFF-VENT switch

B. Hand OFF-AUTO-AUTO switch

PART 3 - EXECUTION

3.01 Installation

A. Wall thermostat shall be installed 5 feet above finished floor. Wall plates, face plates and mounting hardware shall be provided as required for a complete installation.

B. Furnish and install all mounting accessories as required for installation of all thermostats.

3.02 Sequence of Operation

A. General

1. HAND-OFF-AUTO Switches (HOA) shall start the equipment when on the HAND position, STOP the unit when on the OFF position, or perform a specified operation when in the AUTO position.

-- END OF SECTION 15950 --

SECTION 15990

TESTING, ADJUSTING, AND BALANCING OF HEATING AND VENTILATION SYSTEMS

PART 1 - GENERAL

1.01 Work Included

A. The Contractor shall procure the services of an independent air balance and testing agency, who is a current member in good standing of the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) approved by the Owner, and who specializes in the testing, balancing and adjusting of heating and ventilating systems.

B. Test and balance:

1. Exhaust Fans.
2. Indoor Make-up Air Handler.

1.02 Related Sections

A. Section 01300 - Submittals.

B. Section 15500 - Heating and Ventilation.

1.03 Quality Assurance

A. The testing agency shall have in its employ, on a full time basis, a minimum of one AABC-Certified test and balance Engineer or NEBB Test and Balance Supervisor.

1. The certified Engineer or NEBB Supervisor shall be responsible for all aspects of Work specified in this section.
2. The AABC Engineer or NEBB Supervisor shall maintain certification throughout the duration of Work.
3. The AABC Engineer or NEBB Supervisor shall provide certification of all specified testing, adjusting and balancing (TAB) reports.

B. Referenced Publications:

1. Standards listed below form a part of these specifications the same as if they were fully written and followed as minimum requirements. Where contract document requirements are in excess of the referenced publications and are not in conflict with the publications, the contract documents shall govern the work.
   a. ASHRAE system and application handbook, 1991 Edition, Chapter 34.
   b. ASHRAE Fundamentals Handbook, 1989 Edition, Chapter 13.
   c. AABC National Standards for Testing and Balancing of Heating, Ventilating and Air-Conditioning Systems, Fifth Edition, 1989.
   d. NEBB Testing, Adjusting, Balancing of Environmental System, Fourth Edition, 1983.

C. Test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Owner shall review the balancing report and may request a recheck of any part of Heating and Ventilating system. The agency shall provide technicians to assist the Owner in making any test he may require during this period.

D. Make changes in the pulleys, belts, and dampers or the addition of dampers for correct balancing as required by air balance agency.

1.04 Submittals

A. Submit under provisions of Section 01300.

B. Prior to performing any Work required by this Section, provide submittals of the following items to the Owner for approval.

1. Testing agency's name.
2. Testing agency's resume of at least ten similar projects including testing dates, name of project, brief project systems' description, and Contractor.
3. Name of Certified Engineer or Supervisor.
4. Copies of Test Reports intended for use.
5. Written description of test procedures to be used to accomplish the Work required in this Section.
6. Instruments intended for use.

C. Certified TAB Reports:

1. Provide six copies of complete and certified TAB reports described herein, for submission to the Owner prior to system commissioning.
2. Conspicuously identify items not in compliance with the Contract Documents or obvious operating problems in reports. Include a detailed written description of measures to be taken and a schedule to correct such items.

PART 2 - PRODUCTS

2.01 Materials

A. Provide all necessary instrumentation and test equipment required to accomplish the Work specified in this Section.

B. Certified Tab Report:

1. Include the following forms and Test Reports in the certified TAB report. Fully completed reports and forms to the extent applicable to the system, device, equipment, etc., tested, adjusted and balanced including all additional data specified.
2. Certification Form
   a. Additional data.
      (1) Most-current date on Contract Documents used.
3. Instrument List Form

4. Air Moving Equipment Test Report

    a. Additional data.

        (1) Design and operating motor brake-horsepower.

        (2) Manufacturer's fan curve with design and operating points plotted.

        (3) Operating voltage and amperage.

PART 3 - EXECUTION

3.01 Procedure

A. General:

1. Adjust all Heating and Ventilating systems to deliver the specified air quantities within the following tolerances.

    a. Equipment fans. ± 10%.

2. Conform procedures used to perform Work to the recommendations contained within the referenced publications.

B. Final Tests, Inspection, and Acceptance:

1. Contractor to correct punchlist work identified by the testing agency and complete prior to submission of the final TAB report. Using a clear and systematic checklist procedure, the Contractor shall identify the corrective measures required and completed, and the date the work was performed.

2. Submit the final TAB report for review along with the Contractor's completed checklist prior to system commissioning.

3. Pre-test all systems prior to inspection and acceptance tests required by code Authorities having jurisdiction. Provide detailed documentation of the code inspection tests by the Contractor and include test procedures, participants, dates and times, instruments used, test data, and a summation of test results. Submit this documentation prior to system commissioning test conducted by the Owner.

4. System Commissioning Tests.

    a. Tests shall demonstrate that capacities and general performance of air systems comply with Contract requirements.

    b. At the time of system commissioning, recheck, in the presence of the Owner, random selections of data (air quantities) recorded in the Certified TAB Report.

5. Random selection of points and areas for checking by the Owner.

6. Provide same measurement and test procedure same as approved for work forming basis of Certified Report.

7. Selections for checks in general will not exceed 25 percent of the total number tabulated in the report.

C. Retests:

1. If random tests elicit a measured flow deviation exceeding the specified tolerances at ten percent or more of the checked selections, the TAB report will automatically be rejected. In the event the report is rejected, readjusted and tested all systems record new data, submit new Certified Reports submitted, and perform new rechecks, all at no additional cost to the Owner, including time required by the Owner.

2. Marking of Settings: Following final acceptance by the Owner of Certified Reports, permanently mark the settings of all dampers, and other adjustment devices, so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after final acceptance.

3.02 Services

A. Readjustments: Balancing agency shall make additional adjustments required during the reinspection.

– END OF SECTION 15990 –

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 Section Includes

A. Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements.

1.02 Related Sections

1. Division 16 - Electrical
2. Division 11 - Equipment
3. Division 13 - Special Construction
4. Division 15 - Mechanical

1.03 References

A. ANSI/NFPA 70 - National Electrical Code.

1.04 Submittals

A. Submit under provisions of Section 01300.

B. Proposed Products List: Include products specified in the following Sections:

1. Section 16010 - Basic Electrical Requirements.
2. Section 16111 - Conduit.
3. Section 16118 - Underground Electric
4. Section 16123 - Building Wire and Cable.
5. Section 16130 - Boxes.
6. Section 16141 - Wiring Devices.
7. Section 16170 - Grounding and Bonding.
8. Section 16190 - Supporting Devices.
9. Section 16195 - Electrical Identification.
10. Section 16461 - Dry Type Transformers
11. Section 16470 - Panelboards.
12. Section 16480 - Motor Control.
13. Section 16510 - Interior Luminaires.
14. Section 16670 - Lightning Protection Systems.
15. Section 16741 - Telephone Service Entrance

C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittals.

D. Mark dimensions and values in units to match those specified.

1.05 Regulatory Requirements

A. Conform to applicable Building Codes.

B. Electrical: Conform to NFPA 70.

C. Obtain permits, and request inspections from authority having jurisdiction.

1.06 Project/Site Conditions

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare Drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- END OF SECTION 16010 --

SECTION 16111

CONDUIT

PART 1 - GENERAL

1.01 Section Includes

A. Metal conduit.

B. Liquidtight flexible metal conduit.

C. Electrical metallic tubing.

D. Nonmetal conduit.

E. Fittings and conduit bodies.

1.02 Related Sections

A. Section 16130 - Boxes.

B. Section 16170 - Grounding and Bonding.

C. Section 16190 - Supporting Devices.

D. Section 16195 - Electrical Identification.

1.03 References

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

D. ANSI/NFPA 70 - National Electrical Code.

E. NECA "Standard of Installation."

F. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

G. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.04 Design Requirements

A. Conduit Size: ANSI/NFPA 70.

1.05 Submittals

A. Submit under provisions of Section 01300.

B. Product Data: Provide for metallic conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic tubing, fittings, conduit bodies.

1.06 Project Record Documents

A. Submit under provisions of Section 01110.

B. Accurately record actual routing of conduits larger than 2 inches.

1.07 Regulatory Requirements

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.08 Delivery, Storage, And Handling

A. Deliver, store, protect, and handle Products to site under provisions of Section 01600.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.09 Project Conditions

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.01 Conduit Requirements

A. Minimum Size: 3/4 inch unless otherwise specified.

B. Underground Installations:

1. More than Five Feet from Foundation Wall: Use rigid steel conduit.
2. In or Under Slab on Grade: Use rigid steel conduit.

C. Outdoor Locations, Above Grade: Use rigid steel conduit.

2.02 Metal Conduit

A. Manufacturers:

1. Allied Tube and Conduit.
2. Western Tube and Conduit.
3. Century Tube and Conduit.
4. Substitutions: Under provisions of Section 01600.

B. Rigid Steel Conduit: ANSI C80.1.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.03 Liquidtight Flexible Metal Conduit

A. Manufacturers:

1. International Metal Hose Co.
2. Carlon.
3. Alflex.
4. Substitutions: Under provisions of Section 01600.

B. Description: Interlocked steel construction with PVC jacket.

C. Fittings: ANSI/NEMA FB 1.

2.04 Electrical Metallic Tubing (EMT)

A. Manufacturers:

1. Allied Tube and Conduit.
2. Western Tube and Conduit.
3. Century Tube and Conduit.
4. Substitutions: Under provisions of Section 01600.

B. Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron, compression type.

2.05 Nonmetallic Conduit

A. Manufacturers:

1. Carlon.
2. Substitutions: Under provisions of Section 01600.

B. Description: NEMA TC 2; Schedule 40 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 - EXECUTION

3.01 Installation

A. Install conduit in accordance with NECA "Standard of Installation."

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Group related conduits; support using conduit rack. Construct rack using steel channel.

F. Fasten conduit supports to building structure and surfaces under provisions of Section 16190.

G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports

H. Do not attach conduit to ceiling support wires.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route exposed conduit parallel and perpendicular to walls.

K. Route conduit in and under slab from point-to-point.

L. Do not cross conduits in slab.

M. Maintain adequate clearance between conduit and piping.

N. Cut conduit square using saw or pipecutter; de-burr cut ends.

O. Bring conduit to shoulder of fittings; fasten securely.

P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

Q. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 2 inch size.

R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

S. Provide suitable pull string in each empty conduit except sleeves and nipples.

T. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

U. Ground and bond conduit under provisions of Section 16170.

V. Identify conduit under provisions of Section 16195.

3.02 Interface With Other Products

A. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

– END OF SECTION 16111 –

SECTION 16118

UNDERGROUND ELECTRICAL WORK

PART 1 - GENERAL

1.01 Section Includes

A. Conduit.

B. Manholes/Pull Boxes.

C. Metal Frames and Covers.

1.02 Related Sections

A. Section 16111 - Conduit.

B. Section 16123 - Building Wire and Cable.

1.03 References

A. NEMA TC2 - Type EPC -PVC.

B. NEMA TC3 - PVC Fittings.

1.04 Submittals

A. Submit under provisions of Section 01700.

1.05 Project Record Documents

A. Submit under provisions of Section 01110.

B. Accurately record routing of all conduits and duct banks.

PART 2 - PRODUCTS

2.01 Conduit

A. Size as noted.

B. NEMA TC2, Type EPC-PVC for concrete engagement.

C. PVC, Schedule 40 as noted.

2.02 Wire and Cable

A. Size as noted.

B. Furnish in accordance with Section 16123.

2.03 Pull Wire

A. Provide a plastic rope with a minimum tensile strength of 200 pounds in each spare duct. Leave a minimum of 24 inches slack at each end of the pull rope.

2.04 Manholes/Pull Boxes

A. Provide pre-cast units as shown on the drawings.

B. Provide cast iron frames and covers.

C. Provide cable racks and rack arms with insulators to support cables.

PART 3 - EXECUTION

3.01 Concrete

A. Concrete work for duct bank encasement shall conform to the requirements of Section 03300.

B. Provide concrete encasement for PVC duct as shown on the drawings.

C. Top of concrete encasement shall not be less than 18 inches below finished grade. Under roads and pavement it shall not be less than 24 inches below top of pavement.

– END OF SECTION 16118 –

SECTION 16123

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 Section Includes

A. Building wire and cable.

B. Underground feeder and branch circuit cable.

C. Wiring connectors and connections.

1.02 Related Sections

A. Section 16111 - Conduit.

B. Section 16130 - Boxes.

C. Section 16195 - Identification.

1.03 References

A. ANSI/NFPA 70 - National Electrical Code.

1.04 Submittals

A. Submit under provisions of Section 01300.

B. Product Data: Provide for each cable type.

1.05 Regulatory Requirements

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 Manufacturers - Building Wire, Cable And Analog Signal Wire

A. General Electric.

B. Houston Wire and Cable.

C. American Insulated Wire Corp.

D. Substitutions: Under provisions of Section 01600.

2.02 Building Wire And Cable

A. Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70, Type THW, THHN/THWN.

2.03 Analog Signal Wire

A. Description: Type TC, No. 16 AWG, twisted pair, shielded.

B. Conductor: Copper, stranded.

C. Insulation: 300 V, flame retardant ethylene propylene, 90°C.

D. Substitution: Under provisions of Section 01600.

2.04 Manufacturers - Underground Feeder And Branch-Circuit Cable

A. General Electric.

B. Houston Wire and Cable.

C. American Insulated Wire Corp.

D. Substitutions: Under provisions of Section 01600.

2.05 Underground Feeder And Branch Circuit Cable

A. Description: ANSI/NFPA 70, Type UF.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 90 degrees C.

PART 3 - EXECUTION

3.01 Examination

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical Work likely to damage wire and cable has been completed.

3.02 Preparation

A. Completely and thoroughly swab raceway before installing wire.

3.03 Wiring Methods

A. Interior Locations: Use only building wire Type THW, THHN/THWN insulation, in raceway.

B. Exterior Locations: Use only building wire, Type THW, THHN/THWN insulation, in raceway.

3.04 Installation

A. Install products in accordance with manufacturers instructions.

B. Use solid conductor for feeders and branch circuits 10 AWG and smaller.

C. Use stranded conductors for control circuits.

D. Use conductor not smaller than 12 AWG for power and lighting circuits.

E. Use conductor not smaller than 14 AWG for control circuits.

F. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

G. Pull all conductors into raceway at same time.

H. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

I. Protect exposed cable from damage.

J. Neatly train and lace wiring inside boxes, equipment, and panelboards.

K. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

L. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

M. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.05 Interface With Other Products

A. Identify wire and cable under provisions of Section 16195.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.06 Field Quality Control

A. Perform field inspection and testing under provisions of Section 01400.

B. Inspect wire for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

-- END OF SECTION 16123 --

SECTION 16130

BOXES

PART 1 - GENERAL

1.01 Section Includes

A. Wall and ceiling outlet boxes.

B. Pull and junction boxes.

1.02 Related Sections

A. Section 16141 - Wiring Devices: mounting heights of wiring device outlets.

B. Section 16741 - Telephone Service Entrance: Mounting height of outlets.

1.03 References

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. ANSI/NFPA 70 - National Electrical Code.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.04 Project Record Documents

A. Submit under provisions of Section 01700.

B. Accurately record actual locations and mounting heights of outlet, pull, and junction boxes.

1.05 Regulatory Requirements

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 Project Conditions

A. Verify field measurements are as shown on Drawings.

B. Verify locations of outlets in work areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.01 Outlet Boxes

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.

2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.02 Pull And Junction Boxes

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Surface-Mounted Cast Metal Box: NEMA 250, Type 4 flat-flanged, surface-mounted junction box.

1. Material: Galvanized cast iron.

2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 - EXECUTION

3.01 Installation

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

D. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

E. Use gang box where more than one device is mounted together. Do not use sectional box.

F. Use cast outlet box in exterior locations exposed to the weather and wet locations.

G. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.

1. Interior Dry Locations: Use hinged enclosure under provisions of Section 16160.

2. Other Locations: Use surface-mounted cast metal box.

-- END OF SECTION 16130 --

SECTION 16141

WIRING DEVICES

PART 1 - GENERAL

1.01 Section Includes

A. Wall switches.

B. Receptacles.

C. Device plates.

1.02 References

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 6 - Wiring Device Configurations.

1.03 Submittals

A. Submit under provisions of Section 01300.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.

1.04 Regulatory Requirements

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 Wall Switches

A. Manufacturers:

1. General Electric.

2. Hubbell.

B. Description: NEMA WD 1, heavy-duty, AC only general-use snap switch.

C. Device Body: Brown plastic with toggle handle.

D. Voltage Rating: 120-277 volts, AC.

E. Current Rating: 20 amperes.

2.02 Receptacles

A. Manufacturers:

1. General Electric.
2. Hubbell.

B. Description: NEMA WD 1; heavy-duty general-use receptacle.

C. Device Body: Brown plastic.

D. Configuration: NEMA WD 6; type as specified and indicated.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

G. Telephone Jack: Four pin modular jack, Type RJ-11.

2.03 Wall Plates

A. Decorative Cover Plate: Smooth stainless steel.

1. General Electric.
2. Hubbell.

B. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.

1. General Electric.
2. Hubbell.

PART 3 - EXECUTION

3.01 Examination

A. Verify outlet boxes are installed at proper height.

B. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 Installation

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install receptacles with grounding pole on top.

E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

F. Connect wiring devices by wrapping conductor around screw terminal.

G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, and on surface mounted outlets.

3.03 Interface With Other Products

A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights indicated on Drawings.

3.04 Field Quality Control

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Verify that each telephone jack is properly connected and circuit is operational.

3.05 Adjusting

A. Adjust devices and wall plates to be flush and level.

-- END OF SECTION 16141 --

SECTION 16170

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 Section Includes

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.02 Related Sections

A. Section 03200 - Concrete Reinforcement.

B. Section 03400 - Pre-Cast Concrete.

C. Section 16670 - Lightning Protection System.

1.03 References

A. ANSI/NFPA 70 - National Electrical Code.

1.04 Grounding Electrode System

A. Metal frame of the building.

B. Rod electrode.

1.05 Performance Requirements

A. Grounding System Resistance: 5 ohms.

1.06 Submittals

A. Submit under provisions of Section 01300.

B. Product Data: Provide data for grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

1.07 Project Record Documents

A. Accurately record actual locations of grounding electrodes.

1.08 Qualifications

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.09 Regulatory Requirements

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 Rod Electrode

A. Manufacturer:

1. Blackburn or equal.

B. Material: Copper-clad steel.

C. Diameter: 3/4 inch.

D. Length: 10 feet.

2.02 Exothermic Connections

A. Manufacturer:

1. Cadweld or equal.

2.03 Wire

A. Material: Stranded copper.

B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 - EXECUTION

3.01 Examination

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 Installation

A. Install products in accordance with manufacturer's instructions.

B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground. Use three-point test procedure per IEEE STD 142, latest edition.

C. Provide grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

D. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.

E. Bond together metal siding not attached to grounded structure; bond to ground.

F. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.03 Interface With Other Products

A. Interface with lightning protection system installed under Section 16670.

3.04 Field Quality Control

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall- of-potential method.

-- END OF SECTION 16170 --

SECTION 16190

SUPPORTING DEVICES

PART 1 - GENERAL

1.01 Section Includes

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.02 References

A. NECA - National Electrical Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.03 Submittals

A. Submit under provisions of Section 01300.

B. Product Data: Provide manufacturer's catalog data for fastening systems.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.04 Regulatory Requirements

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 Product Requirements

A. Materials and Finishes: Provide adequate corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

C. Anchors and Fasteners:

1. Concrete Structural Elements: Use expansion anchors.

2. Steel Structural Elements: Use beam clamps, spring steel clips.

3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.

2.02 Steel Channel

A. Manufacturers:

1. Midland Ross.

2. B-Line or approved equal.

B. Description: Galvanized steel.

PART 3 - EXECUTION

3.01 Installation

A. Install products in accordance with manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Do not drill or cut structural members.

E. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

F. Install surface-mounted cabinets and panelboards with minimum of four anchors.

G. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.

-- END OF SECTION 16190 --

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 Section Includes

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

1.02 References

A. ANSI/NFPA 70 - National Electrical Code.

1.03 Submittals

A. Submit under provisions of Section 01300.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.04 Regulatory Requirements

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 Nameplates

A. Nameplates: Engraved three-layer laminated plastic, white letters on black background.

B. Locations:

1. Each electrical distribution and control equipment enclosure.
2. Communication cabinets.
3. Motor Control Center.

C. Letter Size:

1. Use 1/4 inch letters for identifying individual equipment and loads.
2. Use 1/4 inch letters for identifying grouped equipment and loads.

2.02 Wire Markers

A. Manufacturers:

1. Burndy.
2. Panduit or equal.

B. Description: Tape, split sleeve, or tubing type wire markers.

C. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

D. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2. Control Circuits: Control wire number indicated on shop drawings.

2.03 Underground Warning Tape

A. Manufacturers:

1. Panduit.

2. 3M.

B. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.01 Preparation

A. Degrease and clean surfaces to receive nameplates.

3.02 Application

A. Install nameplate parallel to equipment lines.

B. Secure nameplate to equipment front using stainless steel screws.

C. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

-- END OF SECTION 16195 --

SECTION 16401

UTILITY SERVICES

PART 1 - GENERAL

1.01 Description

A. Scope: CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install the electric service and associated equipment at the treatment plant.

1. In general, the following work shall be performed by CONTRACTOR.
    a. Furnish and install metering/riser pole and pole mounted isolation cable terminators.
    b. Furnish and install plant grounding system and associated grounding.
    c. Furnish and install distribution poles only.
    d. Furnish and install telephone system.
2. In general, the following work shall be performed by Niagara Mohawk Power Corporation (NMPC).
    a. Furnish and install take-off pole.
    b. Furnish and install span of overhead conductors from the take-off pole to the metering/riser pole, including the primary dead end insulators.
    c. Furnish and install metering transformers, meters, enclosure and all associated metering equipment.
3. All work regarding the construction of the distribution poles, metering/riser pole and grounding system shall be in accordance with the NMPC standard details included at the end of this section. All appurtenances required for the proper construction of the pole, grounding and other items shown on the NMPC details shall be furnished and installed by the CONTRACTOR, unless indicated otherwise.

B. Coordination:

1. CONTRACTOR shall coordinate with NMPC with regard to the electric service connections and requirements. It shall be the responsibility of the Contractor to make all necessary arrangements with NMPC.
2. The CONTRACTOR shall include in his bid all costs associated with providing the electric service to the treatment plant.

C. Related Section:

1. Section 16450, Grounding Systems.
2. Section 16740, Telephone Service Entrances.

1.02 Quality Assurance

A. Work in connection with the electric services shall be done in strict conformance with the requirements of NMPC.

B. Source Quality Control

1. All product related to the electric service specified under this section shall be approved by NMPC prior to purchase.

2. All materials and equipment specified with the applicable provisions and recommendations of the latest edition of the following except where otherwise shown or specified:

C. Reference Standards: Comply with the applicable provisions and recommendations of the latest edition of the following except where otherwise shown or specified:

1. National Electrical Code (NEC).

2. National Electrical Safety Code (NESC).

3. American Wood Preserver's Association (AWPA).

4. American National Standards Institute (ANSI).

5. American Society for Testing and Materials (ASTM).

1.03 Submittals

A. Shop Drawings: Submit for approval the following:

1. Manufacturer's catalog cuts and technical information indicating compliance with this Specification. Any exceptions shall be stated and completely explained.

PART 2 - PRODUCTS

2.01 Materials

A. Distribution Poles, Metering/Riser Pole, and Miscellaneous Equipment:

1. General: All construction related to the pole and miscellaneous equipment shall conform to NESC Grade C. Insulation levels shall be in accordance with 15 KV class minimum.

2. Pole: Pole shall be southern yellow pine and full length pentachlorophenol, CCA, or creosote treated in accordance with the AWPA, Section C4.

3. Framing: Pole shall be framed with 3 inch by 4 inch by 8 foot crossarms of southern yellow pine or douglas fir. Crossarms shall be braced with 1 inch by 1-3/4 inch wood braces. Crossarms and braces shall be pressure treated with pentachlorophenol.

4. Line Conductors and Connectors: Furnished and installed by NMPC.

5. Anchor Systems: Guy wire shall be hot dipped galvanized 3/8 inch extra high strength steel with Class B coating. All guy hardware shall have a 15,000 pound rating minimum. Anchors shall be either crossplate or screw type. Anchors shall be galvanized in accordance with ANSI C135.2. Crossplate anchors shall have a cross section of 200 square inches minimum with 3/4 inch by 8 foot rod. Screw anchors shall be a 8 inch diameter helix, 7000 foot pound rated with a 3/4 inch by 7 foot rod.

PART 3 - EXECUTION

3.01 Installation

A. Install equipment in accordance with the requirements of Niagara Mohawk Power Corporation and in conformance with the National Electric Code and the National Electrical Safety Code.

B. Install all equipment in accordance with the specific recommendations of the manufacturer.

-- END OF SECTION 16401 --

SECTION 16461

DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 Section Includes

A. Dry type two winding transformers.

1.02 Related Sections

A. Section 16111 - Conduit: Flexible conduit connections.

B. Section 16170 - Grounding and Bonding.

C. Section 16190 - Supporting Devices.

1.03 References

A. NEMA ST 1 - Specialty Transformers

B. NEMA ST 20 - Dry Type Transformers for General Applications.

C. NFPA 70 - National Electrical Code.

1.04 Submittals

A. Submit under provisions of Section 01300.

B. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

C. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

E. Manufacturer's Certificates: Certify that Products meet or exceed specified requirements.

1.05 Quality Assurance

A. Perform Work in accordance with NECA Standard of Installation.

1.06 Qualifications

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.07 Regulatory Requirements

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.08 Delivery, Storage, and Handling

A. Store, protect, and handle products to site under provisions of Section 01600.

B. Accept transformers on site. Inspect for damage.

PART 2 - PRODUCTS

2.01 Two-Winding Transformers

A. Manufacturers:

1. Acme Transformer.
2. General Electric.
3. Square D.
4. Substitutions: Under provisions of Section 01600.

B. Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, ratings as indicated.

C. Insulation system and average winding temperature rise for rated KVA as follows:

1. 1-15 KVA: Class 180 with 110 degrees C rise.
2. 16-500 KVA: Class 220 with 150 degrees C rise.

D. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point.

E. Winding Taps:

1. Transformers Less than 15 KVA: Four 2 1/2 percent below normal voltage, full capacity taps; two 2 1/2 percent above normal, full capacity taps.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Mounting: Suitable for wall, floor, or trapeze mounting.

H. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

PART 3 - EXECUTION

3.01 Examination

A. Verify that surfaces are suitable for installing transformer supports.

3.02 Installation

A. Install Products in accordance with manufacturer's instructions.

B. Set transformer plumb and level.

C. Use flexible conduit, under the provisions of Section 16111, 2 ft minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

D. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

E. Provide grounding and bonding in accordance with Section 16170.

– END OF SECTION 16461 –

SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.01 Section Includes

A. Distribution panelboards.

B. Branch circuit panelboards.

1.02 Related Sections

A. Section 16190 - Supporting Devices.

B. Section 16195 - Electrical Identification: Engraved nameplates.

1.03 References

A. NECA (National Electrical Contractors Association) "Standard of Installation."

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

D. NEMA KS 1 - Enclosed Switches.

E. NEMA PB 1 - Panelboards.

F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

G. NFPA 70 - National Electrical Code.

1.04 Submittals

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampere capacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 Quality Assurance

A. Perform Work in accordance with NECA Standard of Installation.

1.06 Qualifications

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 Regulatory Requirements

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.08 Field Measurements

A. Verify that field measurements are as indicated on shop drawings.

PART 2 - PRODUCTS

2.01 Manufacturers

A. General Electric.

B. Square D.

C. Westinghouse

D. Substitutions: Under provisions of Section 01600.

2.02 Distribution Panelboards

A. Panelboards: NEMA PB 1, circuit breaker type.

B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

C. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 18,000 amperes rms symmetrical for 480 volt panelboards, or as indicated.

D. Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

E. Enclosure: NEMA PB 1, Type 1.

PART 3 - EXECUTION

3.01 Installation

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb. Provide supports in accordance with Section 16190.

C. Height: 6 ft to top of panelboard.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 16195.

3.02 Field Quality Control

A. Field observation and testing will be performed under provisions of Section 01400.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

– END OF SECTION 16470 –

SECTION 16480

MOTOR CONTROL

PART 1 - GENERAL

1.01 Work Included

A. Manual motor starters.

B. Magnetic motor starters.

C. Combination magnetic motor starters.

D. Motor control centers.

1.02 Related Sections

A. Section 16190 - Supporting Devices: Housekeeping pads.

1.03 References

A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

B. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.

C. FS W-P-115 - Power Distribution Panel.

D. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.

E. NEMA AB 1 - Molded Case Circuit Breakers.

F. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

G. NEMA KS 1 - Enclosed Switches.

H. NEMA PB 1 - Panelboards.

I. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.04 Submittals

A. Submit shop drawings and product data under provisions of Section 01300.

B. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

C. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

D. Submit manufacturers' instructions under provisions of Section 01300.

1.05 Operation and Maintenance Data

A. Submit operation and maintenance data under provisions of Section 01110.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.06 Delivery, Storage, and Handling

A. Deliver products to site under provisions of Section 01600.

B. Deliver in 60 inch maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.

C. Store and protect products under provisions of Section 01600.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 Acceptable Manufacturers - Motor Starters

A. General Electric.

B. Square D.

C. Westinghouse.

D. Substitutions: Under provisions of Section 01600.

2.02 Manual Motor Starters

A. Manual Motor Starter: NEMA ICS 2; size M-1, 2 or 3 pole, AC general-purpose Class A manually operated non-reversing full-voltage controller for induction motors rated in horsepower, with overload relay, low voltage protection, red and green pilot light, NO and NC auxiliary contact, and push button operator.

B. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, 1 or 2 pole, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red and green pilot light, and toggle operator.

C. Enclosure: ANSI/NEMA ICS 6; Type 1.

2.03 Magnetic Motor Starters

A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

B. Full Voltage Starting: Non-reversing type.

C. Coil Operating Voltage: 120 volts, 60 Hertz.

D. Size: NEMA ICS 2; size as shown on Drawings.

E. Overload Relay: NEMA ICS 2; bimetal.

F. Enclosure: NEMA ICS 6; Type 1.

G. Combination Motor Starters: Combine motor starters with molded case circuit breaker or motor circuit protector disconnect in common enclosure.

H. Auxiliary Contacts: NEMA ICS 2; two normally open field convertible contacts in addition to seal-in contact.

I. Pushbuttons: NEMA ICS 2; START/STOP in front cover.

J. Indicating Lights: NEMA ICS 2; RUN: red and OFF: green in front cover.

K. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.

L. Relays: NEMA ICS 2.

M. Control Power Transformers: 120 volt secondary, 1,000 VA minimum, in each motor starter.

2.04 Controller Overcurrent Protection and Disconnecting Means

A. Molded Case Thermal-Magnetic Circuit Breakers: NEMA AB 1; circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

B. Motor Circuit Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.

2.05 Acceptable Manufacturers - Motor Control Center

A. General Electric.

B. Square D.

C. Westinghouse.

D. Substitutions: Under provisions of Section 01600.

2.06 Motor Control Center

A. Motor Control Centers: NEMA ICS 2; Class II, Type B.

B. Main Overcurrent Protection: Molded case circuit breaker.

C. Motor Starters: As scheduled.

D. Feeder Tap Units: Molded case thermal-magnetic circuit breakers.

E. Voltage Rating: 480 volts, three phase, four wire, 60 Hertz.

F. Horizontal Bussing: Copper, with a continuous current rating of 600 amperes. Include copper ground bus entire length of control center.

G. Vertical Bussing: NEMA ICS 2; copper.

H. Integrated Equipment Short Circuit Rating: 42,000 amperes rms symmetrical at 480 volts.

I. Configuration: Units front mounting only, accessible from the front only.

J. Enclosure: ANSI/NEMA ICS 6; Type 1, non-walk- in.

K. Finish: Manufacturer's standard gray enamel.

L. Provide phase loss protection relay with contacts to de-energize each motor starter in control center.

2.07 Acceptable Manufacturers - Motor Starter Panelboard

A. General Electric.

B. Square D.

C. Westinghouse.

D. Substitutions: Under provisions of Section 01600.

PART 3 - EXECUTION

3.01 Installation

A. Install motor control equipment in accordance with manufacturer's instructions.

B. Select and install heater elements in motor starters to match installed motor characteristics.

C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

-- END OF SECTION 16480 --

SECTION 16495

TRANSFER SWITCHES

PART 1 - GENERAL

1.01 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections and Section 16620, Packaged Engine Generator Systems apply to this Section.

1.02 Summary

A. This Section includes automatic transfer switches (ATS). The ATS and packaged generator system shall be the responsibility of a single manufacturer.

1.03 Submittals

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Shop drawings or published product data for each transfer switch, including dimensioned plans, sections, and elevations showing minimum clearances; conductor entry provisions; gutter space; installed features and devices; and materials lists.

C. Wiring diagrams, elementary or schematic, differentiating between manufacturer-installed and field-installed wiring.

D. Single-line diagrams of transfer switch units showing connections between automatic transfer switch, power source, and load, plus interlocking provisions.

E. Operation and maintenance data for each type of product, for inclusion in Operating and Maintenance Manual specified in Division 1. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay setting and calibration instructions.

F. Manufacturer's certificate of compliance to the referenced standards and tested short-circuit closing and withstand ratings applicable to the protective devices and current ratings used in this Project, as indicated and as specified in paragraph "Tested Fault Current Ratings."

1.04 Quality Assurance

A. Manufacturer's Qualifications: Firms are experienced in manufacturing equipment of the types and capacities indicated and have a record of successful in-service performance.

B. Comply with NFPA 70, "National Electrical Code," for components and installation.

C. Comply with NFPA 110, "Standard for Emergency and Standby Power Systems."

D. UL Listing and Labeling: Items furnished under this Section are listed and labeled by UL for emergency service under UL Standard 1008.

E. Comply with NEMA ICS 1, "General Standards for Industrial Control", ICS 2, "Industrial Control Devices, Controllers and Assemblies", and ICS 6, "Enclosures for Industrial Controls and Systems".

PART 2 - PRODUCTS

2.01 Transfer Switch Products, General

A. Number of Poles and Current and Voltage Ratings: three poles, 250 amp, 480/277 volt.

B. Tested Fault-Current Ratings: Closing and withstand ratings exceed the indicated available rms symmetrical fault current at the equipment terminals based on testing according to UL Standard 1008, conducted at full-rated system voltage and 20 percent power factor. Rate each product for withstand duration time as follows when tested for rated short-circuit current correlated with the actual type of circuit protective device indicated for transfer switches for this Project:

1. Molded-Case Circuit Breakers, 150 Amperes or Smaller: 1.5 closing and withstand duration cycles.

C. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of zero deg F to 120 deg F.

D. Resistance to Damage by Voltage Transients: Components meet or exceed voltage surge withstand capability requirements when tested according to ANSI C37.90.1, IEEE Guide for Surge Withstand Capability (SWC) Tests. Components meet or exceed voltage impulse withstand test of NEMA ICS 1.

E. Neutral Terminal: Provide fully rated, solid, unswitched neutral terminal.

F. Enclosures: General-purpose NEMA 1, conforming to UL Standard 508, "Electric Industrial Control Equipment," except as otherwise indicated.

G. Factory Wiring: Train and bundle factory wiring and identify consistently with shop drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.

1. Designated terminals accommodate field wiring.

2. Power Terminals Arrangement and Field Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.

3. Terminals: Pressure-type, suitable for copper or aluminum conductors of sizes indicated.

4. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

H. Electrical Operation: Where indicated, accomplish by a nonfused, momentarily energized solenoid or electric motor-operated mechanism, mechanically and electrically interlocked in both directions. Switches using components of molded-case circuit breakers or contactors not designed for continuous-duty, repetitive switching between active power sources are not acceptable.

I. Switch Action: Mechanically held in both directions for double-throw switches.

J. Switch Contacts: Use silver composition for switching load current.

K. Overcurrent devices are not part of switch products.

2.02 Remote Annunciation System

A. Provide an alarm signal to the telephone dialer. Signal shall only be activated upon a loss of both utility and generator power that exceeds 60 seconds.

2.03 Automatic Transfer Switches (ATSs)

A. Comply with NFPA 110, "Standard for Emergency and Standby Power Systems."

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning except as indicated.

2.04 Automatic Transfer Switch Features

A. Voltage sensing for each phase of normal source. Pick-up voltage is adjustable from 85 percent to 100 percent nominal, and drop-out voltage is adjustable from 75 percent to 98 percent pick-up value. Factory set for pick-up at 90 percent and drop-out at 85 percent.

B. Time-delay override of normal source voltage-sensing delays transfer and engine start signals. Adjustable 0 to 6 seconds, and factory set at 1 second.

C. Voltage/Frequency Lockout Relay: Prevent premature transfer. Voltage pick-up is adjustable from 85 percent to 100 percent nominal. Factory set to pick-up at 90 percent. Pick-up frequency is adjustable from 90 percent to 100 percent nominal. Factory set to pick-up at 95 percent.

D. Retransfer Time Delay: Adjustable from 0 to 30 minutes and factory set at 10 minutes. Provides automatic defeat of the delay upon loss of voltage or sustained undervoltage of the emergency source, provided the normal supply has been restored.

E. Test Switch: Simulates normal source failure.

F. Switch-Position Pilot Lights: Indicate source to which the load is connected.

G. Source-Available Indicating Lights: Supervise sources via the transfer switch normal and emergency source-sensing circuits.

1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

H. Unassigned Auxiliary Contacts: Two normally open SPDT contacts for each switch position.

1. Rating: 10 amperes at 240 V a.c.

I. Transfer Override Switch: Overrides automatic retransfer control so the ATS will remain connected to the emergency power source regardless of the condition of the normal source. A pilot light indicates the override status.

J. Engine Starting Contacts: One isolated normally closed and 1 isolated normally open. Contacts are gold flashed or gold plated and rated 10 amperes at 32 V d.c. minimum.

K. Engine Shut-Down Contacts: Time delay adjustable from 0 to 5 minutes; factory set at 5 minutes.

L. Large Motor Loads. Include a factory installed and factory wired in-phase monitor relay. The relay controls transfer so it occurs when the two sources are synchronized in phase. The relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees and only if transfer can be completed within 60 electrical degrees. In-phase transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

M. Engine-Generator Exerciser: Solid-state programmable time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiate exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 60 minutes. Factory-set periods are for 30 days and 60 minutes, respectively. Exerciser features include:

1. Exerciser transfer selector switch, which permits selection between exercise with and without load transfer.

2. Push button programming controls with digital display of settings.

3. Integral battery operation of time switch when normal control power is not available.

N. Meters: Provide an AC kilowatt meter voltmeter, ammeter, and frequency meter, analog or digital, 2% accuracy. Provide a phase selector switch to read line to line voltage and line current of all phases of both power sources. See Section 16620 for DC meters.

2.05 Finishes

A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

2.06 Source Quality Control

A. Factory test components, assembled switches, and associated equipment to ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for conformance with specified requirements. Perform dielectric strength test conforming to NEMA ICS 1.

PART 3 - EXECUTION

3.01 Installation

A. Mount Level. Anchor ATS to either the wall structural components or to the floor using manufacturer's recommended hardware.

3.02 Connections

A. Tighten factory-made connections, including connectors, terminals, bus joints, mountings, and grounding. Tighten field-connected connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values. When manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and 486B.

3.03 Grounding

A. Make equipment grounding connections for transfer switch units as indicated and as required by the National Electrical Code.

3.04 Field Quality Control

A. Preliminary Tests: Perform electrical tests as recommended by the manufacturer.

B. Field Tests: Give 7-day advance notice of the tests and perform tests in presence of owner's representative.

C. Coordinate tests with tests of generator plant and run them concurrently.

D. Tests: As recommended by the manufacturer and as follows:

1. Operational Tests: Demonstrate interlock, sequence, and operational function for each switch at least 3 times.

   a. Simulate power failures of normal source to ATSs and of emergency source with normal source available.

   b. Simulate low phase-to-ground voltage for each phase of normal source of ATSs.

   c. Verify time-delay settings and pick-up and drop-out voltages.

E. Test Failures: Correct deficiencies identified by tests and prepare for retest. Verify that equipment meets the specified requirements.

F. Reports: Maintain a written record of observations and tests. Report defective materials and workmanship and retest corrected items. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.05 Demonstration

A. Training: Furnish the services of a factory-authorized service representative to instruct Owner's personnel in the operation, maintenance, and adjustment of transfer switches and related equipment. Provide a minimum of 4 hours of instruction scheduled 7 days in advance.

-- END OF SECTION 16495 --

SECTION 16510

INTERIOR AND EXTERIOR LUMINAIRES

PART 1 - GENERAL

1.01 Section Includes

A. Interior luminaires and accessories.

B. Exterior luminaires and accessories.

C. Emergency lighting units.

D. Ballasts.

E. Lamps.

F. Luminaire accessories.

1.02 Related Sections

A. Section 16130 - Boxes.

1.03 References

A. ANSI C78.379 - Electric Lamps - Incandescent and High- Intensity Discharge Reflector Lamps - Classification of Beam Patterns.

B. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.

C. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).

D. ANSI/NFPA 70 - National Electrical Code.

E. ANSI/NFPA 101 - Life Safety Code.

F. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.04 Submittals

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 Project Record Documents

A. Submit under provisions of Section 01055.

B. Accurately record actual locations of each luminaire.

1.06 Qualifications

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.07 Regulatory Requirements

A. Conform to requirements of ANSI/NFPA 70.

B. Conform to requirements of NFPA 101.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 Luminaires

A. Furnish products as specified in schedule on Drawings.

B. Substitutions: Under provisions of Section 01600.

C. Install ballasts, lamps, and specified accessories at factory.

PART 3 - EXECUTION

3.01 Installation

A. Install in accordance with manufacturers instructions.

B. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

C. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

D. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.

E. Install wall mounted luminaires, at height as indicated on Drawings.

F. Install accessories furnished with each luminaire.

G. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Install specified lamps in each luminaire.

3.02 Field Quality Control

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.03 Cleaning

A. Clean Work under provisions of Section 01700.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.04 Demonstration

A. Provide systems demonstration under provisions of Section 01700.

-- END OF SECTION 16510 --

SECTION 16620

PACKAGED ENGINE GENERATOR SYSTEMS

PART 1 - GENERAL

1.01 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 Summary

A. This Section includes a packaged diesel engine generator system including engine generator set, cooling system, fuel system, combustion air intake and engine exhaust systems, starting system, and the following additional features:

1. Weatherproof housing.
2. Sub-base fuel tank.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 16 Section "Transfer Switches" for transfer switches, including sensors and relays, to initiate automatic starting and stopping signals for engine generator set.
2. The packaged generator system and automatic transfer switch shall be the responsibility of a single manufacturer.

1.03 Definitions

A. Emergency or Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage, with capability for a minimum overload of 10 percent of the rating for 2 continuous hours out of 24 continuous operating hours.

B. Operational Bandwidth: The total variation from the lowest to the highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

C. Power Output Rating: Gross electrical power output of generator set minus total power requirements of electric motor-driven accessories normally constituting part of the engine assembly.

D. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hz or cycles per second.

1.04 System Description

A. System Includes: Standby-rated, automatically started diesel engine coupled to an a.c. generator unit. Engine and generator are factory-mounted and -aligned on a structural steel skid. Subsystems and auxiliary components and equipment are as indicated.

B. Functional Description: When the mode selector switch on the control and monitoring panel is in the "automatic" position, remote control contacts in the separate automatic transfer switch initiates the starting and stopping of the generator set. When the mode selector switch is placed in the "on" position, the generator set starts manually. The "off" position of the same switch initiates shutdown of the generator set. When the unit is running, specified system or equipment failures or derangements automatically shut the unit down and initiate alarms. Operation of a remote emergency stop switch also shuts down the unit. Automatic transfer switches are specified in another Section of these Specifications.

1.05 Submittals

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for products specified in this Section. Include data on features, components, ratings, and performance. Include dimensioned outline plan and elevation drawings of engine generator set and other system components.

C. Maintenance data for system and components for inclusion in Operating and Maintenance Manual specified in Division 1. Include the following:

1. Lists: Tools, test equipment, spare parts, and replacement items recommended to be stored at the site for ready access. Include part and drawing numbers, current unit prices, and source of supply.

2. Detailed Operating Instructions: Cover operation under both normal and abnormal conditions.

D. Shop Drawings: Detail fabrication, piping, wiring, and installation of the field-installed portions of the system. Include general arrangement drawings showing locations of auxiliary components in relation to the engine generator set and duct, piping, and wiring connections between the generator set and the auxiliary equipment. Show connections, mounting, and support provisions and access and working space requirements.

E. Wiring Diagrams for System: Show power and control connections and distinguish between factory-installed and field-installed wiring.

F. Qualification Data for Manufacturer: Include capabilities and experience data required to demonstrate qualifications specified in Quality Assurance Article. Include list of completed projects with project names and addresses and names of Engineers and Owners, plus other information specified. Include separate data for each of the following items:

1. Engine Generator System.

2. Engine Generator Set.

G. Exhaust Emissions Test Report.

H. Certification of Torsional Vibration Compatibility: Conform to NFPA 110.

I. Factory Test Reports: For units to be shipped for this Project showing evidence of compliance with specified requirements.

J. Field Test Report: Record of tests specified in Part 3.

1.06 Quality Assurance

A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of the types and capacities indicated that have a record of successful in-service performance.

B. Comply with NFPA 70, "National Electrical Code."

C. Comply with NFPA 110, "Standard for Emergency and Standby Power Systems," for requirements for a Level 2 emergency power supply system.

D. Engine Exhaust Emissions: Comply with applicable Federal, State, and local government requirements.

E. Single-Source Responsibility: Obtain engine generator system components from a single manufacturer with responsibility for entire system. Unit shall be a representative product built from components that have proven compatibility and reliability and are coordinated to operate as a unit as evidenced by records of prototype testing.

1.07 Delivery, Storage, And Handling

A. Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards.

1.08 Extra Materials

A. Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, and identified with labels describing contents. Deliver extra materials to the Owner.

QUANTITIES INDICATED IN THE FOLLOWING ARE EXAMPLES.

1. Fuses: 1 for every 10 of each type and rating, but not less than 1 of each.
2. Pilot Lights: 2 for every 6 of each type used, but not less than 2 of each.
3. Filters: 1 set each of lubricating oil, fuel, and combustion air filters.

PART 2 - PRODUCTS

2.01 System Service Conditions

A. Environmental Conditions: Engine generator system withstands the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 30 deg F to plus 104 deg F.
2. Altitude: Sea level to 1000 feet (300 m).

2.02 Engine Generator System

A. General: System is a coordinated assembly of compatible components.

B. Ratings: Voltage, frequency, and power output ratings of the system are 480/277V, 60 Hz, 125 KW at 0.8 power factor.

C. Output Connections: 3 phase, 4 wire.

D. Safety Standard: Comply with ASME B15.1, "Safety Standard for Mechanical Power Transmission Apparatus."

E. Nameplates: Each major system component is equipped with a conspicuous nameplate of the component manufacturer. Nameplate identifies manufacturer of origin and address, and the model and serial number of the item.

2.03 System Performance

A. Steady-State Voltage Operational Bandwidth: 4 percent of rated output voltage from no load to full load.

B. Steady-State Voltage Modulation: Less than 1 Hz.

C. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within 2 seconds.

D. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.

E. Steady-State Frequency Stability: When the system is operating at any constant load within the rated load, there are no random speed variations outside the steady-state operational band and no regular or cyclical hunting or surging of speed.

F. Transient Frequency Performance: Less than 3 Hz variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within 3 seconds.

G. Output Waveform: At no load, the harmonic content measured line-to-line or line-to-neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor determined according to NEMA MG1, "Motors and Generators," does not exceed 50.

H. Sustained Short-Circuit Current: For a 3-phase bolted short circuit at the system output terminals, the system will supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.

I. Temperature Rise of Generator: Within acceptable limits for insulation systems used according to NEMA MG1 when operating continuously at standby rating conditions, including 2 hours per 24 hours at 110 percent of rated capacity.

J. Nonlinear Load Performance: System performance is not degraded from that specified in this Article by continuous operation, with the load current having a minimum total harmonic content of 15 percent rms, and minimum single harmonic content of 10 percent rms.

K. Starting Time: Maximum total time period for a cold start, with ambient temperature at the low end of the specified range, is 5 seconds. Time period includes output voltage and frequency settlement within specified steady-state bands.

L. Step Load. The diesel generator set shall be capable of picking up 100% nameplate KW in one step with the engine generator set at operating temperature per NFPA Standard 110.

M. Motor KVA. Motor starting KVA shall be 100, based on a sustained RMS voltage drop of no more than 10% of no load voltage with the specified load KVA at near zero power factor applied to the engine-generated sets.

2.04 Engine Generator Set

A. Power Output Rating: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.

B. Skid: Adequate strength and rigidity to maintain alignment of the mounted components without dependence on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.

2.05 Engine

A. Comply with NFPA 37, "Stationary Combustion Engines and Gas Turbines."

B. Fuel: Natural gas.

C. Maximum Speeds: Engine - 1800 rpm. Piston speed for 4-cycle engines - 2250 feet per minute.

D. Lubrication System: Pressurized by a positive displacement pump driven from the engine crankshaft. The following items are mounted on the engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 microns and smaller while passing full flow.

2. Oil Cooler: Maintains lubricating oil at the manufacturer's recommended optimum temperature throughout 2 hours of operation of the generator set at 110 percent of system power output rating.

3. Thermostatic Control Valve: Controls flow in the system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.

4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without the use of pumps or siphons or special tools or appliances. Drain shall be accessible with sub-base fuel tank installed.

E. Engine Fuel System: Comply with NFPA 30, "Flammable and Combustible Liquids." System includes:

1. Integral Injection Pumps: Driven by the engine camshaft. Pumps are adjustable for timing and cylinder pressure balancing.

2. Main Fuel Pump: Mounted on the engine. Pump ensures adequate primary fuel flow under starting and load conditions.

3. Parallel Fuel Oil Filters: Ahead of the injection pumps. Changeover valves allow independent use of either filter.

4. Relief/Bypass Valve: Automatically regulates pressure in the fuel line and returns excess fuel to the source.

F. Jacket Coolant Heater: Electric immersion type, factory-installed in the jacket coolant system. Unit is rated and thermostatically controlled to maintain an engine temperature of 75 deg F at the low end of the ambient temperature range specified under "Environmental Conditions" above.

G. Speed Governor: Adjustable isochronous type, with speed sensing.

2.06 Engine Cooling System

A. Description: Closed-loop, liquid-cooled, with radiator factory-mounted on engine generator set skid and integral engine-driven coolant pumping.

B. Radiator: Factory-piped and -rated for specified coolant.

C. Coolant: Solution of 50 percent ethylene glycol and 50 percent water.

D. Temperature Control: Self-contained thermostatic control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by the engine manufacturer. Features include:

1. Thermostatic Elements: Interchangeable and nonadjustable.

2. Actuator Design: Normally-open valves to return to open position when actuator fails.

E. Coolant Hose: Flexible assembly with nonporous rubber inside surface and aging, ultraviolet, and abrasion-resistant fabric outer covering.

1. Rating: 50 psi (345 kPa) maximum working pressure with 180 deg F (82 deg C) coolant, and noncollapsible under vacuum.

2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

2.07 Fuel Supply System

A. System complies with NFPA 30, "Flammable and Combustible Liquids Code," and NFPA 37, "Standard for Stationary Combustion Engines and Gas Turbines."

B. Fuel Piping: Provide manufacturer's standard piping for natural gas system.

2.08 Engine Exhaust System

A. Muffler: Residential-type, sized as recommended by the engine manufacturer. Measured sound level in the 20-75 Hz frequency band, according to the "DEMA Test Code for the Measurement of Sound from

Heavy-Duty Reciprocating Engines" at a distance of 10 feet from the exhaust discharge, is 95dB "A" or less.

B. Connections from Engine to Exhaust System: Flexible section of corrugated stainless steel pipe.

C. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liners.

D. Supports for Muffler and Exhaust Piping: Vibration isolating-type.

E. Thimbles for Exhaust Piping: Conform to NFPA 211, "Chimneys, Fireplaces, Vents, and Solid-Fuel Burning Appliances."

2.09 Combustion Air-Intake System

A. Air-Intake Silencer: Filter-type providing filtration as recommended by the engine manufacturer.

1. Mounting: Factory-installed on engine generator set at a location readily accessible for servicing.

2.10 Starting System

A. Description: 12 or 24 V electric, as recommended by the generator set manufacturer, with negative ground and including the following items:

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with the ambient temperature at the maximum specified in paragraph "Environmental Conditions."

2. Cranking Motor: Heavy-duty unit that automatically engages and releases from the engine flywheel without binding.

3. Cranking Cycle: As required by NFPA 110 for system level specified.

4. Battery complies with SAE J537, "Storage Batteries," and has adequate capacity within the ambient temperature range specified in paragraph "Environmental Conditions" to provide the specified cranking cycle series at least twice without recharging.

5. Battery Cable: Size as recommended by the generator set manufacturer for the cable length indicated. Include required interconnecting conductors and connection accessories.

6. Battery-Charging Alternator: Factory-mounted on engine with solid-state voltage-regulation and 35 ampere minimum continuous rating.

7. Battery Charger: Current limiting, automatic equalizing and float charging-type designed for operation from a 120 V 60 Hz supply source. Unit complies with UL 508, "Electrical Industrial Control Equipment," and includes the following features:

a. Operation: Equalizing charging rate of 10 amperes is initiated automatically after the battery has lost charge until an adjustable equalizing voltage is achieved at the battery terminals. The unit then automatically switches to a lower float-charging mode, and continues operating in that mode until the battery is discharged again.

b. Automatic Temperature Compensation: Adjusts the float and equalizes voltages for variations in the ambient temperature from minus 30 deg F to plus 104 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.

c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.

d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.

2.11 Control And Monitoring

A. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages are grouped in a common control and monitoring panel. Mounted on the generator set. Mounting method isolates the control panel from generator set vibration.

B. Indicating and Protective Devices, and Controls: Include those required by NFPA 110 for a Level 2 system plus the following.

1. A.C. Voltmeter.
2. A.C. Ammeter.
3. A.C. Frequency Meter.
4. D.C. Voltmeter (Alternator Battery Charging).
5. Engine Coolant Temperature Gage.
6. Engine-Lubricating Oil Pressure Gage.
7. Running Time Meter.
8. Ammeter/Voltmeter Phase Selector Switch or Switches.
9. Generator Voltage-Adjusting Rheostat.

C. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.

D. Connection to Data Link: A separate terminal block factory-wired to Form C dry contacts for each alarm and status indication is reserved for future connection for transmission of indications by data link to remote data terminals. Send a signal to the telephone dialer (specified in a different section) if any of these conditions occur: generator shutdown, low fuel level, leak in sub-base tank.

2.12 Generator, Exciter, And Voltage Regulator

A. Comply with NEMA MG 1, "Motors and Generators," and specified performance requirements.

B. Drive: Generator shaft is directly connected to the engine shaft. Exciter is rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Station Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Excitation uses no-slip or collector rings, or brushes, and is arranged to sustain generator output under short circuit conditions as specified.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state-type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent adjustment of output voltage operating band.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above the dew point.

2.13 Outdoor Generator Set Enclosure

A. Description: Weatherproof steel housing. Multiple panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one person without tools.

B. Fixed Louvers: At air inlet and discharge. Louvers prevent entry of rain and snow.

C. Automatic Dampers: At air inlet and discharge. Dampers are closed to reduce engine and battery heat loss in cold weather when unit is not operating.

D. Air Flow Through Housing: Adequate to maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at the top of the range specified under "System Service Conditions."

2.14 Finishes

A. Indoor Enclosures and Components: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

B. Outdoor Enclosures: Polyurethane enamel over corrosion-resistant pretreatment and manufacturer's compatible standard primer.

2.15 Source Quality Control

A. Project-Specific Equipment Tests: Test engine generator set and other system components and accessories prior to shipment. Test items individually and assembled and connected as a complete system at the factory in a manner equivalent to that required at the Project site. Record and report test data. Conform to SAE 8528, "Engine Power Test Code-Spark Ignition and Diesel," and the following:

1. Test Equipment: Use instruments calibrated within the previous 12 months and with accuracy directly traceable to the National Institute of Standards and Technology (NIST).
2. Hydrostatic Test: Perform on radiator, heat exchanger, and engine water jacket.
3. Generator Tests: Conform to IEEE 115, "Test Procedures for Synchronous Machines."
4. Complete System Continuous Operation Test: Includes nonstop operation for a minimum of 8 hours, including at least 1 hour each at 1/2, 3/4, and full load, and 2 hours at 110 percent of full load. If unit stops during the 8-hour test, repeat the complete test. Record the following minimum data at the start and end of each load run, at 15-minute intervals between those times, and at 15-minute intervals during the balance of the test:
    a. Fuel consumption.
    b. Exhaust temperature.
    c. Jacket water temperature.
    d. Lubricating oil temperature and pressure.
    e. Generator load current and voltage, each phase.
    f. Generator system gross and net output kW.
5. Complete System Performance Tests: Include the following to demonstrate conformance to specified performance requirements:
    a. Single-step load pickup.
    b. Transient and steady-state governing.
    c. Transient and steady-state voltage performance.
    d. Safety shutdown devices.

6. Observation of Test: Provide 2-week advance notice of tests and opportunity for observation of test by Owner's representatives.

7. Report test results within 10 days of completion of test.

PART 3 - EXECUTION

3.01 Installation

A. Exhaust Piping Installation: Conform to NFPA 211, "Chimneys, Fireplaces, Vents, and Solid-Fuel Burning Appliances." Use thimbles where indicated.

B. Maintain minimum working space around components according to manufacturer's shop drawings and NEC.

C. Manufacturer's Field Services: Arrange and pay for the services of a factory-authorized service representative to supervise the installing, connecting, testing, and adjusting of the unit.

3.02 Identification

A. Identify system components per the manufacturer's standard practice.

3.03 Field Quality Control

A. Supervised Adjusting and Pretesting: Under supervision of factory-authorized service representative, pretest all system functions, operations, and protective features. Provide all instruments and equipment required for tests. Adjust to ensure operation is according to Specifications. Load system using a variable resistive and reactive load bank simulating kW, and power factor of loads for which unit is rated.

B. Tests: Provide the services of a qualified testing agency to perform the tests listed below according to manufacturer's recommendations upon completion of installation of system. Use instruments bearing records of calibration within the last 12 months, traceable to NIST standards, and adequate for making positive observation of test results. Include the following tests:

1. Insulation Tests: Test generator windings using 500 V d.c. for units rated up to 250 volts. Verify minimum insulation resistance is 25 megaohms.

2. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.

3. Battery Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

5. Simulation of malfunctions to verify proper operation of local and remote protective, alarm, and monitoring devices.

6. Load Test: Use variable load bank capable of simulating kVA, kW, and power factor of load for which unit is rated. Run unit at 25, 50, and 75 percent of rated capacity for 30 minutes each, and at 100 percent for 3 hours. Make the 100-percent load run at 80 percent power factor. Record

voltage, frequency, load current, battery-charging current, power output, oil pressure, and coolant temperature periodically during the test.

7. Vibration Baseline Test: Measure amplitude for nominal frequency and for frequencies 5, 10, 15, and 20 percent above and below nominal at each main bearing cap. Vibration levels not exceeding those specified in NEMA MG1, "Motors and Generators," are acceptable.

8. Exhaust Emissions Test: Conform to applicable government test criteria.

9. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50-percent and 100-percent step-load increases and decreases and verify that performance is as specified.

10. Harmonic Content Tests: Measure harmonic content of input and output current under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

C. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.04 Cleaning

A. Upon completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.05 Demonstration

A. Training: Arrange and pay for the services of a factory-authorized service representative to demonstrate adjustment, operation, and maintenance of the system and to train Owner's personnel.

B. Conduct a minimum of 8 hours of training as specified under Instructions to Owner's Employees in the Project Closeout Section of these Specifications.

C. Schedule training with at least 7-day advance notice.

3.06 Commissioning

A. Battery Equalization: Equalize charging of battery cells according to manufacturer's instructions. Record individual cell voltages.

– END OF SECTION 16620 –

SECTION 16670

LIGHTNING PROTECTION SYSTEMS

PART 1 - GENERAL

1.01 Section Includes

A. Air terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

1.02 Products Installed But Not Furnished Under This Section

A. Section 16170 - Grounding and Bonding.

1.03 References

A. ANSI/NFPA 780 - Lightning Protection Code.

B. ANSI/UL 96 - Lightning Protection Components.

C. UL 96A - Installation Requirements for Lightning Protection Systems.

D. LPI - Lightning Protection Institute.

1.04 System Description

A. Lightning Protection System: ANSI/NFPA 780; Class I UL 96A; Master Labeled system protecting, consisting of air terminals on roofs, bonding of structure and other metal objects; grounding electrodes; and interconnecting conductors.

1.05 Submittals

A. Submit shop drawings and product data under provisions of Section 01300.

B. Submit shop drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

C. Submit product data showing dimensions and materials of each component, and include indication of listing in accordance with ANSI/UL 96.

D. Submit manufacturer's installation instructions under provisions of Section 01300.

1.06 Project Record Documents

A. Submit project record documents under provisions of Section 01700.

B. Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

1.07 Qualifications

A. Manufacturer: Company specializing in lightning protection equipment with minimum three years documented experience and member of the Lightning Protection Institute.

B. Installer: Authorized installer of manufacturer with minimum three years documented experience and member of the Lightning Protection Institute.

1.08 Sequencing and Scheduling

A. Coordinate the Work of this Section with roofing and exterior and interior finish installations.

PART 2 - PRODUCTS

2.01 Manufacturers

A. Independent Protection Co., Inc., 1605 S. Main St., Goshen, IN.

B. National Lightning Protection Corp., 11098 Jasper Rd., LaFayette, CO.

C. Harger Lightning Protection, Inc., 547 North Ave., Libertyville, IL.

D. Substitutions: Under provisions of Section 01600.

2.02 Materials

A. Components: All lightning protection materials shall comply in weight, size, and composition with the requirements of UL material Code 96 and NFPA code 780. All components shall be of copper and will comply with the requirements of UL and NFPA for height and type of building. Class I materials shall be used on structures not more than 75 feet in height. Copper materials shall not be mounted on aluminum surfaces or in locations where moisture could run off copper onto aluminum causing electrolytic corrosion of the dissimilar metals.

B. Air Terminals: Copper.

C. Grounding Rods: Copper-clad steel.

D. Conductors: Copper cable.

E. Connectors and Splicers: Bronze.

PART 3 - EXECUTION

3.01 Examination

A. Verify that surfaces are ready to receive work.

B. Verify that field measurements are as shown on shop drawings.

C. Beginning of installation means installer accepts existing conditions.

3.02 Protection of Surrounding Elements

A. Protect elements surrounding work of this Section from damage or disfiguration.

3.03 Installation

A. Air Terminals: Air terminals may be of copper and shall project a minimum of ten inches above the object to be protected. Air terminals shall be placed at intervals not exceeding 20 feet along ridges and around perimeters and not more than 24 inches from ridge ends, roof edges, or the outside corners of protected structures. On flat or gently sloping roofs, additional air terminals shall be located at intervals not exceeding 50 feet. Prominent non-metallic objects or metal objects having a thickness of less than 3/16" require the installation of air terminals and necessary conductors. Objects having a metal thickness 3/16" or greater shall be connected to the lightning protection system using main size conductor.

B. Conductors: Copper conductors of the size required by code shall interconnect all air terminals and provide a two-way path to the ground from each air terminal. Conductors shall maintain a horizontal and/or downward path to the ground and shall be free of excessive splices and sharp bends. No bend shall form an included angle of more than 90 degrees or have a radius of less than 8 inches. Down conductors shall be spaced at intervals averaging no more than 100 feet around the perimeter of the structure. A structure shall never have fewer than two down conductors.

C. Fasteners: Fasteners shall be placed on each run of exposed conductor at intervals not more than 3 feet. Concealed conductors shall be anchored as necessary to maintain permanent positioning.

D. Connections: All cable connectors shall be made with bolt-pressure or compression type connectors. All fasteners used in these connectors shall be made of stainless steel.

E. Bonding Metal Bodies: All metal bodies permanently affixed to a structure that are subject to a direct lightning strike shall be provided with two-way paths to the lightning protection system using full size conductor. All grounded metal bodies which are located within the bonding distance for the building shall be bonded to the system. The bonding distance shall be determined according to code requirements related to the lengths and number of the building's down leads.

F. Grounding: Each down lead shall terminate in a ground connection below finished grade. Ground terminations shall consist of 1/2" x 9' (minimum) copper-clad steel ground rods. The down conductor shall be connected to the ground rod using a bronze ground clamp having at least 1 1/2" of contact between the rod and the conductor. The rods shall be located between the rod and the conductor. The rods shall be located two feet below grade, two feet from the foundation, and extend a minimum of 10 feet vertically into the earth.

3.04 Field Quality Control

A. Field observation and testing will be performed under provisions of Section 01400.

B. Obtain the services of Underwriters Laboratories, Inc. to provide inspection and certification of the lightning protection system under provisions of UL 96A.

C. Obtain UL Master Label and attach to building at location directed by Owner.

-- END OF SECTION 16670 --

SECTION 16740

TELEPHONE SYSTEMS

PART 1 - GENERAL

1.01 Related Documents

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-16 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.02 Summary

A. Extent of telephone system work is hereby defined to include, but not by way of limitation, telephone wiring/cabling, control/signal transmission media, line drivers, terminals, telephone instruments (DIALER), and ancillary equipment.

B. Types of telephone systems required for project include the following:

1. Telephone Dialer.

C. Wires/cables, control/signal transmission media, raceways, electrical boxes and fittings, and cable trays, which are required in connection with the installation of telephone systems, are specified in other Division-16 sections.

1.03 Submittals

A. Product Data: Submit manufacturer's data on telephone systems and components.

B. Wiring Diagrams: Submit analog and digital data transmission wiring diagrams for telephone systems, including rack and terminal connections. Also show wiring connections to electrical power feeders. Differentiate between portions of wiring that are manufacturer-installed and portions that are field-installed.

1.04 Quality Assurance

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of telephone systems and ancillary equipment, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 2 years of successful installation experience with projects utilizing telephone systems and equipment similar to that required for this project.

C. Codes and Standards

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC, including 800-Series articles as applicable to installation, and construction of telephone systems.

1.05 Delivery, Storage, And Handling

A. Deliver telephone equipment and components in factory-fabricated containers or wrappings, which properly protect equipment from damage.

B. Store telephone equipment and components in original packaging. Store inside in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.

C. Handle telephone equipment and components carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.06 Sequencing And Scheduling

A. Installer shall notify local Bell operating company in writing of telephone interface connection requirements to ensure proper and timely interfacing of building telecommunication systems with the Bell operating company's systems.

PART 2 - PRODUCTS

2.01 Telephone Systems

A. General: Except as otherwise indicated, provide telephone systems with voice-quality lines, of types, styles, sizes and capacities indicated, which comply with manufacturer's standard design, materials, and components. Construct system in accordance with published product information, and as required for complete installation. Where types are not indicated, provide products complying with Rules of FCC, and established industry standards.

B. Telephone Dialer Operation: Telephone Dialer will be activated by open contact input from generator system, contacts to be rated for 10A, 250V. Upon receiving open contact, Telephone Dialer will dial emergency telephone number supplied by user. When call is connected, Telephone Dialer will play recorded message supplied by user. If call is not connected, Telephone Dialer will disconnect call and repeat dialing at five-minute intervals until call is connected.

C. Telephone Dialer Equipment: Telephone Dialer equipment will include the following:

1. NEMA 12 enclosure with provision for wall mounting.
2. Modular Telephone Plug (USOC No. RJ11C) with 20 foot cable for connection to telephone company service.
3. Contact input screw terminals rated for 15A/300V.
4. Keyboard entry and digital display of programmed telephone number.
5. Voice message recording capability with test button and speaker. One minute message duration.
6. Line power screw terminals for 120 VAC/60 Hz. Terminals to be Phoenix type UK 4 or equivalent.
7. Battery power provision to provide continuous operation for at least 1 hour without line power.
8. Modular Telephone Jack (USOC No. RJ11C) for connection of auxiliary telephone.

PART 3 - EXECUTION

3.01 Examination

A. Examine areas and conditions under which telephone systems are to be installed. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 Installation Of Telephone Systems

A. Install telephone systems in accordance with manufacturer's written instructions and with recognized industry practices; ensure systems comply with installation and operational requirements of EIA, NEC and the Federal Communications, Commission.

B. Interface building telephone system with the operating telephone company's network, after the installation work has been completed.

C. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the National Electrical Code.

3.03 Grounding

A. Provide equipment grounding connections for telephone systems as recommended by manufacturer. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.04 Adjusting And Cleaning

A. Clean telephone equipment and components of dirt and construction debris upon completion of installation.

B. Touch-up scratched or marred enclosure surfaces to match original finishes.

C. Protect installed equipment and components from damage during remainder of construction period.

3.05 Demonstration

A. Upon completion of installation of telephone systems, and after telephone wire circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with testing. Demonstrate to Owner that requirements for basic output signal levels, and values for attenuation and signal-to-noise ratios, have been achieved.

3.06 Personnel Training

A. Train Owner's personnel, as designated by Owner, in operation and maintenance of the telephone system. Provide minimum of 12 days of on-site in-service training by the manufacturer, or their representative.

-- END OF SECTION 16740 --

APPENDIX H - REMEDIAL ACTION WORK PLAN

REMEDIAL ACTION WORK PLAN

BUFFALO COLOR CORPORATION
AREA "D" SITE

Buffalo, New York **Site No. 9 -15-012**

SUBMITTED TO

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS
WASTE REMEDIATION

SUBMITTED BY

AlliedSignal

PREPARED BY

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(716) 633-7074 FAX (716) 633-7195
Buffalo, New York

PARSONS

FEBRUARY 1996
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REMEDIAL ACTION WORK PLAN

For:
BUFFALO COLOR CORPORATION
AREA "D" SITE
100 LEE STREET
BUFFALO, ERIE COUNTY, NEW YORK
(NYSDEC SITE NO. 9-15-012)

Submitted to:

THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

Submitted by:

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FEBRUARY 1996

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SECTION 1

INTRODUCTION

1.1 PURPOSE AND REQUIREMENTS

In accordance with requirements of the New York State Department of Environmental Conservation (NYSDEC) Order on Consent (Index No. B9-0014-84-01RD), AlliedSignal, Inc. is required to prepare a Remedial Action Work Plan (RAWP) which describes the anticipated remedial construction activities in accordance with the Record of Decision (ROD) issued for the site, and NYSDEC accepted remedial design plans and specifications. This Plan includes descriptions of the construction records and reports, site controls (security, erosion and sedimentation, dust), onsite earthmoving activities, construction equipment, monitoring systems, community relations, and schedule for implementation of the accepted remedial design. Included with this RAWP are the following documents:

- *Work Plans;*
- *Project Operation Plan;*
- *Remedial Action Health and Safety Plan* (Attachment 1);
- *Construction Quality Assurance Plan* (Attachment 2).

1.2 PROJECT BACKGROUND

The ROD presented the following Remedial Action (RA) objectives established by the NYSDEC:

- Prevent direct exposure to onsite soils so that the potential risk to human health through exposure is at an acceptable level.
- Prevent erosion of contaminated onsite surficial and shoreline soils and waste into the Buffalo River, thereby eliminating contaminant loading to the Buffalo River through mechanical erosion and eliminating a potential source of contaminants to the sediment.
- Limit the migration of contaminated groundwater and NAPL constituents from the site into the Buffalo River via subsurface groundwater.
- Limit the migration of contaminants to the groundwater.

The ROD identified the preferred remedy to address specific site conditions. The remedy included:

- Cutoff wall construction;
- Site cap construction;
- Shoreline stabilization;

- Non-aqueous phase liquid (NAPL) and groundwater collection;
- Groundwater treatment; and
- Long-term groundwater monitoring.

1.3 PROJECT OBJECTIVE AND SCOPE OF WORK

The objective of this project is to construct a remedial action which is cost effective, reduces mobility and potential pathways of contamination, and is constructed in a safe and efficient manner.

The RA construction activities for the Site include the following:

- consolidation of wastes;
- stabilization and habitat enhancements of the site shoreline along the Buffalo River;
- removal and consolidation of sediments located within site wetlands;
- installation of a slurry cutoff wall to limit migration of contaminants;
- installation of a flexible membrane liner (fml) cap over the consolidated wastes;
- installation of a 24-inch cover soil;
- installation of a 6-inch vegetated topsoil layer;
- installation and operation of groundwater and LNAPL extraction wells;
- onsite treatment of groundwater/LNAPL and subsequent discharge to the Buffalo River; and
- enactment of deed restrictions affecting future use of the properties.

1.4 ORGANIZATION OF THE WORK PLAN

This RAWP outlines the tasks to be conducted for the pre-construction and construction oversight activities for the remediation of the Site. The RAWP includes the following:

- The purpose and requirements, project objectives and scope of work, and a brief background are presented in this section (Section 1);
- A summary of historical activities, operations, and previous investigative results (Section 2);
- A description of the remedial action work plan including: construction of the cutoff wall extraction and conveyance systems, cover systems construction, consolidation of wastes, and erosion control measures (Section 3);
- Operations Plan including the Project Team, construction controls, and a proposed project schedule (Section 4); and
- A description of contract management activities and procedures (Section 5).

SECTION 2

SITE BACKGROUND AND DESCRIPTION

2.1 SITE LOCATION

Buffalo Color Corporation's (BCC) Area "D" is an inactive hazardous waste site located at 100 Lee Street in the City of Buffalo, Erie County, New York (see Figure 2.1). The site consists of a 19-acre peninsula surrounded on three sides by the Buffalo River and on the fourth side by a railroad yard and BCC's dye manufacturing facility.

Three waste management units were operated in Area "D"; iron sludge ponds, a metal sludge weathering area, and an incinerator area (see Figure 2.2). Two of the areas, the iron sludge ponds (Site Code 9-15-012A) and the metal sludge weathering area (Site Code 9-15-012B) are currently listed as Class 2 sites in the Registry of Inactive Hazardous Waste Disposal Site by the New York State Department of Environmental Conservation (NYSDEC). The site and immediate surrounding area are zoned for heavy industry. The nearest residential area is approximately 1,200 feet northwest of the site. The topography of the Area "D" site and the surrounding area is relatively flat. Surface run-off at the site is entirely to the Buffalo River.

2.2 HISTORY OF SITE OPERATIONS

2.2.1 Site Use

Area "D" was used from 1905 to 1974 as a chemical manufacturing, handling, and disposal site. From 1905 to 1920, acids, chemicals, and dye intermediates were produced by Contact Process Company and by National Aniline Chemical Company which merged into Allied Chemical and Dye Corporation in 1920. Phosgene gas was produced during 1917 to 1918 by National Aniline and Edgewood Arsenal. Allied Chemical and Dye Corporation manufactured petroleum-based detergents, dye intermediates, picric acid; and other chemicals at Area "D" during 1920 to 1974. During this period, a number of structures, railroad tracks, and tank parks were built at the site. All chemical manufacturing operations ceased in 1974 and chemical waste handling ceased in 1976 at Area "D".

In 1977, the property was sold to BCC and has remained idle since that time. All structures on the site were demolished to grade by Buffalo Color in 1984.

2.2.2 Area of Concern

The portions of the Area "D" which are of concern include:

1. The "Weathering Area" located at the tip of the peninsula which was utilized for the storage of metal oxide sludges for weathering before shipment to metal recyclers (1916-1976);

BUFFALO SE, N. Y.

SE/4 BUFFALO 15' QUADRANGLE

N4245—W7845/7.5

1965

QUADRANGLE LOCATION

FIGURE 2.1

BUFFALO COLOR AREA "D"

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SITE LOCATION MAP

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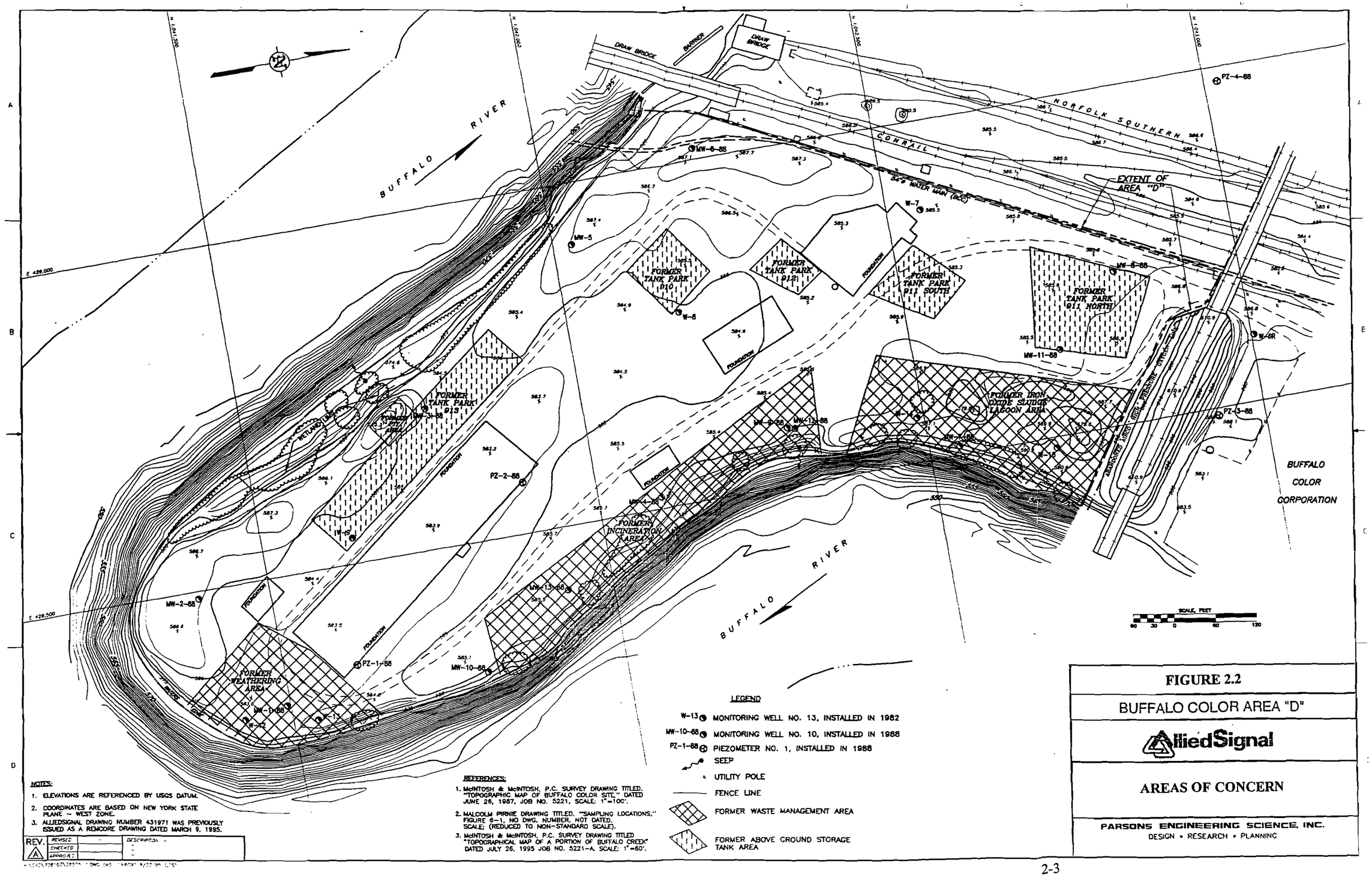

NOTES:

1. ELEVATIONS ARE REFERENCED BY USGS DATUM.
2. COORDINATES ARE BASED ON NEW YORK STATE PLANE – WEST ZONE.
3. ALLIEDSIGNAL DRAWING NUMBER 431971 WAS PREVIOUSLY ISSUED AS A REMCORE DRAWING DATED MARCH 9, 1995.

REV.	REVISIC	–	DESCRIPTION –
A	CHECKED		–
	APPROVE		–

REFERENCES:

1. McINTOSH & McINTOSH, P.C. SURVEY DRAWING TITLED, "TOPOGRAPHIC MAP OF BUFFALO COLOR SITE," DATED JUNE 26, 1987, JOB NO. 5221, SCALE: 1"=100'.
2. MALCOLM PIRNIE DRAWING TITLED, "SAMPLING LOCATIONS," FIGURE 6-1, NO DWG. NUMBER, NOT DATED, SCALE: (REDUCED TO NON-STANDARD SCALE).
3. McINTOSH & McINTOSH, P.C. SURVEY DRAWING TITLED "TOPOGRAPHICAL MAP OF A PORTION OF BUFFALO CREEK" DATED JULY 26, 1995 JOB NO. 5221-A, SCALE: 1"=60'.

LEGEND

- W-13 — MONITORING WELL NO. 13, INSTALLED IN 1982
- MW-10-88 — MONITORING WELL NO. 10, INSTALLED IN 1988
- PZ-1-88 — PIEZOMETER NO. 1, INSTALLED IN 1988
- SEEP
- UTILITY POLE
- FENCE LINE
- FORMER WASTE MANAGEMENT AREA
- FORMER ABOVE GROUND STORAGE TANK AREA

FIGURE 2.2

BUFFALO COLOR AREA "D"

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AREAS OF CONCERN

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2. The "Iron Oxide Sludge Lagoons" which were used for storage of iron oxide sludge from the manufacturer of dyes and intermediates (1916-1976);
3. Tank farm areas used for the bulk storage of petroleum products and process chemical; and
4. The area on the eastern side of the peninsula, formerly occupied by open burning pits (1922-1954) and later by an incinerator (1954-1972), was used for burning organic wastes generated during dye manufacturing processes.

These areas of concern cover most of the Area "D" site. In addition, the analytical results of the samples collected during the present Remedial Investigation (RI) have demonstrated contamination at the Area "D" to be both widespread and variable with respect to its character and concentration. Contamination was found in the soil and/or groundwater at virtually every location of the site investigated. Any attempts to isolate the hot spots for remediation will be extremely difficult and will ultimately result in remediation of the whole site. Therefore, the Area "D" is considered as a whole for remediation.

2.3 SITE GEOLOGY AND HYDROGEOLOGY

2.3.1 Geology of the Site

The Area "D" site is underlain by five stratigraphic units (fill, alluvium, glaciolacustrine deposits, glacial till, and bedrock). Fill consists of mixtures of gravel, sand, silt, clay, demolition debris, chemical wastes, and other foreign materials and averages 9.0 feet thick.

Alluvium underlies fill and generally consists of black to gray silty sand with traces of clay, and averages 17.8 feet thick. Glaciolacustrine deposits underlie the alluvium and consist of gray and brown-gray clayey silt and silty clay, and average 27.9 feet thick. Glacial till is the lowest surficial deposit and consists of gray and brown sandy silt, with small percentages of clay and gravel and averages 12.0 feet thick. The bedrock beneath the site consists of dark gray limestone of the Middle Devonian Formation.

2.3.2 Hydrogeology

Three (3) hydrostatigraphic units were defined at the Area "D" site. The Shallow Water-bearing Zone is located in the fill/alluvium deposits and yields an average hydraulic conductivity of 2.2×10^{-3} cm/sec and an average seepage velocity of 1.4×10^{-5} cm/sec. The groundwater flow in this zone is primarily from the north and flows directly to the Buffalo River. Overburden aquitard has a hydraulic conductivity of only 1.2×10^{-9} cm/sec. Hydraulic conductivity in the bedrock zone has been estimated to be 1.4×10^{-2} cm/sec, and flow probably occurs under confined conditions.

2.3.3 Nature and Extent of Contamination

The results of sample collection and analysis have demonstrated contamination at the Area "D" to be both widespread and variable with respect to character and concentration. Contamination was found in the soil and/or groundwater at every location of the site investigated during the RI. The fill layer exhibited elevated levels

of polynuclear aromatic hydrocarbons (PAHs) and chlorinated benzenes. Also, variable concentrations of heavy metals and arsenic were found. Comparison of surface water concentration differences between upstream and downstream sampling inconclusive, but sediments adjacent to the site exhibited elevated levels of PAHs, arsenic, and other heavy metals. In addition, an oily sheen was observed in the soils at a number of locations and a six-foot layer of light non-aqueous phase liquid (NAPL) was found floating on the groundwater in the area of the former tank park 910.

The following table summarizes the ranges of various notable contaminants found at the site:

Type of Analysis	Analyte	Range
a. Organics/Surface Soils (0-2') mg/kg	Nitrobenzene	0.21 - 580
	Benzoic Acid	2.8
	Naphthalene	470
	2-Chloronaphthalene	66
	Phenanthrene	4.6 - 270
	Fluoranthene	4.8 - 330
	Pyrene	3.9 - 310
	Benzo(a)Anthracene	1.9 - 180
	Chrysene	2.1 - 180
	Benzo(b)Fluoranthene	3.1 - 150
	Benzo(k)Fluoranthene	140
	Benzo(a)Pyrene	1.7 - 140
	Indenol(1,2,3-cd)Pyrene	0.76 - 77
	Benzo(g,h,i)Perylene	0.78 - 63
	EOX(mg/kg)	11 - 2,780
b. Inorganics/Surface Soils (0-2') mg/kg	Arsenic	4.5 - 77.2
	Cadmium	0.82 - 24.8
	Chromium	44.2 - 1,990
	Copper	36.2 - 3,580
	Iron	15,200 - 537,000
	Lead	8.9 - 27,300
	Mercury	0.07 - 6.2
c. Organics/Subsurface Soils mg/kg	1,4-Dichlorobenzene	1.7 - 13
	1,2-Dichlorobenzene	0.91 - 110
	Nitrobenzene	0.21 - 1,100
	1,2,4-Trichlorobenzene	1.2 - 150
	Naphthalene	1.9 - 8.2
	2-Chloronaphthalene	0.55 - 140
	Fluoranthene	0.19 - 14
	Pyrene	0.14 - 13
	Benzo(a)Anthracene	1.1 - 6.7

	Chrysene	0.35 - 8.2
	Benzo(b)Fluoranthene	1.6 - 9.7
	Benzo(a)Pyrene	11 - 360
	EOX (mg/kg)	11 - 360
d. Inorganics/Subsurface Soils mg/kg		
	Arsenic	4 - 2,860
	Cadmium	0.7 - 7
	Chromium	5.7 - 440
	Copper	6 - 14,500
	Iron	1,750 - 360,000
	Lead	8.4 - 83,200
	Mercury	0.19 - 14
e. Organics/Groundwater ug/l		
	2-Chlorophenol	0.8 - 1,800
	1,4-Dichlorobenzene	1 - 4,900
	1,2-Dichlorbenzene	2 - 21,000
	1,2,4-Trichlorbenzene	8 - 1,200
	Naphthalene	0.3 - 4,900
	4-Chloroaniline	8 - 11,000
	2,4-Dinitrotoluene	2,000
	2,6-Dinotrotoluene	1,500 - 1,700
	Benzidine	90 - 360
	1-Naphthylamine	6 - 42,000
	Aniline	5 - 660
	Benzene	0.1 - 28,000
	Toluene	0.09 - 4,700
	Chlorobenzene	0.6 - 48,000
	Ethylbenzene	0.2 - 43,000
	Xylene (Total)	1 - 1,700
f. Inorganics/Groundwater ug/l		
	Arsenic	5.7 - 1,820
	Cadmium	5 - 127
	Chromium	13 - 2,140
	Copper	15 - 78,700
	Iron	3,940 - 405,000
	Lead	5 - 3,030
	Mercury	0.29 - 50

The analytical results of the subsurface soil samples indicates that no organic contaminants were found below the 30 foot depth. Also, the groundwater data indicates that only the uppermost saturated zone is contributing the contaminants to the Buffalo River. Therefore, it is apparent that the underlying clay/till layer is effective in providing a barrier for contamination migration downwards.

2.4 RESULTS OF PREDESIGN INVESTIGATIONS

A number of predesign activities were conducted by REMCOR, Inc., Parsons ES, and other consultants which formed the basis of the proposed remedial design. The predesign activities included:

- a site survey and mapping;
- wetlands delineation;
- treatability testing of groundwater;
- groundwater pump tests;
- Hydraulic Evaluation of Landfill Performance (HELP) model simulations;
- a geotechnical investigation to determine the load bearing capacity of onsite soils;
- drilling and sampling of seven deep test borings;
- installation of four piezometers and 13 monitoring wells within shallow and dep water bearing zones;
- determine the geological and hydrogeological features of the region and the area;
- measurement of groundwater and river water levels;
- sampling of groundwater, surface water river sediments, and surficial soil;
- compatibility testing of construction materials;
- shoreline stabilization studies; and
- groundwater modeling.

The results of these investigations are presented in a series of reports and technical memoranda which are included as appendices to the Remedial Design Report (Parsons ES, October 1995). Section 2 of the Remedial Design Report summarizes the methodologies, conclusions, and recommendations of these studies.

SECTION 3

WORK PLAN

3.1 REMEDIAL DESIGN

The remedial design for the Site includes clearing, regrading, consolidation of waste materials, and installation of the following features:

- a cutoff wall comprised of a soil/bentonite slurry;
- a multi-layered cover system including a flexible membrane liner (fml), a synthetic drainage layer, and 30 inches of cover soil;
- groundwater and LNAPL collection system and conveyance piping;
- a perimeter drainage trench along the cutoff wall;
- storm water management and erosion controls;
- shoreline stabilization and habitat enhancements;
- an onsite groundwater treatment facility;
- site access roads and fences;
- upgradient and downgradient monitoring wells; and
- abandonment of existing onsite monitoring wells.

The Remedial Design Report (Parsons ES, October 1995) describes the basis of the remedial design. Appendices F and G to the Remedial Design Report contain construction plans and technical specifications, respectively.

3.2 CONTRACT DOCUMENTS

Parsons ES has prepared contract documents for the project which include contractor requirements and technical specifications. The technical specifications detail procedures to be followed in implementing the remedial construction. Technical specifications are included in Appendix G to the Remedial Design Report (October 1995).

3.3 REMEDIAL CONSTRUCTION ACTIVITIES

3.3.1 Monitoring Well Abandonment

Prior to the start of major construction activities, existing monitoring wells that extend into the subsurface clay layer must be removed. Shallow monitoring wells only require abandonment if they interfere with remedial construction.

A monitoring well abandonment specification has been developed to address proper decommissioning of wells in order to eliminate any potential contaminant migration through the unused well casings or surrounding seals. The monitoring well abandonment plan (Technical Specification 02050) incorporates all appropriate

regulatory requirements, including NYSDEC monitoring well decommissioning procedures. The Plan identifies:

- which site wells require abandonment;
- inspection of wells for integrity; and
- proper decommissioning procedures for the selected wells, including:
  - removal of protective casing;
  - overdrill of well casing with augers sized larger than the original borehole;
  - removal of the well casing from the borehole; and
  - addition of cement/bentonite grout from the bottom of the borehole via tremie pipe.

The decommissioning method to be used will depend upon the depth of the wells. Alternate methods and additional care may be necessary because of the potential presence of confining zones at the site. Alternate methods will be defined in the field as needed. Approval will be obtained from the NYSDEC prior to implementing any deviations from the abandonment plan.

3.3.2 Clearing, Grubbing, and Demolition

Following monitoring well abandonment, the site will required clearing and grubbing of vegetation and debris. This will involve clear cutting of all wood vegetation and brush. All vegetation debris will be disposed of in accordance with specification Section 02110. Brush and woody debris, less than four inches in diameter, will be chipped and uniformly spread across the site such that the thickness will not exceed six inches. Logs and branches greater than four inches in diameter will be cut into lengths not to exceed four feet in length. The logs will be ground and placed in an area beneath the high point (crest) of the regraded site.

Follow-on remedial construction will require selective demolition of foundations of former buildings. The foundations to be demolished include portions of foundation along the alignment of the slurry cutoff wall and adjacent to shoreline areas necessary to regrade and stabilize the shoreline. All foundation rubble will be disposed of as general fill under the cap subgrade.

Erosion control/measures will be integrated with these activities such that it will allow the cleaning and demolition work to proceed. As soon as practical, erosion control measures must be installed. Refer to Section 3.4.3 regarding implementation of erosion control measures during construction.

3.3.3 Cutoff Wall

The cutoff wall will consist of a three foot wide trench backfilled with a bentonite/soil slurry mix with a maximum permeability of 1.0×10^{-7} cm/sec. The cutoff wall will circumnavigate the site and will be keyed into the lower clay unit to prevent leakage of contaminated groundwater from the site. The alignment and details for the cutoff wall, are respectively presented on Drawings C-2 through C-5 in Appendix F of the Remedial Design Report. Construction of the slurry cutoff wall generally involves specialized construction techniques, multifaceted construction, and precise scheduling.

Initial tasks will involve preliminary grading of the site along the river shoreline slopes and embankment. A stable and level earthen bench will be necessary for excavators used to construct the slurry trench cutoff wall.

Construction of the slurry trench cutoff wall will require the implementation of rigorous construction quality assurance/quality control program. Refer to Section 4.5.3 and Attachment 2 regarding the implementation of the construction monitoring program.

3.3.4 Capping System

Construction of the capping system will involve shaping and contouring the site to desired grades and covering the site with a multilayered cap system to prevent the infiltration of precipitation. The capping system will be integrated with the cutoff wall, forming a barrier against vertical and lateral infiltration and migration of water through the site. The limits of the capping system coincide with the alignment of the cutoff wall.

The subgrade plan and final grading plan for the capping system are presented on Drawings C-6 and C-7. The drawings identify the final elevations and footprint area of the cover system and appurtenant facilities. The plans were developed with consideration of the following criteria:

- a 5 percent minimum slope to promote surface water runoff;
- a maximum slope of three horizontal to one vertical to four horizontal (3H:1V, or 33 percent) along the Buffalo River shoreline for constructability and stability;
- excavation of sediment and low strength soils along shoreline to provide stable surfaces for shoreline armoring;
- a final cover system consisting of a 60-mil FML, a synthetic drainage layer, a 24-inch barrier protection layer, and a 6-inch vegetative support layer to prevent infiltration of water from the surface.

Three passive gas vents will also be installed as part of the capping system. The vents will be located along the crest of the capped area to provide equalization of atmospheric pressure under the capping system during pumping operations.

The complete capping system will be seeded with a combination grass mix and wildflowers. A majority of the site will be seeded with a tall grass mixture that is hardy to the region and will effectively stabilize soils from erosion. The tall grassed area will be mowed once per year, after July 15th, to establish habitat for field nesting birds. Several strips of the site, adjacent to the rivershore area, will be seeded with a wildflower mixture, natural grasses, and planted with shallow rooted shrubs to enhance the aesthetics of the site to boaters and canoers travelling along the Buffalo River.

Construction of the capping system will require the implementation of a rigorous construction quality assurance/quality control program. Refer to Section 4.5.3 and Attachment 2 regarding the implementation of the construction monitoring program.

3.3.5 River Bank Stabilization

Erosion control measures along the Buffalo River shoreline were evaluated to ensure adequate erosion protection and stability. The shoreline stabilization will initially involve removal of a nominal two feet of "low" strength soil adjacent to the shoreline. The shoreline, in zones subject to river erosion will be protected with a woven geotextile and covered with 30-inches of riprap. The erosion protection will extend from Elevation 560, 5 feet below the minimum daily mean water level, to Elevation 580.0 feet, which provides 3 feet of freeboard above the maximum mean daily water level.

3.3.6 Engineered Wetlands and Habitat Enhancement

Engineered wetlands will be developed along the southwest portion of the shoreline. The area will be widened to form a bench to a maximum width of 40 feet at Elevation 573.0. The surface of the bench will be covered and shaped with soils capable of supporting wetland vegetation in lieu of riprap. Initially, the surface will be stabilized by covering the soils with a coconut mat or jute mesh. This will reduce the potential for scour prior to the establishment of vegetation. Willow poles will be planted along the edge of the area to redirect floating debris away from the area. Several species of vegetation will be planted to stimulate plant growth.

In addition to the engineered wetlands, the perimeter of the site will be revegetated in accordance with the habitat restoration plan and the Technical Specifications. This involves filling topsoil between riprap void spaces. Seedlings of several species of trees will be randomly planted in soil pockets.

3.3.7 Groundwater Extraction and Conveyance System

Four extraction wells (EW-1 through EW-4) will be installed to maintain an inward groundwater gradient at the site and collect contaminated groundwater and non-aqueous phase liquids (NAPL) present at the site. Extraction wells will extend typically to a depth of Elevation 555 (see Drawing C-15). The wells will be constructed of 6-inch diameter stainless steel screens and riser sections for long term durability and compatibility. The well heads will be protected with a precast concrete vault which will also house flow monitoring, flow control, and sampling devices. The extraction wells will be filled with submersible water well pumps (P-1 through P-4). The pumps were sized to pump desired flow rates against system head losses. Collected waters will be conveyed through a network of buried and above ground piping to the Water Treatment Plant (WTP). Buried piping will consist of double wall high density polyethylene (HDPE) pipe placed directly above the capping system HDPE fml. HDPE was chosen for its durability and compatibility with the chemicals onsite. The pumping will be double walled so as to minimize potential leakage of collected waters to the surrounding environment. The conveyance piping will be placed above ground near the perimeter of the capped area and continue to the treatment plant. The piping will also be double walled. The piping will be supported by a series of stanchions. All above ground piping, as well as piping in the vaults will be heat traced and insulated for frost protection. Buried piping will be protected from frost by maintaining four feet of earthen cover.

3.3.8 Water Treatment Plant

Collected groundwater will be treated at the Groundwater Treatment Plant (WTP) prior to discharge to the Buffalo River. The WTP will consist of the following unit operations to treat groundwater:

- oil/water separation;
- flow equalization;
- metals precipitation;
- clarification/filtration; and
- carbon adsorption.

Incidental unit operations will also include:

- sludge thickening; and
- sludge dewatering.

The WTP will be located north of the site on property owned by BCC. The treatment facility will be enclosed by a pre-engineered metal building with outside dimensions of 40-feet by 60-feet. The building will be supported by a concrete foundation and floor slab. The building will be heated with natural gas. The layout of the building will include a main area for the treatment process equipment, an office area, laboratory, lavatory, and electrical room.

Building utilities include onsite connections to BCC water, natural gas, and sanitary sewerage. Separate utilities will be brought to the site for electricity and treated water discharge.

3.4 PERMITS AND APPROVALS

3.4.1 SPDES Discharge Permit

Effluent discharge from the Wastewater Treatment Facility will be directly to the Buffalo River. Effluent criteria and general conditions for the long term discharge of treated groundwater are included in the Operations and Maintenance Manual.

3.4.2 U.S. Army Corps of Engineers Permit Applications

A *Joint Application for Permit* is being prepared for the United States Army Corps of Engineers (USACE), the lead agency, and NYSDEC (coordinated review) covering the placement of erosion control material (i.e., riprap) along the Buffalo River shoreline. The permit application also reflects fill/dredge activities within Site wetlands.

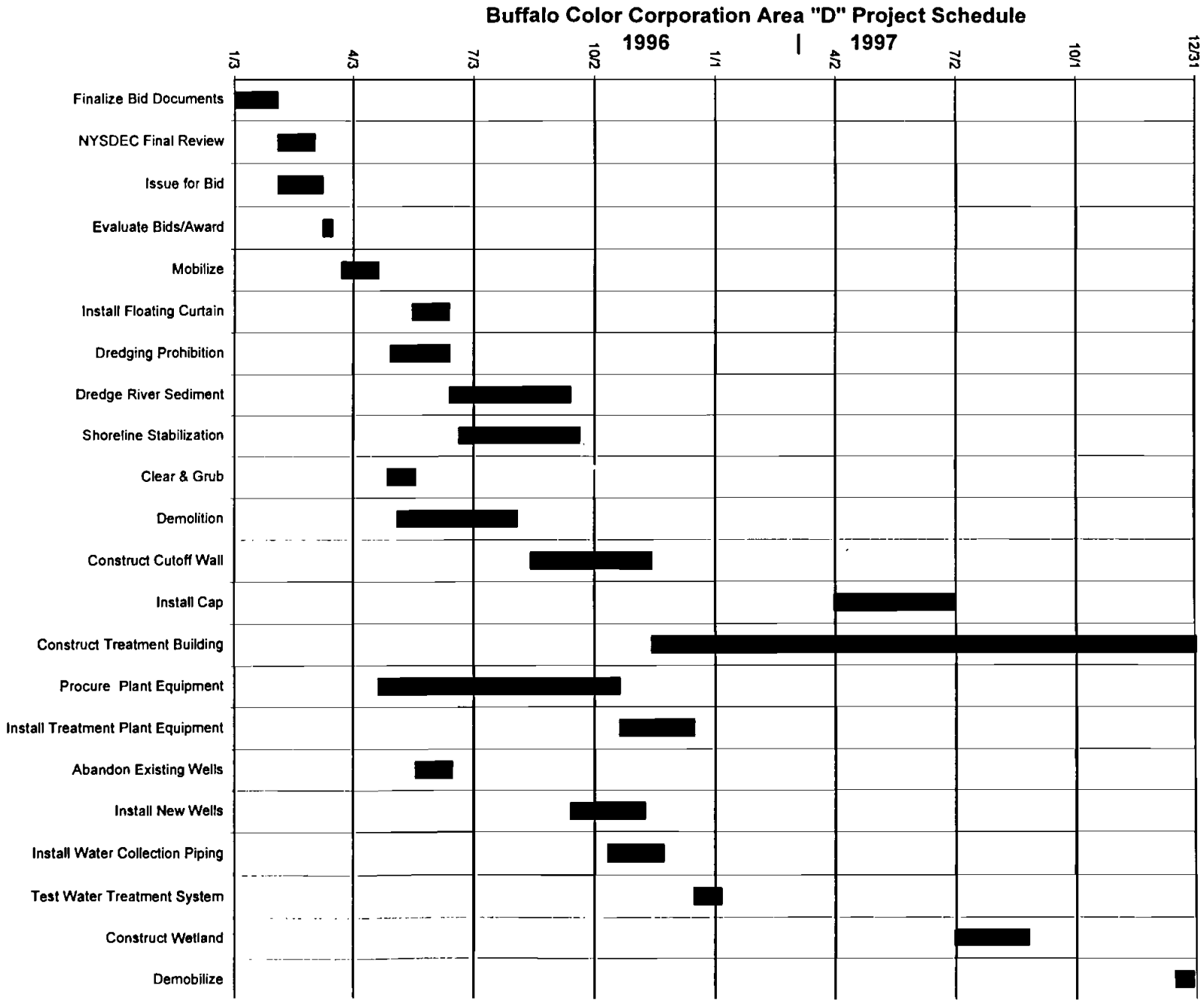
3.4.3 Coastal Zone Consistency Evaluation

A "Coastal Assessment Form/Federal Consistency Assessment Form" is being prepared as required for compliance with the Coastal Management Program. The form describes the potential impacts of the proposed project on coastal areas including scenic qualities and impacts to fish and wildlife habitat.

3.5 SCHEDULE

A proposed schedule of construction activities is presented in Figure 3.1.

Figure 3.1


Buffalo Color Corporation Area "D" Project Schedule
1996
1997
1/3
4/3
7/3
10/2
1/1
4/2
7/2
10/1
12/31
Finalize Bid Documents
NYSDEC Final Review
Issue for Bid
Evaluate Bids/Award
Mobilize
Install Floating Curtain
Dredging Prohibition
Dredge River Sediment
Shoreline Stabilization
Clear & Grub
Demolition
Construct Cutoff Wall
Install Cap
Construct Treatment Building
Procure Plant Equipment
Install Treatment Plant Equipment
Abandon Existing Wells
Install New Wells
Install Water Collection Piping
Test Water Treatment System
Construct Wetland
Demobilize

SECTION 4

PROJECT OPERATIONS PLAN

4.1 PROJECT ORGANIZATION

The Contractor will prepare and implement a project control organization plan. A preliminary plan with resumes will be included with the bid. The plan shall include duties, responsibilities, authority, safety, schedule changes, and associated cost. The following activities must be performed at a minimum:

- Project Management
- Construction QA
- Construction Inspection
- Contractor Survey
- Dredging
- Slurry Wall Construction
- Pre-engineered Building Fabrication
- Concrete - Masonry Work
- Electrical Work
- Mechanical Work
- Piping Installation
- Site Health and Safety Plan Implementation
- Shoreline Erosion Control Installation
- Well Drilling
- Painting
- Liner Installation
- Landscaping

The Contractor will be required to state the percent of a project to be subcontracted with the bid.

4.2 CONTRACTOR QUALIFICATIONS

Prospective contractors will be pre-qualified before the actual bidding documents are issued. Contractor Prequalification Forms will be sent out to a list of prospective bidders. The prospective contractor list will be generated by AlliedSignal, Inc.

4.3 CONTRACTOR QUOTATIONS

The Contractor's quotation is to provide for the furnishing of all materials, equipment, and labor required to complete the work. The quotation shall be prepared with consideration of meeting the stated milestones and schedule as set forth in the bid documents, specifications, and drawings.

4.4 CONSTRUCTION CONTROLS

4.4.1 Remedial Action Health and Safety Plan

This document includes a Remedial Action Health and Safety Plan (RAHASP) which conforms to requirements in 29 CFR 1910.120. The RAHASP includes a description of site activities that could create potential physical and chemical exposure hazards, appropriate levels of worker and public protection, action levels to for upgrading of personal protective equipment (PPE), an emergency contingency plan, and a list of emergency contacts. The RAHASP is presented as Attachment 1.

4.4.2 Remedial Action Contingency Plan

The Remedial Action Contingency Plan (RACP) is included within the RAHASP (Attachment 1). The RACP details procedures to implement in an emergency in order to protect the health and safety of workers and the local community during remedial action activities at the site. Precautions will be taken to minimize the potential for accidents that may affect the health and safety during the remedial construction. The contingency plan also establishes formal emergency preparedness and response measures. The RACP:

- Identifies key personnel responsible for emergency actions including the project manager, site supervisor, health and safety officer, subcontractor(s), site security personnel, waste transporters, etc.;
- Identifies emergency response teams in the local community;
- Addresses the prevention of potential onsite emergencies;
- Describes onsite response to emergency situations; and
- Presents an emergency notification and response program that will be implemented in the event of an onsite emergency or offsite transportation accident that could affect the health and safety of the surrounding community.

4.4.3 Construction Quality Assurance Plan

A *Construction Quality Assurance Plan* (CQA Plan) has been developed to describe the procedures governing all aspects of quality assurance for remedial construction. The CQA Plan includes a discussion of the following:

- delegation of responsibility and authority for all aspects of the project, including chain-of-command and duties of project manager, engineer, and inspection personnel;
- project meetings, including preconstruction, weekly/monthly progress meetings, and unscheduled meetings to address problems or work deficiencies;

- qualifications of all designated project personnel, including training of on-site QA inspector(s);
- QA testing protocols for all construction materials, particularly those related to the cap;
- QA testing of all geosynthetics, as applicable;
- discussion of procedures to be followed should any QA test fail to achieve project requirements; and
- identification of QA documentation, including daily monitoring logs, progress reports, corrective measures reports, and final construction certification report.

The Construction QA Plan is presented in Attachment 2.

4.4.4 Storm Water Management and Erosion Control

In accordance with, and in compliance with, the provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et. seq.); New York State Environmental Conservation Law (ECL) Articles 17, Titles 7, 8, and Article 70; and the New York State Department of Environmental Conservation Storm Water General Permit GP-93-06, a Stormwater Management and Erosion Control Plan (Parsons ES, October 1995) has been prepared to address:

- construction activities that may cause soil erosion or that may affect the quality of storm water discharges;
- erosion control and sedimentation procedures;
- maintenance measures which eliminate pollution of storm runoff during the construction process;
- long term post-construction control measures; and
- the Notice of Intent and Storm Water General Permit for Construction Activity.

4.5 COMMUNITY RELATIONS ACTIVITIES

The NYSDEC has developed a *Community Participation Plan* (CPP) for the Site. This CPP will be updated by NYSDEC/AlliedSignal, Inc. to reflect the designed remedial actions.

The CPP addresses AlliedSignal's role in the implementation of community participation activities. Specific activities which may be conducted regarding the CPP include:

- Preparation and distribution of a public notice and an updated fact sheet at the completion of engineering design;
- Conducting a public information meeting at the completion of the remedial design;
- Conducting activities ranging from small group meetings to Site visits to regular fact sheets on the technical status; and

- Addressing public concerns by providing proactive releases to the press and community leaders.

4.6 OPERATION AND MAINTENANCE

A draft Operations and Maintenance (O&M) Manual has been prepared to provide detailed instructions for the operation and maintenance of the Site over the anticipated 30 year post-construction O&M period. The final O&M Manual will reflect the post closure monitoring and maintenance guidelines as stated in the NYSDEC's April 1992 memorandum for O&M manuals at hazardous waste sites. Therefore, the draft O&M Manual will be revised as needed to incorporate the as-built conditions.

The draft Operations and Maintenance Manual for the Buffalo Color Corporation Area "D" Site is included as Appendix E of the Remedial Design Report. The O&M Manual describes standards and procedures for conducting post closures monitoring and maintenance at the Site. The details in the plan include frequency for inspection and sampling of groundwater; specific features and areas for inspection; specific parameters and methods for chemical analysis of environmental samples; cap and monitoring well maintenance procedures; and recordkeeping and reporting requirements.

SECTION 5

CONTRACT MANAGEMENT

5.1 PRE-AWARD

Engineering support services will be required by AlliedSignal, Inc. for the contract bidding process for remedial construction at the two sites. During the pre-construction phase the following activities will be conducted by the Engineer designated by AlliedSignal, Inc.:

- Support a pre-bid conference and site tour to emphasize the specific components of the project;
- Prepare minutes of the meeting highlighting the discussions;
- Attend public meetings (if required) and answer questions raised concerning the project design, construction techniques, and project scheduling; and
- Assist in interpretations and clarification of the bidding documents.

5.2 AWARD OF CONTRACT

The final selection of the Remedial Construction Contractor and execution of the contract agreement will be the responsibility of AlliedSignal. Following review of the bids and selection of the contractor, a pre-construction meeting will be held by AlliedSignal, Inc. and assisted by the Engineer to review the project with the chosen Contractor. Submittals required in the contract will be reviewed by AlliedSignal Inc. and or the Engineer. Submittals include shop drawings; borrow soil testing results; materials samples; and proposals for use of material, equipment or techniques which vary from the contract documents. Some of the submittals such as borrow soil test results and other material approvals will be required before the contractor can start work while other submittals will not be required until after the construction has begun.

5.3 CONTRACTOR PAYMENT

Monthly Contractor payments will be based on lump sum and unit prices provided for the bid, with quantities determined by the Contractor and verified by the Engineer. A minimum of 10 percent of each application for payment will be withheld from the Contractor's payment to ensure adequate funds for corrective actions during construction, if needed.

5.4 RECORD MANAGEMENT

The Engineer shall be responsible for monitoring all aspects of construction and providing construction QA functions to ensure conformance to project plans and specifications. In addition, the Engineer shall maintain the following project documentation:

- daily inspection reports;
- records of work in progress as compared to project schedule;
- security and safety logs; and
- complete project file.

AlliedSignal, Inc. will maintain the following project records:

- records of payment to the contractor;
- records of change orders; and
- photographic records of the construction.

The Engineer and AlliedSignal, Inc. will conduct pre-final and final inspections. The pre-final inspection will be conducted when the work is nearly complete and will include preparation of a punch list of work items that need to be completed and an estimate of the value of this work. The final inspection will include the Engineer's determination of the final value of the work completed by the contractor.

5.5 COMMUNICATIONS MANAGEMENT

A series of project meetings will be held throughout the duration of the construction phase as forum to communicate construction issues. The NYSDEC will be informed of all meeting dates and will be invited to attend.

5.5.1 Preconstruction Meeting

A preconstruction meeting will be held prior to construction of the final cover systems. Representatives of AlliedSignal, Engineer, and the Construction Contractor will be present. The agenda for this meeting will include, but not be limited to the following:

- provide each organization with all relevant QA documents and supporting information;
- familiarize each organization with the *Construction QA Plan* and its role relative to the design criteria, construction and closure plans, specifications, and construction documentation;
- determine if any changes to the *Construction QA Plan* are needed to ensure that the final cover system will be constructed to meet or exceed the specified design;
- review the responsibilities of each organization;
- review lines of authority and communication for each organization;
- discuss the established procedures or protocol for observations and tests including sampling strategies;
- discuss the established procedures or protocol for handling construction deficiencies, repairs, and retesting;
- review methods for documenting and reporting inspection data;

- review methods for distributing and storing documents and reports;
- review work area security and health and safety protocol; and
- discuss procedures for the location and protection of construction materials and for the prevention of damage of the materials from inclement weather or other adverse events.

5.5.2 Monthly Progress Meetings

Monthly progress meetings will be held during the course of the work to:

- discuss the project schedule and work performed to date;
- address and resolve (i.e.; establish corrective actions for) any existing or anticipated construction problems; and
- discuss and resolve (i.e.; establish corrective actions for) any coordination or QA problems encountered to date.

The meetings will be attended by AlliedSignal or designated personnel, Engineer, representatives for the NYSDEC, and Construction Contractor. The meetings minutes will be documented by the Engineer.

5.5.3 Problem or Work Deficiency Meetings

A special meeting will be held when and if a major QA problem or deficiency is present or likely to occur. At a minimum, the meeting shall be attended by the construction contractor, QA inspection personnel, AlliedSignal personnel, and the Engineer. NYSDEC personnel will also be informed of the meeting time and place. The purpose of these meetings will be to define and resolve the QA problems(s) encountered or recurring QA deficiencies in the following manner:

- define and discuss the problem or deficiency;
- define and discuss the problem or deficiency;
- review alternative solutions; and
- implement a plan to resolve the problem or deficiency.

The meeting minutes will be documented by the Engineer.

5.6 FILING/DOCUMENT RETRIEVAL

During the construction of the remedial action systems, the Engineer will be responsible for all facility QA documents. This includes the Engineer's copy of the design criteria, engineering design plans, and specifications, the CQA Plan, and the originals of all data sheets and reports. All originals will be maintained in the Engineer's office. Duplicate records will be kept in the field office to avoid loss of this information if the originals are destroyed.

Once the remedial action construction is complete, the document originals will be stored by AlliedSignal, Inc. in a manner that allows for easy access while still protecting them from any damage. A final construction monitoring report will be kept by the NYSDEC in a publicly acknowledged repository. All documentation will be

maintained through the operating and post-remedial construction monitoring periods of the site.

5.7 CERTIFICATION DOCUMENTATION

Following completion of the remedial construction and the field quality assurance program, the Engineer will assist in preparing documentation verifying that the remedy was completed in accordance with the plans and specifications approved by the NYSDEC. The content of the documentation will depend on the type of material used in the remedial construction system. For soils, the documentation will include verification of the soil thickness; laboratory results of the permeability tests; and the nuclear density readings. For the geosynthetic membrane, the documentation will include results of the material inspection; non-destructive seam testing results; and the laboratory results of the destructive seam testing. In addition, the documentation will include a summary of the remedial chronology.

The documentation will also include selected documentation photographs and the verified record drawings of the remediations. This document will be signed and sealed by a Professional Engineer registered in the State of New York.

ATTACHMENT 1

REMEDIAL ACTION HEALTH AND SAFETY PLAN

EXHIBIT 3

FORMS FOR HEALTH AND SAFETY-RELATED ACTIVITIES

Note: The OSHA Job Safety and Health Protection Poster must be posted prominently during field activities. The following page is an example of the poster to be used in the field. The actual poster must be an 11 inch by 17 inch size version of this page.

PROJECT HEALTH AND SAFETY PLAN

AND WORK PLAN ACCEPTANCE FORM

(For Operations and Maintenance employees only)

I have read and agree to abide by the contents of the Post-Remedial Construction Operation and Maintenance Plan and Health and Safety Plan for the following project:

_____	_____
(Project Title)	(Project Number)

Furthermore, I have read and am familiar with the work plan or proposal which describes the field work to be conducted and the procedures to be utilized in the conduct of this work.

Name (print)	Signature	Date
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Place in project Health and Safety File as soon as possible

SITE-SPECIFIC HEALTH AND SAFETY TRAINING

(For All Operation and Maintenance employees and subcontract employees on site)

I hereby confirm that site-specific health and safety training has been conducted by the site health and safety officer which included:

- Names of personnel responsible for site safety and health
- Safety, health, and other hazards at the site
- Proper use of personal protective equipment
- Work practices by which the employee can minimize risk from hazards
- Safe use of engineering controls and equipment on the site
- Acute effects of compounds at the site
- Decontamination procedures

For the following project:

_____	_____
(Project Title)	(Project Number)

Name (print)	Signature	Date
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Place in project Health and Safety File as soon as possible

EXHIBIT 4

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

All monitoring instruments must be calibrated and maintained periodically. The limitations and possible sources of errors for each instrument must be understood by the operator. It is important that the operator ensures that the instrument responds properly to the substances it was designed to monitor. Portable air quality monitoring equipment that measures total ionizables present, such as the Photovac MicroTIP HL-2000® must be calibrated at least once each day. Combustible gas/oxygen/%LEL meters (explosimeters) such as the MSA Model 360® must be calibrated at least once each week. The specific instructions for calibration and maintenance provided for each instrument should be followed.

EXHIBIT 5

STANDARD SAFE WORK PRACTICES

STANDARD SAFE WORK PRACTICES

1) Eating, drinking, chewing tobacco, smoking and carrying matches or lighters is prohibited in a contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.

2) Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, etc).

3) All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved; i.e., presence of strong and irritating or nauseating odors.

4) Prevent, to the extent possible, spillages. In the event that a spillage occurs, contain liquid if possible.

5) Field crew members shall be familiar with the physical characteristics of investigations, including:

- Wind direction
- Accessibility to associates, equipment, vehicles
- Communication
- Hot zone (areas of known or suspected contamination)
- Site access
- Nearest water sources

6) All wastes generated during activities onsite should be disposed of as directed by the project manager or his onsite representative.

7) Protective equipment as specified in the section on personnel protection will be utilized by workers during the initial site reconnaissance, and other activities.

EXHIBIT 6

ACCIDENT REPORT FORM

ACCIDENT REPORT FORM

Project Name:_____

INJURED OR ILL EMPLOYEE

1. Name _____ Social Security #_____
   (First) (Middle) (Last)
2. Home Address _____
   (No. and Street) (City or Town) (State)
3. Age _____ 4. Sex: Male ( ) Female ( )
5. Occupation _____
   (Specific job title, not the specific activity employee was performing at time of injury)
6. Department _____
   (Enter name of department in which injured person is employed, even though they may have been temporarily working in another department at the time of injury)

EMPLOYER

7. Name _____
8. Mailing Address _____
   (No. and Street) (City or Town) (State)
9. Office location, if different from mailing address _____

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident of exposure _____
    (No. and Street) (City or Town) (State)
11. Was place of accident or exposure on employer's premises? _____(Yes/No)
12. What was the employee doing when injured?_____

(Be specific - was employee using tools or equipment or handling material?)

13. How did the accident occur? _____
    (Describe fully the events which resulted in the injury or occupational illness. Tell what happened and how. Name objects and substances involved. Give details on all factors which led to accident. Use separate sheet if needed)

ACCIDENT REPORT FORM

14. Time of accident: _____

15. Date of injury or initial diagnosis of occupational illness _____ (Date)

16. PARSONS ES WITNESS TO ACCIDENT

(Name)	(Affiliation)	(Phone No.)
_____	_____	_____
_____	_____	_____

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

17. Describe the injury or illness in detail and indicate the part of the body affected. _____

_____

18. Name the object or substance which directly injured the employee. (For example, object which struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation which irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.

_____

_____

19. Did the accident result in employee fatality? _____ (Yes or No)

20. Number of lost workdays ____/restricted workdays _____ resulting from injury or illness?

OTHER

21. Did you see a physician for treatment? _____ (Yes or No) _____ (Date)

22. Name and address of physician _____

_____

23. If hospitalized, name and address of hospital _____

_____

Date of report _____ Prepared by _____

Official position _____

ATTACHMENT 2

CONSTRUCTION QUALITY ASSURANCE

CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL PLAN

BUFFALO COLOR CORPORATION
AREA "D" SITE

Buffalo, New York **Site No. 9 -15-012**

SUBMITTED TO

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS
WASTE REMEDIATION

SUBMITTED BY

AlliedSignal

PREPARED BY

PARSONS ENGINEERING SCIENCE, INC.
180 Lawrence Bell Drive, Suite 100
Williamsville, New York 14221
(716) 633-7074 FAX (716) 633-7195
Buffalo, New York

PARSONS

FEBRUARY 1996
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CONSTRUCTION
QUALITY ASSURANCE PLAN

For:

BUFFALO COLOR CORPORATION
AREA "D" SITE
BUFFALO, ERIE COUNTY, NEW YORK
(NYSDEC SITE NO. 9-15-012)

Submitted to:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

Submitted by:

ALLIEDSIGNAL, INC.

Prepared by:

PARSONS ENGINEERING SCIENCE, INC.
180 Lawrence Bell Drive
Suite 100
Williamsville, New York 14221
Phone: (716) 633-7074
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FEBRUARY 1996

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SECTION 1

INTRODUCTION

1.1 GENERAL

This Construction Quality Assurance (QA) Plan describes quality assurance procedures for the remedial construction of the Buffalo Color Area "D" Site (Area D Site) located in Buffalo, New York (see Figure 1.1). This Construction QA Plan stresses careful inspection and documentation during the entire construction phase of the project, from the selection of materials through the installation of the remedial action systems. Also, this Construction QA Plan was prepared to ensure that the Remedial Action Construction of the Area "D" Site will be constructed in accordance with plans and specifications prepared by Parsons Engineering Science, Inc. (Parsons ES), as approved by the New York State Department of Environmental Conservation (NYSDEC).

All parties involved in this construction project will receive a copy of this Construction QA Plan including AlliedSignal, Inc., Engineer, and the NYSDEC. They will also be given any other quality assurance documents specially prepared for the project, if any.

This Construction QA Plan governs all aspects of construction quality assurance. The Construction QA Plan addresses the following items:

- Delegation of responsibility and authority for all aspects of the project, including chain-of-command and duties of project manager, engineer, and inspection personnel.
- Project meetings, including preconstruction, weekly/monthly progress meetings, and unscheduled meetings to address problems or work deficiencies.
- Qualifications of all designated project personnel including training of onsite QA inspector.
- QA testing protocols for all cap construction materials.
- Soil sampling protocols, including borrow material sampling procedures, sample compositing, identification, handling procedures, and laboratory test methods.
- QA testing of all geosynthetic materials.
- A detailed discussion which clearly outlines procedures to be followed should any QA test fail to achieve project requirements.
- All project QA documentation including daily monitoring logs, progress reports, corrective measures reports, and final construction certification report.

The Plan has been designed to work in concert with the Technical Specifications for the remedy, and with requirements and procedures of the Remedial Contractor.

SECTION 2

SCOPE OF WORK

2.1 SCOPE

The work addressed under this Construction QA Plan will facilitate proper remedial action/construction of the Area D Site. All work will be constructed to the lines, grades, and dimensions indicated on the plans and details, and in accordance with the project specifications and/or closure plan or as may otherwise be required by AlliedSignal, Inc. or their designate.

Inspectors will issue a daily report of activities at the site. These reports will include, at a minimum, observations and test results, as well as problems encountered and solutions achieved.

The overall goals of this Construction QA Plan are to ensure that proper construction techniques and procedures are used, and to verify that the materials used meed the specifications. This Construction QA Plan is designed as a supplement to the contract documents and is intended for use by the QA personnel only. Any conflicts between the contract documents and the Construction QA Plan shall be brought to the immediate attention of the Allied/Signal, Inc. and the Engineer. The Contract Documents shall govern unless otherwise directed by the Engineer. Additionally, the program will attempt to identify and define problems that may occur during construction and address corrective measures. After completion of the construction work, a construction monitoring report will be prepared which documents that the facility was constructed in general conformance with the design standards and Contract Document specifications and plans. The construction monitoring report identifies where and why constructed activities were observed to deviate from the Contract Documents.

SECTION 3

RESPONSIBILITY AND AUTHORITY

3.1 QUALITY ASSURANCE (QA) MANAGEMENT ORGANIZATION

The principal organizations involved in permitting, designing, and constructing the final cover system for the Area "D" Site include the New York State Department of Environmental Conservation (NYSDEC), AlliedSignal, Inc., the Construction Contractor, Parsons Engineering Science, Inc. (the design engineer), and QA Consultant.

3.1.1 New York State Department of Environmental Conservation (NYSDEC)

It is the responsibility of the NYSDEC to review the Remedial Action Plan (including Construction QA Plan) for compliance with the agency's regulations, and to make a decision to accept or reject the remedial action construction based on this review. The NYSDEC will have the responsibility and authority to review and accept, or reject, any design revisions or requests for a variance that are submitted by AlliedSignal, Inc., the Design Engineer, or QA personnel. The agency also has the responsibility and authority to review and approve the Construction Monitoring Report and all QA documentation collected during the construction of the disposal area to confirm that the Construction QA Plan was followed and that the Area "D" Site remedial action was constructed as specified in the Contract Documents.

3.1.2 Buffalo Color Area "D" Responsible Party

AlliedSignal, Inc. is the responsible party for the remediation of the Area "D" Site. This responsibility includes complying with NYSDEC landfill construction QA requirements. AlliedSignal, Inc. has the authority to monitor and control the quality of construction and related activities in full conformance with the NYSDEC approved engineering design plans and specifications. AlliedSignal, Inc. also has the authority to select professional organizations/contractors to assist them in fulfilling these responsibilities.

3.1.3 Construction QA Consultant

The Construction QA (CQA) Consultant, herein referred to as Engineer, selected by AlliedSignal, Inc. will be responsible for engineering design changes, construction inspection, and quality assurance in accordance with this Construction QA Plan. The Engineer will inform all parties involved with construction of their responsibilities, lines of communication, lines of authority, and quality assurance procedures. The Engineer will monitor the final closure construction activities. CQA personnel will be assigned specific responsibilities and tasks. All field and laboratory testing and monitoring will be performed by the Consultant and/or subcontractor, at a frequency and manner specified in this Construction QA Plan. CQA personnel will include a Project Officer, Project Manager, Resident Engineer, QA Engineer, and the necessary supporting engineering and inspection personnel. Specific QA responsibilities of the Project Officer, and Project Manager will include:

- Overall technical quality assurance;
- Certifications, on behalf of AlliedSignal, Inc., that the construction was completed in general conformance with the approved engineering design plans and specifications; and
- Supporting the Resident Engineer and QA Engineer in meetings with the NYSDEC, as necessary.

Specific responsibilities of the Resident Engineer will include:

- Reviewing design criteria, plans, and specifications for clarity and completeness so that the QA Plan can be implemented;
- Supporting the QA Engineer in meetings with the NYSDEC, as necessary;
- Consulting with the QA Engineer on field problems and corrective measures;
- Scheduling and coordinating QA inspection activities;
- Witness critical aspects of construction work, as necessary;
- Reporting progress to AlliedSignal, Inc.; and
- Serving as the primary interface with NYSDEC personnel.

Specific responsibilities of the QA Engineer will include:

- Directing and supporting the QA inspection personnel in performing observations and tests by:
  - confirming that regular calibration of testing equipment is properly conducted and recorded;
  - confirming that the testing equipment, personnel, and procedures do not change over time or making sure that any changes do not adversely impact the inspection process;
  - confirming that the test data are accurately recorded and maintained; and
  - verifying that the raw data are properly recorded, validated, reduced, summarized, and interpreted.
- Informing the Engineer and AlliedSignal, Inc. of problems or deficiencies, if any;
- Review the adequacy of completed work;
- Witnessing all critical aspects of construction work:
  - the QA Engineer will, at a minimum, observe the following, prior to burial:
  - subgrade preparations;
  - low permeability soil layer test patch construction;
  - geotextile and geomembrane installation.

- Prompt inspection of suspected, non-standard work when notified by QA inspection personnel; and
- Providing reports to AlliedSignal, Inc. on the inspection results including:
  - review and interpretation of all data sheets and reports;
  - identification of work that they believe should be accepted, rejected, or uncovered for observation, or that may require special testing, inspection, or approval; and
  - rejection of defective work and verification that corrective measures are implemented.

Specific responsibilities of the Subcontract Soils Laboratory Director include:

- Coordinating activities with the QA Engineer and supporting QA inspection personnel regarding the collection and analysis of soil samples;
- Scheduling and quality assurance of all soil analyses; and
- Informing the QA Engineer of materials that are not of acceptable quality or that fail to meet specifications.

For the supporting QA inspection personnel, specific responsibilities will include:

- Performing independent, continuous, onsite inspection of the work in progress to assess compliance with the facility design criteria, plans, and specifications;
- Verifying that the equipment used in testing meets the test requirements and that the tests are conducted according to this Construction QA Plan;
- Reporting to the QA Engineer results of all inspections including work that is not of acceptable quality or that fail to meet the specified design; and
- Inspect and verify that labels, tags, manifests, or other identifying documents of all construction materials conform to material specifications.

3.2 PROJECT MEETINGS

Conducting periodic project meetings is the responsibility of the Engineer and AlliedSignal, Inc.

3.2.1 Preconstruction Meeting

A preconstruction meeting will be held prior to starting construction. Representatives of AlliedSignal, Inc., the Engineer, and the Construction Contractor will be present. The agencies for this meeting will include, but not be limited to the following:

- Provide each organization with all relevant QA documents and supporting information;
- Familiarize each organization with the Construction QA Plan and its role relative to the design criteria, construction and closure plans, specifications, and construction documentation;

- Determine if any changes to the Construction QA Plan are needed to ensure that the final cover system will be constructed to meet or exceed the specified design;
- Review the responsibilities of each organization;
- Review lines of authority and communication for each organization;
- Discuss the established procedures or protocol for observations and tests including sampling strategies;
- Discuss the established procedures or protocol for handling construction deficiencies, repairs, and retesting;
- Review methods for documenting and reporting inspection data;
- Review methods for distributing and storing documents and reports;
- Review work area security and health and safety protocol; and
- Discuss procedures for the location and protection of construction materials and for the prevention of damage of the materials from inclement weather or other adverse events.

3.2.2 Monthly Progress Meetings

Monthly progress meetings will be held during the course of the work to:

- Discuss the project schedule and work performed to date;
- Address and resolve (i.e.; establish corrective actions for) any existing or anticipated construction problems; and
- Discuss and resolve (i.e.; establish corrective actions for) any coordination or QA problems encountered to date.

The meetings will be attended by AlliedSignal, Inc. or designate, the Engineer, and Construction Contractor. The meetings minutes will be documented by the Engineer. The NYSDEC will be informed of the meeting schedule.

3.2.3 Problem or Work Deficiency Meetings

A special meeting will be held when and if a major QA problem or deficiency is present or likely to occur. At a minimum, the meeting shall be attended by AlliedSignal, Inc. or designate, the construction contractor, QA inspection personnel, and the QA Engineer. NYSDEC personnel will also be informed of the meeting time and place. The purpose of these meetings will be to define and resolve the QA problems(s) encountered or recurring QA deficiencies in the following manner:

- Define and discuss the problem or deficiency;
- Define and discuss the problem or deficiency;
- Review alternative solutions; and
- Implement a plan to resolve the problem or deficiency.

The meeting minutes will be documented by the Engineer.

SECTION 4

REVIEW AND INSPECTION ACTIVITIES

4.1 SHOP DRAWING REVIEW AND APPROVAL

Initial review activities by the Engineer will involve review of Contractor submittals and shop drawings as identified in various specification sections. The Engineer's role is to review items and equipment furnished by the Contractor. The Contractor will submit to the Engineer for review and approval all documents as described in Technical Specification 01300. The Engineer will review the submittals and determine if they generally conform to the intent of specified items. The purpose of having submittals reviewed by the Engineer is to assist the Contractor in interpreting the Contract Documents. Upon approval by the Engineer, the Contractor will be allowed to proceed with construction using the approved material. Field inspections by QA personnel will involve inspection of installed items for conformance with the approved item. The Contractor will not be allowed to use substitute materials unless the Contractor has resubmitted a substituted item for the Engineer's review and approval by AlliedSignal.

4.2 ROUTINE INSPECTION

During the course of remedial construction, QA personnel will be generally performing independent, continuous, onsite inspection of the work in progress by the Contractor to assess compliance with facility design criteria, plans, and specifications. QA personnel will routinely inspect and verify that labels, tags, manifests, or other identifying documents of all construction materials conform to approved material/specifications. The QA personnel will also monitor testing of components and equipment by the Contractor to ensure that the tests and results conform with intended criteria. QA personnel will be present to witness testing, and observe constructed features before being covered or obscured by subsequent construction activities.

All daily routine inspections, test monitoring, and independent testing performed by QA personnel will be recorded on appropriate forms.

4.3 CAP CONSTRUCTION QUALITY ASSURANCE PROGRAM

4.3.1 General

Cap Construction Quality Assurance program complies with applicable regulations and the current 6 NYCRR Part 360-2.13. Details regarding quality assurance procedures are provided in the technical specifications. The design of the final cover system consists of the following elements from bottom to top:

- a cushion geotextile layer;
- a HDPE flexible membrane barrier layer;

- a composite geonet drainage layer;
- an 24-inch cover soil layer; and
- a 6-inch topsoil layer.

The final cover system will be integrated with a bentonite slurry cutoff wall constructed around the perimeter of the Site.

The final cover system for the Site will include a high density polyethylene (HDPE) synthetic geomembrane. The synthetic geomembrane selected for use will comply with the requirements of the design plans and specifications. The Installation Contractor will provide a written, notarized letter which states the previous experience of the personnel being used to field seam the geomembrane and will be submitted prior to field installation. The installer's representatives will be factory trained with demonstrated ability and experience. At a minimum, one individual will have experience seaming at least 1 million square feet of geomembrane, utilizing the proposed seaming method. All personnel involved in the geomembrane installation will wear shoes with bonded soles and heels lacking heavy tread or lug surfaces.

Criteria used for placing soil material during cover system construction are defined in the project specifications. The following construction guidelines shall be followed:

- The subgrade will be uniformly graded to lines and grades depicted on construction grading plans and will be free of soft or wet areas and organic material;
- Final subgrade preparation will require approval by the Engineer prior to placing cover soil;
- The subgrade material must be sufficiently dry and structurally sound to ensure that all lifts of soil placed over it can be adequately compacted, if required, to the design requirements and project specifications;
- The subgrade must be proof-rolled;
- Cover soil will be compacted with self-propelled tamping foot or sheepsfoot rollers;
- Compacted cover layer soil zones will be not less than ten (10) feet in width or greater than 500 feet in length and will be compacted across the entire width;
- Damage to compacted lifts (i.e.; rutting by equipment) will be repaired prior to placing any overlying materials;
- If necessary, irregular surfaces and contours will be cut back or modified to design grades and lines; and
- Compaction of cover layer soil containing excessive moisture will not be attempted until the soil moisture content is dried to an acceptable moisture content.

The Engineer will oversee the above activities conducted to assure that construction of the remedial action systems for the site is in accordance with the project engineering design and closure plans, specifications and/or NYSDEC requirements.

Construction QA for the above cover system are presented in the following sections.

All quality assurance testing will be conducted in accordance with the project specifications or as specified herein. Where there are discrepancies between the design plans/specifications and the Construction QA Plan, it shall be the Contractor's responsibility to bring the discrepancy to the attention of the Engineer for written clarification. All applicable testing methods as previously identified will be observed. Documentation and reporting of test results will be in accordance with the requirements identified in Section 7.0.

4.4 SYNTHETIC CAP MATERIALS

4.4.1 Quality Assurance (QA) Testing Frequency

Testing frequencies for synthetic cap materials QA testing categories identified in the Construction Quality evaluation subsections have been summarized in Table 4.1. All QA testing will be conducted in accordance with the project specifications or as specified herein.

4.4.2 Synthetic Membrane

The synthetic geomembrane material (herein after referred to as geomembrane) will be selected for use by the Contractor in accordance with the design plans and specifications. The Contract Documents define the required quality assurance testing of the geomembrane installation. Specific quality control testing for the geomembrane shall consist of materials evaluation and a construction quality evaluation. Each is discussed in more detail in the following sections.

4.4.2.1 Material Evaluation

Quality assurance evaluation of the polyethylene geomembrane material will include submittals by the geomembrane manufacturer documenting that the following tests have been performed on the material and that the results are within requirements:

- Melt index; and
- Density.

All incoming raw materials will be samples by the sheet manufacturer to ensure compliance with the requirements for the geomembrane manufacturer and included in the construction monitoring report.

The geomembrane material proposed for use will be manufactured in accordance with the American Society for Testing Materials standards stated in the specifications. The geomembrane manufacturer shall provide certification to the installation contractor and Engineer that the rolls of geomembrane meet the specification requirements. This affidavit will be included in the construction monitoring report provided by the Engineer. The geomembrane sheets used in construction must be traceable from the original design used in its manufacture. No rolls can be utilized until the proper certification of the resin and the geomembrane material itself is provided to the Engineer.

Upon delivery at the site, the Manufacturer or Installation Contractor and the Engineer will conduct a visual surface inspection of all rolls and blankets for defects and for shipping damage. The inspection will be conducted without unrolling rolls unless defects or damages are found or suspected. The Engineer will not allow:

- rolls or blankets, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and
- rolls or blankets which include minor repairable flaws.

The geomembrane will be stored in accordance with the Manufacturer's recommendations and will be the responsibility of the Installation Contractor The area designated for storage of the geomembrane will be protected from ultraviolet light exposure, precipitation, or other inundation, theft, vandalism, mud, dirt, dust, puncture, cutting , or other damaging or deleterious conditions. The Engineer will verify that storage of the geomembrane ensures adequate protection.

4.4.2.2 Construction Quality Evaluation

The quality assurance of the geomembrane installation will be divided into the following segments:

- Visual Inspection;
- Destructive Material Testing; and
- Non-Destructive Testing.

The detailed procedures to be followed for QA of the geomembrane are provided in Technical Specification 02405.

4.4.3 Geonet Drainage Layer

The geonet drainage material will be furnished and installed by the Contractor in accordance with the design plans and specifications. The specified geonet has a transmissivity of 10g/min/ft which is equivalent to a 12-inch sand layer with a hydraulic conductivity of 0.6 cm/sec. The contract documents define the required material and installation requirements for the geonet. Specific quality control testing for the geonet drainage material will consist of material evaluation and a construction quality evaluation. Each is discussed in more detail below.

4.4.3.1 Material Evaluation

Quality control for the geonet drainage layer will consist of review and approval of shop drawings by the QA personnel. The geonet proposed for use will be manufactured in accordance with the American Society for Testing Materials Standards stated in the specifications and so certified, by affidavit, from the geonet Manufacturer to the Installation Contractor. The installation contractor will be required to submit the affidavit to the Engineer which will be included in the construction monitoring report prepared by the Engineer. No geonet drainage material will be accepted at the site until after the affidavit is received and the shop drawings are approved by the Engineer.

The geonet will be stored in accordance with the Manufacturer's recommendations and will be the responsibility of the Installation Contractor. The area designated for

storage of the geonet will be protected from ultraviolet light exposure, precipitation or other inundation. theft, vandalism, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. The Engineer will verify that storage of the geonet ensures adequate protection.

Geonet installation will not commence until the Engineer and the Installation Contractor approve the subgrade surface and Installation conditions. The surface will be maintained as acceptable during geonet installation, and will be observed daily.

4.4.3.2 Construction Quality Evaluation

The quality assurance for the geonet installation will consist of visual inspection.

The geonet Installation Contractor will document, in writing, that the surface on which the geonet will be installed is acceptable. The Installation Contractor shall also provide certification from the manufacturer that the geonet material provided complies with all specifications. This documentation will be given to the Engineer prior to commencement of the geonet installation.

Care will be taken to avoid damaging of the surface supporting the geonet.

- The Contractor will comply with all specifications regarding damaging supporting surface materials and the procedure for repairing damaged surface.
- Immediately prior to installation of the geonet, the supporting surface will be observed by the Engineer and the Manufacturer or Installation Contractor, the decision to make repairs, if any, or to commence placement of the geonet will then be made by the Engineer.

Installation of the geonet material and repairs, if necessary, will be in accordance with the technical specifications.

4.4.4 Geotextiles

The geotextile materials will be furnished and installed by the Contractor in accordance with the design plans and specifications. The contract documents define the material and installation requirements for the geotextile layers. Quality assurance/quality control for the geotextile will consist of material evaluation and a construction quality evaluation. Each is discussed in more detail below.

4.4.4.1 Material Evaluation

Quality control for the geotextiles will consist of review and approval of shop drawings by the QA personnel. The geotextiles proposed for use will be manufactured in accordance with the American Society for Testing Materials Standards stated in the specifications and so certified, by affidavit, from the geotextile manufacturer(s) to the Installation Contractor. The installation contractor will be required to submit the affidavit to the Engineer which will be included in the construction monitoring report prepared by the Engineer.

The geotextile(s) will be stored in accordance with the Manufacturer's recommendations and will be the responsibility of the Installation Contractor. The area designated for storage of the geotextile will be protected from ultraviolet light exposure, precipitation or inundation, theft, vandalism, mud, dirt, dust, puncture,

cutting, or other damaging or deleterious conditions. The Engineer will verify that storage of the geotextile(s) ensures adequate protection.

Geotextile installation will not commence until the Engineer and the Installation Contractor approve the surface (geosynthetic or soil) and installation conditions. The surface will be maintained as acceptable during geotextile installation, and will be observed daily.

4.4.4.2 Construction Quality Evaluation

The quality assurance of the geotextile installation will consist of visual inspection and conformance testing.

The geotextile Installation Contractor will document in writing that the surface on which the geotextile will be installed is acceptable. This documentation will be given to the Engineer prior to commencement of the geotextile installation.

Care will be taken to avoid damage of the surface supporting the geotextile or damaging supporting synthetic surfaces:

- The Contractor will comply with all specifications regarding damaging supporting surface materials and the procedure for repairing damaged surfaces.
- Immediately prior to installation of the geotextiles, the supporting surface will be observed by the Engineer and the Installation Contractor, the decision to make repairs, if any, or to commence placement of the geotextile layer will then be made by the Engineer.

Installation of the geotextiles, and repairs if necessary, will be in accordance with the technical specifications.

5.4.5 Collection/Drainage Piping

The collection/drainage piping materials will be furnished and installed by the Contractor in accordance with the design plans and specifications. The contract documents define the material and installation requirements for the collection/drainage piping. Quality assurance/quality control for the collection/drainage piping will consist of material evaluation and a construction quality evaluation. Each is discussed in more detail below.

4.4.5.1 Material Evaluation

Quality control for the collection/drainage piping will consist of review and approval of shop drawings by the QA personnel. The collection/drainage piping proposed for use will be manufactured in accordance with the American Society for Testing Materials Standards stated in specifications and so certified by affidavit, from the collection/drainage manufacturer(s) to the Installation Contractor. The installation contractor will be required to submit the affidavit to the Engineer which will be included in the construction monitoring report prepared by the Engineer.

The collection/drainage pipe will be stored in accordance with the Manufacturer's recommendations and will be the responsibility of the Installation Contractor. The area designated for storage of the collection/drainage pipe will be protected from theft, vandalism, mud, dirt, dust, puncture, cutting, or other damaging or deleterious

conditions. The Engineer will verify that storage of the collection/drainage piping ensures adequate protection.

Collection/drainage piping installation will not commence until the Engineer and the Installation Contractor approve the surface and installation conditions. The surface will be maintained as acceptable during geotextile installation, and will be observed daily.

4.4.5.2 Construction Quality Evaluation

The quality assurance of the collection/drainage pipe installation will consist of visual inspection.

The installation contractor will document in writing that the surface on which the collection/drainage pipe will be installed is acceptable. This documentation will be given to the Engineer prior to commencement of the collection/drainage pipe installation.

Care will be taken to avoid damage of the supporting synthetic surfaces:

- The Contractor will comply with all specifications regarding damaging supporting synthetic surface materials and the procedure for repairing damaged surfaces.
- Immediately prior to installation of the collection/drainage pipe, the supporting surface will be observed by the Engineer and the Installation Contractor, the decision to make repairs, if any, or to commence placement of the collection/drainage pipe will then be made by the Engineer.

Installation of the collection/drainage piping, and repairs if necessary, will be in accordance with the technical specifications.

4.5 EARTH CAP MATERIALS QUALITY ASSURANCE

4.5.1 Quality Assurance (QA) Testing Frequency

Testing frequencies for earth cap materials QA testing categories identified in the Construction Quality evaluation subsections have been summarized in Table 4.1. All QA testing will be conducted in accordance with the project specifications or as specified herein. To facilitate the QA program, the following definitions are presented:

- A layer is defined as a compacted stratum composed of several lifts constructed without construction joints.
- A lift is defined as a constructed segment of a layer composed of soil materials placed in a maximum 12-inches for cover layers.

Construction testing will be conducted on samples taken from the material during the course of the work. QA testing will consist of material evaluation tests and construction quality evaluation tests as described in Material Evaluation subsections. The exact location of the construction quality test will be determined in the field by the QA personnel. The construction personnel will measure to the nearest foot, and mark by staking and reference the location of all construction quality tests to the existing horizontal grid system. The QA testing frequencies are specified on Table 4.1.

Additional testing will be utilized at the discretion of AlliedSignal, Inc. or Engineer, when visual observations of construction performance indicate a potential problem.

4.5.2 Cover Soil Layer

Specific quality control testing for the cover soil layer shall consist of material evaluations and construction quality evaluations. Each is discussed in more detail below.

4.5.2.1 Material Evaluations

Material evaluations shall be performed on mined and stockpiled soil proposed for use to determine its acceptability as construction material and compliance with the engineering design plans and specifications.

Criteria to be used for determining the acceptability of materials for use during construction are defined in the project specifications approved by the NYSDEC. All evaluation tests will be performed in an independent soils testing laboratory.

The following tests will be performed at the frequency stated in Table 4.1 to facilitate material evaluations:

Cover Soil

ASTM Test	Standard No.
Gradation Analysis of Soils (Sieve and Hydrometer)	D422-63

a. Gradation

The cover soil layer material shall conform to the following general gradation requirements:

Sieve Size Designation Test	Percent Passing Weight
3 inches	100
No. 4	>75
No. 200	>10

Soil material which does not meet this gradation may be rejected as cover soil protection construction material depending on testing results (see Forms A and B, Exhibit A). No stones may exceed 3 inches in diameter.

4.5.2.2 Construction Quality Evaluation

Construction quality evaluations will be performed on all components of the barrier protective layer construction as part of the certification program. The six-inches of the soil layer immediately below the synthetic liner and above the geonet must be reasonably free of stones. Additional criteria to be used for determination of acceptability of the construction work will be as identified in the project plans and specifications.

Construction evaluation testing will consist of visual observations of the work, and a survey of as-built conditions. The cover layer will be placed in two 12-inch lifts. Each lift will be compacted with a minimum of two complete passes by suitable compaction equipment.

4.5.3 Topsoil Layer

The topsoil layer is the uppermost component of the cover system. Its functions are to protect the underlying layers from mechanical damage, and (in conjunction with a vegetative cover) to protect against erosion.

4.5.3.1 Material Evaluation

Criteria to be used for determining the acceptability of materials for use during construction are defined in the project specifications approved by the NYSDEC. All evaluation tests will be performed in an independent soils testing laboratory.

The following tests will be performed at the frequency stated in Table 4.1 to facilitate material evaluations:

Topsoil

Test	ASTM Standard No.
Gradation Analysis of Soils (Sieve and Hydrometer)	D422-63
Soil pH	D4972
Organic Content	D2974

a. Gradation

The topsoil material shall conform to the following general gradation requirements:

Sieve Size Designation Test	Percent Passing Weight
3 inches	100
No. 200	10 - 20
.002 mm	15 max.

Soil material which does not meet this gradation may be rejected as topsoil material depending on testing results (see Forms A and B, Exhibit A). No stones may exceed 3 inches in diameter.

4.5.3.2 Construction Quality Evaluation

Preconstruction inspection activities will include checking topsoil properties against the design specifications and ensuring that deleterious materials are not included. The foundation for the topsoil layer will be the 24-inch cover soil layer. The 24-inch cover

soil layer should be checked to ensure that it has been constructed to meet or exceed the specified design.

Following the final grading and compaction of the cover soil layer, a topsoil layer will be placed over the cover soil layer to a uniform depth of six (6) inches. Topsoil will not be placed when it is partially frozen or muddy or on the cover soil layer when frozen or covered with ice, snow, or standing water. Construction personnel will use grade stakes to establish the appropriate depth of the topsoil layer. During construction of the topsoil layer, QA inspection personnel will monitor the uniformity of the application process, observe the placement procedure to ensure that the soil not overly compacted, and measure the thickness and slope of the topsoil layer. QA inspection personnel should also ensure that care is taken in the vicinity of vents, monitoring wells, or other protrusions to prevent damage by construction equipment. A survey will be performed by a licensed land surveyor to verify the thickness of the topsoil layer.

Topsoil placement, preparation for seeding, and the seeding will take place in a more or less continuous operations. The appropriate seed, mixture, fertilizer, and additives are defined in the specifications. The application rate of seed, fertilizer, and additives will be monitored to confirm that is as specified in the project specifications. QA inspection personnel will verify that all vents and standpipes or any other penetrations through the cover are not damaged the seeding application process.

QA inspection personnel will ensure that the application equipment is appropriate for the job. The rate of seed and mulch application, amount and uniformity of coverage, and water instruction will be as specified. Mulch will be applied within 72 hours of seeding and will be uniformly applied in a continuous blanket to reasonably cover the soil from view. Care will be taken not to over-apply mulch. Perimeter areas will be examined to ensure that bare spots are not left inadvertently. QA inspection personnel will ensure that seeding occurs in accordance with technical specification 02990.

4.5.6 In-Place Density Control

Where required by individual specification sections, earthen construction materials requiring compaction to desired densities will be tested for in-place density. These materials will be field tested in accordance with the procedures for determining the acceptable level of compaction as described by respective ASTM test methods. The Contractor shall select equipment which is capable of providing the minimum densities required by respective specifications and shall submit a description of the type of the equipment proposed for use to the QA personnel for approval.

Field tests to measure the dry density and moisture content of the compacted soil materials will be performed using Troxler nuclear moisture/density gauges Model 3411-B or equivalent. The testing must be conducted by personnel who are trained and certified in the use of the Troxler. These measurements will be performed with the gauge in the direct transmission mode with the depth probe typically extended six inches. The gauges will be standardized daily. The QA inspector will program the nuclear densitometer with the maximum dry density of the soil actually being placed (i.e., based on material evaluation of stockpile being placed).

4.5.7 Thickness Verification

Prior to placing any final cover materials, the subgrade materials will be stripped of any vegetation, graded to a uniform slope, and compacted. Construction personnel will obtain the approval of the subgrade from QA personnel before beginning construction of the final cover systems.

Following a visual inspection and approval of the subgrade by QA personnel, a licensed land surveyor will perform a topographic survey of the site using a 50 foot by 50 foot grid interval over the entire area to be lined or capped. Grade stakes will be used to establish the appropriate subgrade elevations. The survey will be referenced to a horizontal control onsite. The survey will be the determining factor in checking that the subgrade has been graded to the minimum approved elevations.

The minimum thickness of each layer (i.e.; cover soil layer, etc) will be confirmed by contracting with a land surveyor licensed in New York State for the performance of a topographic survey of the site following completion of the construction of each layer. The licensed land surveyor will utilize the same grid system throughout all stages of the geomembrane and final cover construction. Construction personnel will obtain the approval of the Engineer for a minimum layer thickness before placement of subsequent layers.

4.6 SOIL-BENTONITE SLURRY TRENCH CUTOFF WALL

4.6.1 General

The slurry wall installation contractor will be responsible for developing, performing, and documenting all quality control procedures performed before, during, and after slurry wall installation. A QAP covering aspects of the project to be performed by the contractor will be submitted by the contractor for approval prior to performance of any work. This QAP will include tasks to be performed before, during, and after slurry wall installation. Specific QA considerations which should be included in this plan are discussed below.

4.6.2 QA Measures Prior to Installation

The quality control measures performed prior to slurry wall installation will include a series of bench scale tests using soil from proposed borrow soil sources. The complete test procedures will be described in the installation contractor Work Plan and submitted prior to initiating construction of the wall. This testing will be done in order to determine the appropriate design and mixture of soil, bentonite, and additives, if required, that will meet the required specifications and be compatible with the site conditions. At a minimum, the testing shall demonstrate the following:

- Ability of bentonite slurry/soil backfill to achieve and maintain the desired permeability of less than 1×10^{-7} cm/sec.
- Determine the optimal mix ratio of soil, bentonite, and additives.

The materials used for mix design will be soils from the proposed borrow source. These materials will also be tested for applicable geophysical properties such as type and grain size distribution.

4.6.3 QA Measures During and After Installation

QA measures to be performed during installation include inspection and testing of the trench and wall construction, as well as testing of the construction materials. The two critical excavation considerations are trench continuity and key integrity. The continuity of the trench will be demonstrated by passing the excavation equipment vertically and horizontally along the trench to ensure that the entire trench is full excavated. All loose material will be removed from the bottom of the trench to ensure that the wall is fully keyed into the clay unit. Penetration of the bottom of the trench into the clay unit will be assured by observation of the cuttings removed from the trench and by comparing direct trench depth measurements to anticipated depths based on design soil borings.

Construction material quality control will involve testing of the bentonite, the backfill, the slurry, and the mix water. Permeability testing of the backfill mix will be performed in a laboratory on material samples collected from the material being used to backfill the trench to verify the maximum permeability of 1×10^{-7} cm/sec is achieved. In addition, *in situ* permeability of the placed backfill will be determined by installing several temporary piezometers in the slurry wall. Permeability will be determined by the falling head test method.

4.7 WELL INSTALLATION QA MEASURES

4.7.1 Drilling Methodology and Well Construction

The pumping wells and observation wells (piezometers) will be drilled using hollow-stem augering techniques. Specifications for these pumping wells will follow those described in the Technical Specifications.

Pumping wells will be constructed of a 6-inch diameter continuous wrapped stainless steel 0.020 to 0.040-inch screen, approximately 15 feet in length, and 6-inch diameter stainless steel riser. Screens and risers will be flush-jointed. After installation of the screen, a filter pack consisting of washed silica sand will be placed in the annular space to a height at east two feet above the top of the screen. A three-foot seal consisting of bentonite pellets, or where conditions do not permit, a bentonite slurry will be placed above the sand pack.

Piezometers and new monitoring wells will be constructed of 2-inch diameter stainless steel screens, and 2-inch diameter stainless steel risers. The slot size for the piezometer screens will vary from 0.006-inch to 0.020-inch depending upon the grain size of the lithologic unit into which the screen is installed. Screen lengths of piezometers will range form 5 to 15 feet. Screens and risers will all be flush-jointed. After installation of the screen, a filter pack consisting of washed silica sand will be placed in the annular space to a height at least two feet above the top of the screen. The sand will be sized in accordance with the screen slot size. A three-foot seal consisting of bentonite pellets, or a bentonite slurry will be placed above the sand pack. An above grade steel protective casing with a lockable cap will then be cemented in place.

4.7.2 Well Development

All newly installed wells will be developed after a minimum time of 24 hours of well construction. This time is necessary to ensure that the grout and concrete used in the installation process had adequate time to cure. Development will be accomplished by pumping with a submersible pump, air jetting, or dual line air development.

4.8 HORIZONTAL AND VERTICAL CONTROL

Horizontal and vertical controls will be established on the project site using the methodology described in Exhibit B. All QA testing locations will be referenced to the 50 foot by 50 foot grid established.

The horizontal and vertical controls established will be used to develop the as-built site drawings and to verify thickness of the soil layers for the site and panel locations for geomembrane installation, slurry trench cutoff wall alignment, extraction well and monitoring well locations, and other site features.

4.9 DOCUMENTATION TO DEMONSTRATE COMPLIANCE

Documentation testing performed on the soil materials and synthetic materials for use in the final cover systems shall be submitted to the Engineer for review. Typical forms used for reporting this information are included in Exhibit A. Copies of all tests shall be submitted to the NYSDEC as part of the certification documentation from Engineer. Documentation to demonstrate compliance shall include the following report forms:

- Particle Size Distribution Curve (where required);
- Permeability Test Report (where required);
- Standard and Modified Proctor, Moisture-Density Curve (where required);
- Daily Inspection Report - to be prepared by QA personnel;
- Certification from Contractor demonstrating material tested offsite is same as material delivered to site;
- Peal and shear testing reports; and
- Non-destructive Field Geomembrane Field Test Reports.

TABLE 4.1

BUFFALO COLOR AREA "D" SITE
CONSTRUCTION QUALITY ASSURANCE
TESTING FREQUENCIES

TEST	FREQUENCY
MATERIALS EVALUATION:	
For Offsite Fill:	
Mechanical Gradation Analysis (ASTM D422, D421)	1 per 5,000 cu. yds.
For Cover Soil Layer:	
Mechanical Gradation Analysis (ASTM D422, D421)	1 per 5,000 cu. yds.
Gradation Analysis (ASTM D422, D421)	1 per 5,000 cu. yds.
For Topsoil Layer:	
Mechanical Gradation Analysis (ASTM D422, D421)	1 per 5,000 cu. yds.
Gradation Analysis (ASTM D422, D421)	1 per 10,000 cu. yds.
Soil pH (ASTM D4922)	1 per 10,000 cu. yds.
Organic Content (ASTM D2974)	1 per 10,000 cu. yds.
For Geomembrane:	
Melt Index (ASTM D123:A)	1 prior to lot shipment and any new lots
Density (ASTM D1505A)	1 prior to lot shipment and any new lots
CONSTRUCTION QUALITY EVALUATION:	
For Fill Placement:	
Compaction Evaluation	Continuous
For Cover Soil Layer:	
Thickness Evaluation	Survey at 50 foot by 50 foot grid points upon layer completion
Compaction Evaluation (visual)	Continuous
For Topsoil Layer:	
Thickness Evaluation	Survey at 50 foot by 50 foot grid points upon layer completion
Compaction Evaluation (visual)	Continuous
For Geomembrane:	
Visual	Continuous
Peel Strength (ASTM D4437/413)	1 per crew per day
Bond Seam Strength (ASTM 4437/3083)	1 per crew per day
Non-Destructive Seam Tests (per procedure used)	Along all completed seams
For Geonet:	
Visual	Continuous
For Geotextiles:	
Visual	Continuous

SECTION 5

SOIL SAMPLING AND TEST STRATEGIES

5.1 GENERAL

Generally, one of the three methods will be utilized to collect soil samples for analysis. One method is to collect the samples by digging a series of representative test pits at the borrow area and obtaining samples from them. Another method involves collecting samples from representative stockpiles (normally after the material has been mechanically screened or prepared). The final method involves taking representative samples of material as they are being placed in the field. These procedures are discussed in Section 5.2.

5.2 SOIL SAMPLING METHODS

5.2.1 Borrow Area Test Pit Sampling Method

In accordance with the technical specifications, all soil obtained from the borrow area shall be tested for and comply with the gradation defined in Section 02200. Periodic grain size analysis will be conducted on every 5,000 cubic yards of material.

Sampling Procedures

Step 1: Using a shovel, collect a sample at approximately mid-depth at each of the sampling locations representing 1,000 cubic yards of the proposed excavation area.

Step 2: Transfer each sample into a separate container.

Step 3: Attach label to container and record location referencing the established grid system in the borrow area.

Step 4: Deliver the samples to the laboratory for analysis as soon as possible.

Sample Containers

Plastic 5-gallon buckets or plastic bags will be used to transport soil samples to the laboratory for analysis.

5.2.2 Stockpiled Soil Sampling Method

As shown in Figure 5-2, 12 samples of approximate equal volume will be collected by QA personnel from the top, middle, and bottom of each 1,000 cubic yards stockpile. The samples will be composited in the field to provide a representative composite sample per specified frequency.

Sampling Procedures

Step 1: Using a shovel, excavate into the pile to a depth of about two to three feet.

Step 2: Collect a sample using a shovel.

Step 3: Repeat Steps 1 through 3 at each of the sampling points (see Figure 5-2).

Step 4: Mix subsamples, using a shovel, into one homogeneous mass and place in a properly labeled container.

Step 5: Attach label to container and record necessary data in field log book.

Step 6: Return remaining contents of composite sample to stockpile.

Step 7: Deliver the composited sample to the laboratory for analysis as soon as possible.

Sample Containers

Plastic 5-gallon buckets or plastic bags will be used to transport soil samples to the laboratory for analysis.

5.2.3 Field Placed Soil Sampling Method

Soil samples of approximate equal volume will be collected from incoming truck loads of soil. Typically, a small volume of soil will be collected from every fourth truck load of soil. The collected soil samples will be composited in the field to provide a representative composite sample for the specified frequency of soil placed.

Sampling Procedures

Step 1: Using a shovel, collect sample from every fourth truckload of soil.

Step 2: Repeat step 1 as often as necessary to collect a sufficient volume of soil representative of 1,000 cubic yards of soil placed.

Step 3: Mix subsamples, using a shovel, into one homogeneous mass and place in a properly labeled container.

Step 4: Attach label to container and record necessary data in field log book.

Step 5: Deliver the composited sample to the laboratory for analysis as soon as possible.

Sample Containers

Plastic 5-gallon buckets or plastic bags will be used to transport soil samples to the laboratory for analysis.

5.3 SAMPLE IDENTIFICATION AND DATA COLLECTION

5.3.1 Sample Identification

All soil samples will be identified with chain-of-custody labels which will include the following information:

- Project Name;
- sample number;
- initials of QA inspector or sample collection personnel;

- date of collection; and
- location of collection (i.e.; stockpile number and/or location).

5.3.2 Field Data

All information pertinent to each sampling event will be recorded. Each report will correspond to a test pit and will contain the following information:

- sample number;
- approximate location of test pit or sample location;
- field observation;
- climatologic conditions;
- date of collection; and
- name of person collecting sample.

5.4 COMPOSITE SOIL SAMPLING METHOD (FOR MATERIALS EVALUATION)

The sample to be used for laboratory tests run at specified frequencies will be a composite of sample aliquots (collected by field personnel in accordance with Section 5.2) of the appropriate number of 1,000 cubic yard samples. The samples will be composited in the laboratory. The composite samples of soil will then be thoroughly mixed and quartered with one (1) quarter being used as the representative sample for testing.

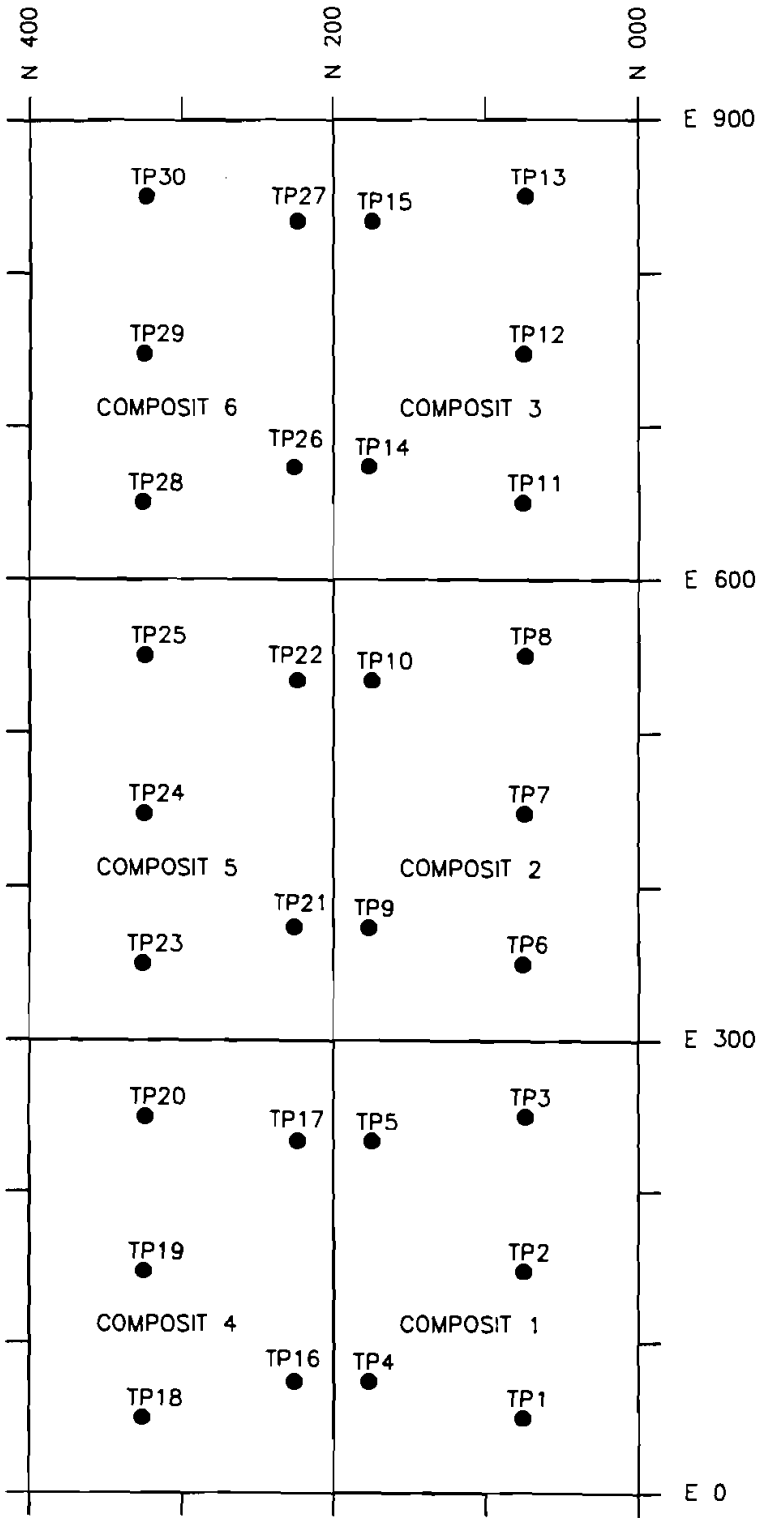
5.5 IN-PLACE MOISTURE-DENSITY TESTS

The frequency of moisture-density testing is discussed in the Technical Specifications for various earthen materials. These test will be spaced at approximately 70-foot intervals (assuming that the acre-lift is square). These intervals will be taped off in the field. The QA inspector may determine that more than the minimum (i.e.; nine) required moisture-density tests per acre are necessary to accurately evaluate the quality of the compacted soil lift being evaluated. Any additional tests deemed necessary will be located at the QA inspector's discretion and tied into a grid system.

5.6 TREATMENT OF LABORATORY TEST RESULT OUTLIER

Occasionally, one laboratory test value deviates markedly from the remainder of the test values. Such a value is called an outlier. When an outlier is determined to exist, the following procedures will be followed by laboratory personnel:

- Recalculate the test value checking for math errors;
- Check any values used for comparison, making sure they were the correct values to be used;
- If outlier value(s) still exists, perform test again on the same soil sample; and
- If outlier value(s) still exists, discuss value(s) and course of action with Engineer,



LEGEND

TP TEST PIT

NOT TO SCALE

FIGURE 5-1

CONSTRUCTION QA PLAN
BORROW AREA SAMPLING
PROCEDURES DIAGRAM

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
200 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, N.Y. 13088 • 315/451-9560
OFFICES IN PRINCIPAL CITIES

DATE: 01/31/96 (SEH)
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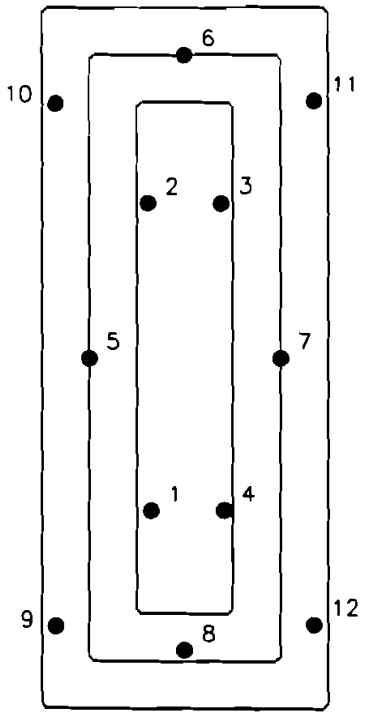
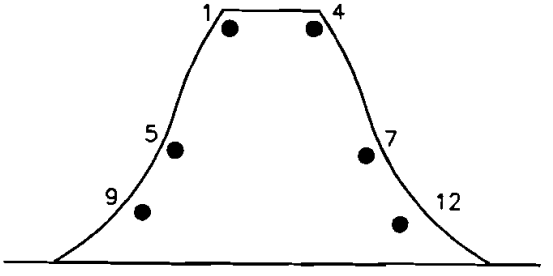


PLAN



SECTION

NOT TO SCALE

FIGURE 5-2

CONSTRUCTION QA PLAN
STOCKPILE SAMPLING
PROCEDURES DIAGRAM

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, N.Y. 13088 • 315/451-9560
OFFICES IN PRINCIPAL CITIES

DATE: 01/31/96 (SEH)
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SECTION 6

CORRECTIVE MEASURES

6.1 SOIL LAYERS

When material or work is rejected because field observations or tests indicate that it does not meet the design specifications, corrective measures must be implemented. For questionable material or workmanship, additional testing may be necessary. The following are procedures and corrective measures to be followed for QA Testing problems which are likely to occur:

- **Excessive Drying or Wetting of Stockpiles Soil.** If excessive drying or wetting of stockpiled soil becomes a problem, consideration will be given to cover the piles with plastic sheets to minimize moisture loss or gain until the material is utilized in the construction activities. Water can also be sprayed on the stockpile to prevent drying.
- **In Place Moisture-Density Test Failures.**
  - Moisture - When the moisture content is determined to be too far below optimum, the compacted soil will be disked and moisture added to achieve a moisture content greater than optimum prior to recompaction. When the moisture content is so high that the soil cannot be compacted to required density limits, the soil will be disked or scarified and left to dry in the sun and wind prior to recompaction. If this action does not result in sufficient drying, the soil will be removed and stockpiles until it dries to an acceptable moisture content.

    Under either failure condition, the extent of work will include the area delineated by a circle with the center at the location of the failed test and a radius corresponding to the distance from the location of the failed test to the nearest passing test or to a closer passing test as determined by additional testing. Retesting will be performed within 10 feet of the original location of the failed test after corrective measures have been taken.
  - Density. If the compaction is less than the specified maximum dry density, or is not considered acceptable using the procedures described in Exhibit C, the lift of soil in the work area shall be deemed unacceptable. The soil will be removed and set aside for alternative uses. The extent of the work area will include the area delineated by a square with the center at the failed test and a rectilinear dimension of 50 feet. Retesting will be performed within 10 feet of the original failed test after corrective measure have been taken.
  - Ponding of Water on Completed Cover Soil Layers, Lifts, or Subgrades. If ponding of water on completed, compacted layers, lifts, or subgrades

become a routine problem, the completed surfaces which are to receive additional lifts of compacted soil will be rolled with a smooth drum roller at the end of each day. This will limit ponding as well as help to minimize drying and desiccation cracking. The affected area will be scarified prior to placement of the next lift of soil.

Observations and test results which indicate adverse conditions not corrected by the Contractor, should be well documented and discussed with the Engineer before specifying corrective measures to AlliedSignal, Inc.. The general procedure for handling QA problems or differences (not specifically discussed above) is specified in Section 3.2.3.

6.2 GEOMEMBRANE

When material or work is rejected because field observation or tests indicate that it does not meet the design specifications, corrective measures must be implemented. For questionable material or workmanship, additional testing may be necessary. The following are procedures and corrective measures to be followed for QA testing problems which are likely to occur:

- Seam Strength. If a seam fails to achieve the appropriate strength after an adequate curing period, the seam will be replaced using appropriate methods described in the specifications and retested.
- Non-Destructive Testing. If non-destructive testing methods reveal an inadequately bonded seam, the seam will be repaired using appropriate methods described in the specifications and retested.
- Damaged In-Place Geomembrane. Any damage occurring to the geomembrane after the geomembrane has been installed, seamed, and tested will be repaired. All patching will be performed, and tested with the same level of standards as the initial installation.
- Inadequate Subgrade. If the subgrade to receive the geomembrane has been deemed unacceptable, refer to Section 6.1 for corrective measures or barrier layer soils.

Observations and test results which indicate adverse conditions not corrected by the Contractor, shall be well documented and discussed with the Engineer before specifying corrective measures to AlliedSignal, Inc. The general procedure for handling QA problems or differences (not specifically discussed above) is specified in Section 3.2.3.

6.3 GEONET DRAINAGE LAYER

When material or work is rejected because field observations indicate that it does not meet the design specifications, corrective measures must be implemented. The following are procedures and corrective measures to be followed for QA problems which are likely to occur.

- Damaged In-Place Geonet. Any damage occurring to the geonet drainage layers after installation will be repaired. All repair work will be performed in

accordance with the Manufacturer's recommendations and with the same level of standards as the initial installation.

- Damaged Underlying Materials. If underlying materials to receive the geonet drainage layer has been deemed unacceptable, appropriate corrective measures to underlying materials will be required. Observations and test results which indicate adverse conditions not corrected by the Contractor shall be well documented and discussed with the Engineer before specifying corrective measures to AlliedSignal, Inc. The general procedure for handling QA problems or differences (not specifically discussed above) is specified in Section 3.2.3.

6.4 GEOTEXTILES

When material or work is rejected because field observations indicate that it does not meet the design specifications, corrective measures must be implemented. The following are procedures and corrective measures to be followed for QA problems which are likely to occur:

- Damaged In-Place Geotextiles. Any damage occurring to the geotextile layers after geotextiles have been installed will be repaired. All repair work will be performed in accordance with Manufacturer's recommendations and with the same level of standards as the initial installation.
- Inadequate Subgrade. If the subgrade to receive the geotextile layer has been deemed unacceptable, refer to Section 6.1 for corrective measures for soils.

Observations which indicate adverse conditions not corrected by the Contractor, shall be well documented and discussed with the Engineer before specifying corrective measures to AlliedSignal, Inc. The general procedure for handling QA problems or differences (not specifically discussed above) is specified in Section 3.2.3.

6.5 COLLECTION/DRAINAGE PIPE

When material or work is rejected because field observations indicate that it does not meet the design specifications, corrective measures must be implemented. The following are procedures and corrective measures to be followed for QA problems which are likely to occur.

- Damaged In-Place Collection/Drainage Pipe. Any damage occurring to the collection/drainage piping after installation will be repaired. All repair work will be performed in accordance with Manufacturer's recommendations and with the same level of standards as the initial installation.
- Damaged Underlying Materials. If underlying materials to receive the collection/drainage piping has been deemed unacceptable, appropriate corrective measures to underlying materials will be required.

Observations and test results which indicate adverse conditions not corrected by the Contractor shall be well documented and discussed with the Engineer before specifying corrective measures to AlliedSignal, Inc. The general procedure for handling QA problems or differences (not specifically discussed above) is specified in Section 3.2.3.

6.6 SLURRY WALL

When material or work is rejected because field observations indicate that is does not meet technical specifications, corrective measures must be implemented. Details regarding potential problems and corrective measures associated with the slurry wall are provided in technical specification 02296.

SECTION 7

DOCUMENTATION

7.1 GENERAL

Construction QA Engineer will document all activities associated with the construction of the Area "D" Site remedial action systems. Such documentation will include, at a minimum, daily report of construction activities, photographs, and sketches as necessary. Field investigation reports will be filled out by the QA Engineer or specialty QA personnel when major QA questions arise (see Form F, Exhibit B) at the site.

7.2 CONSTRUCTION MONITORING

Construction of the Area "D" Site remedial action systems and appurtenant items will be monitored by QA personnel.

7.2.1 Daily Monitoring Reports

Standard daily reporting procedures will include preparation of a summary report with supporting data sheets and, when appropriate, problem identification an corrective measures reports (see Form G of Exhibit B for Daily Report).

A report will be prepared and submitted to the QA Engineer daily by onsite personnel. These reports will provide the chronological framework for identifying and recording all other reports. Additional information which may be included on the forms by the QA personnel includes:

- Unit processes and locations of construction under way during the time frame of the daily monitoring report;
- Equipment and personnel working in the area including subcontractors;
- Descriptions of areas being monitored and documented; and
- Description of off-site materials received, including any quality verification (vendor certification) documentation.

7.2.2 Data Sheets

All field an/or laboratory tests will be recorded on data sheets. The following data sheets will be utilized:

- Laboratory Testing Summary Report;
- Grain Size Distribution Test Report;
- Proctor Test Report (where required);
- Permeability Test Results (Undisturbed Shelby Tube and Recompacted, where required); and

- Nuclear Density Test Data.

The completed reports will be available onsite and will be submitted to the NYSDEC as part of the final Construction Certification Report.

7.2.3 Problem Identification and Corrective Measures Reports

A problem identification report (see Form H, Exhibit B) and a corrective measure report (see Form I, Exhibit B) will be completed whenever major field problems are encountered and corrective measures may be necessary. These reports will be attached to the associated daily reports.

The NYSDEC will be notified by AlliedSignal, Inc. of problems requiring modifications to design plans and details prior to proceeding or completion of the construction item. Changes or additions will be noted on construction record drawings.

7.2.4 Acceptance of Completed Components

All daily reports, data sheets, problem identification, and corrective measures reports will be reviewed by the Engineer. The documentation will be evaluated and analyzed for internal consistency and for consistency with similar work. Timely review of these documents will permit errors, inconsistencies, and other problems to be detected and corrected as they occur.

The above information will be assembled and summarized as part of the final Construction Certification Report. The report will indicate that the materials and construction processes comply with the engineering plans and specifications for this project.

7.3 FINAL CONSTRUCTION CERTIFICATION REPORT

Construction QA Consultant will prepare a final construction certification report for remedial action construction addressing each item identified above. The report will include an analysis of the contractor's compliance with the project plans and specifications and a summary of QA sampling and testing. The report will also include:

- Scale drawings depicting a topographic survey of the site before and after construction of each layer of the final cover;
- Record drawings;
- Statements pertaining to the extent of construction (i.e.; depths plan dimensions, elevations, and thickness);
- A discussion of any remedial actions which were necessary. This will include a description of the overall circumstances, actions taken, and results of retesting; and
- Certification copies for all synthetic materials used in the geomembrane system, "as-built" panel layout sheets showing all panel seams, test locations, and repairs.

7.4 CERTIFICATION OF REMEDIAL ACTION CONSTRUCTION

Upon final completion of the remedial action construction, AlliedSignal, Inc. and CQA Consultant shall submit to the NYSDEC in conjunction with the Final Construction Certification Report, certification that the Area "D" Site Remedial Action has been constructed in accordance with the specifications, requirements, and NYSDEC approved modifications (if any) and is fully capable of being operated and maintained in accordance with the specifications and requirements of the Remedial Design Report. The certification report, including all plans, shall be signed by a NYS-registered Professional Engineer.

7.5 STORAGE OF RECORDS

During the remedial construction phase, the Engineer will be responsible for all facility QA documents. This includes the Engineer's copy of the design criteria, engineering design plans, and specifications, the Construction QA Plan, and the originals of all data sheets and reports. All originals will be maintained in the QA Engineer's office. Duplicate records will be kept in the field office to avoid loss of this information if the originals are destroyed.

Once the facility construction is complete, the document originals will be stored by AlliedSignal, Inc. in a manner that protects them from any damage. A final construction certification report will be kept by the NYSDEC in a publicly acknowledged repository. All documentation will be maintained through the post-closure monitoring periods of the site.

EXHIBIT A

STANDARD DOCUMENTATION FORMS

Project.....
Project Number..
Location.....

Sample Number	Moisture Content %	Gravel %	Sand %	Silt %	Clay %	Classification
P 11	12.0	32.6	20.1	31.6	15.7	GC
P 12	10.4	31.4	22.3	24.5	21.8	GC
P 13	10.2	29.3	22.6	25.4	22.7	GC
P 14	11.3	27.6	22.7	35.0	14.7	GC
P 15	11.4	27.3	22.4	35.0	15.3	CL
P 16	11.0	26.8	22.4	32.7	18.1	CL
P 17	9.6	28.8	23.8	30.3	17.1	GC
P 18	10.0	30.4	22.8	31.3	15.5	GC
P 19	11.1	26.5	23.4	27.7	22.4	CL
P 20	11.4	25.1	22.5	36.3	16.1	CL

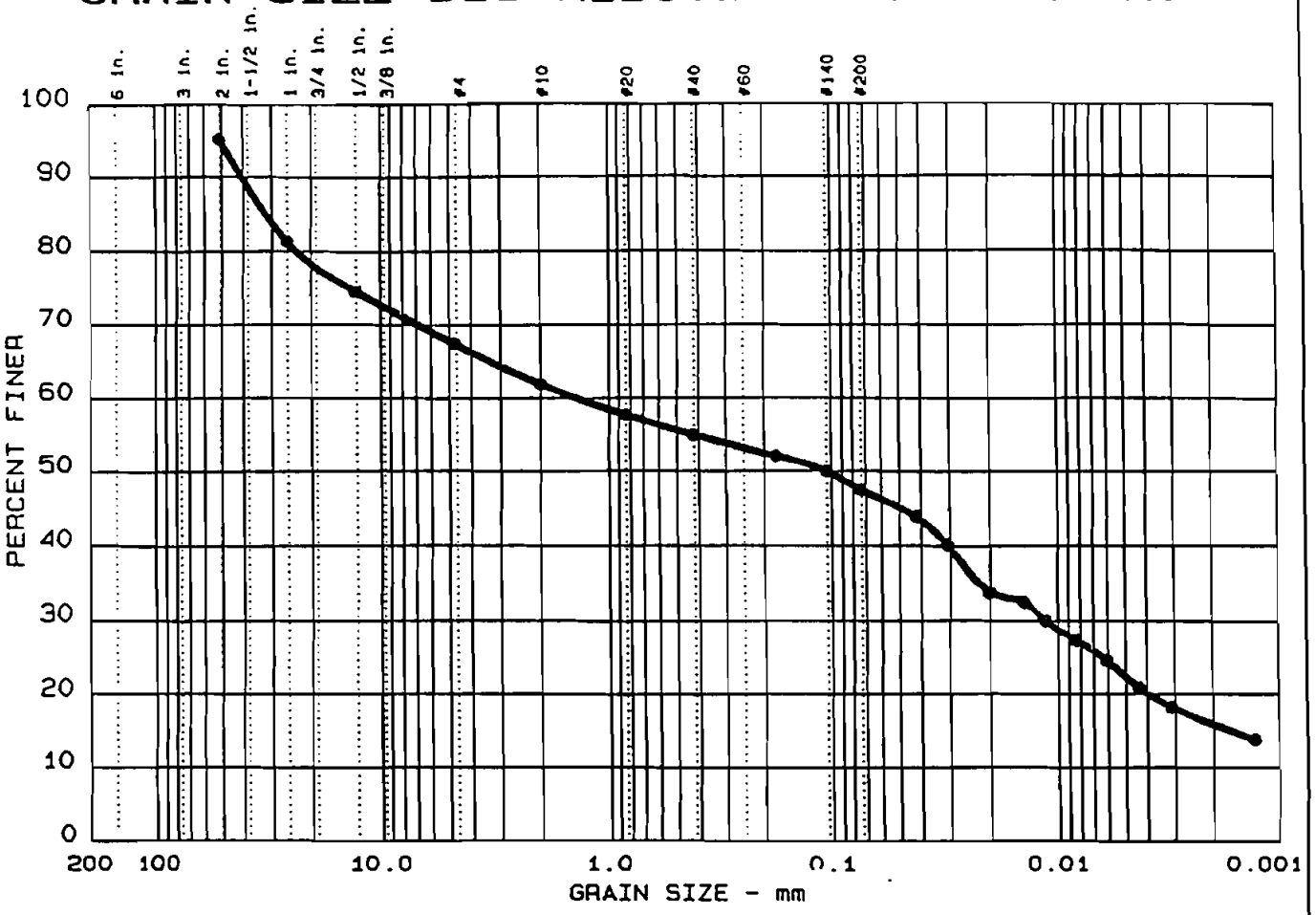
FORM A
1 of 2

Project.....
Project Number..
Location.....

Sample Number	Liquid Limit %	Plasticity Index	Optimum Moisture Content %	Maximum Dry Density pcf	Permeability cm/sec
COMP 4	28.8	8.7	10.4	132.1	5.3 E -9
COMP 5	28.5	9.3	10.7	134.7	1.0 E -8

FORM A
2 of 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	1	0.0	32.6	20.1	31.6	15.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
●	28.8%	8.7	31.62	1.41	0.11	0.011	0.0017			

	MATERIAL DESCRIPTION	USCS	AASHTO
●	BROWN, GRAVELLY, SILTY	GC	-

Project No.:
Project:
● Location:

Date:

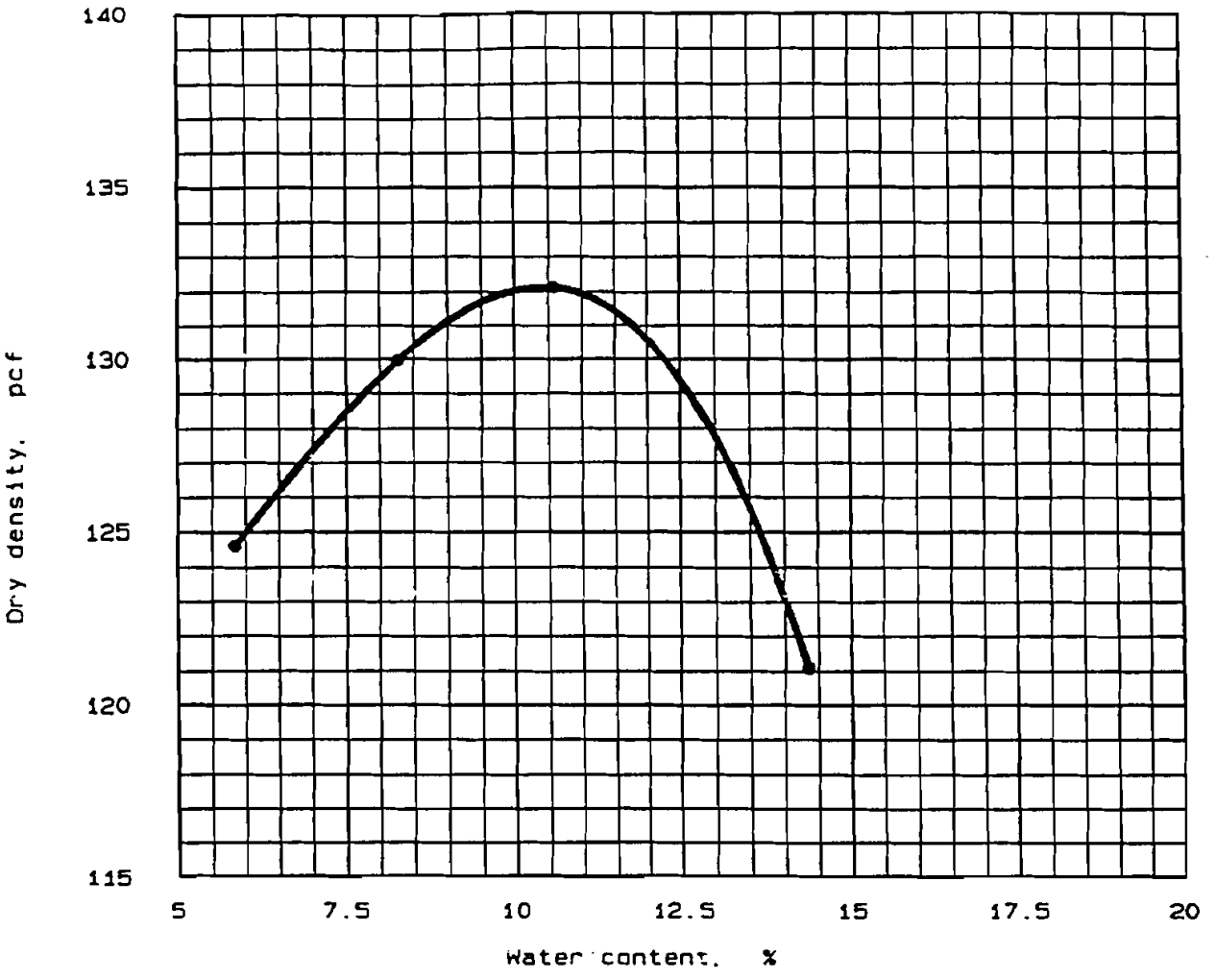
GRAIN SIZE DISTRIBUTION TEST REPORT

Remarks:
-
-
-
-

Figure No. -

FORM C

PROCTOR TEST REPORT



"Modified" Proctor, ASTM D 1557, Method C

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				2.65			%	%

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 10.4 % Maximum dry density = 132.1 pcf	YELLOW BROWN, VERY ROCKY

Project No.:

Project:

Location:

Date:

Remarks:

PROCTOR TEST REPORT

Figure No.

Project.....
Project Number..
Location.....

PERMEABILITY TEST RESULTS

SAMPLE PARAMETERS	INITIAL	FINAL
Height.....(in)	2.75	2.75
Diameter.....(in)	2.875	2.875
Wet Density.....(pcf)	142.73	148.39
Moisture Content.....(%)	11.0	11.4
Optimum Moisture Content..(%)	-	-
Dry Density.....(pcf)	128.6	133.2
Percent Compaction.....(%)	-	-
Saturation.....(%)		

TEST PARAMETERS	
Test Type.....	UNDISTURBED
	CONSTANT HEAD
Head Pressure.....(psi)	9
Back Pressure.....(psi)	6
Chamber Pressure..(psi)	11
Fluid.....	DEAIRED WATER
Permeation Time..(days)	8

TEST RESULTS

Coefficient of Permeability, K..(cm/sec) 1.2 E -7

FORM D

FORM E

Project: _____ Date: _____

Client: _____ Job No. _____

Contractor: _____ Type of Material: _____

Proctor Test Data- Maximum Density: _____ Optimum Moisture Content: _____

NUCLEAR GAGE STANDARD COUNTS Density: _____ Moisture: _____

TEST NUMBER												
DEPTH OR ELEVATION												
MODE AND DEPTH												
DENSITY COUNT												
DENSITY COUNT RATIO $\left(\frac{DC}{SC}\right)$												
WET DENSITY (pcf)												
AIR GAP COUNT												
AIR GAP COUNT RATIO $\left(\frac{AGC}{SC}\right)$												
AIR GAP DENSITY												
MOISTURE COUNT												
MOISTURE COUNT RATIO $\left(\frac{MC}{SC}\right)$												
MOISTURE (pcf)												
DRY DENSITY (pcf)												
PERCENT MOISTURE												
PERCENT COMPACTION												

TEST NO.	LOCATION OR REMARKS

INSPECTION TIME: _____

INSPECTOR: _____ TITLE: _____

DATA CHECKED BY:

FORM F

FIELD INVESTIGATION REPORT

DATE _____

DAY | S | M | T | W | TH | F | S |

Project Name _____ Job No. _____

Contractor _____

Subject _____

_____

WEATHER	Brite Sun	Clear	Overcast	Rain	Snow
TEMP.	To 32	32-50	50-70	70-85	85 up
WIND	Still	Moder	High	Report No	
HUMIDITY	Dry	Moder	Humid		

DISTRIBUTION:
1. Proj. Mgr.
2. Field Office
3. File
4. Owner

Signature _____ Title _____

Wiley-Fisk Form 8-3

ENGINEERING-SCIENCE, INC.

FORM G

DAILY FIELD REPORT

JOB NAME _____ DATE _____
PROJECT _____ REPORT NO. _____
JOB NO. _____ SHEET _____ OF _____
LOCATION _____ WEATHER _____
CLIENT _____ TEMP _____ AT _____ AM/PM

WORK IN PROGRESS OR COMPLETE (INCLUDING SUBCONTRACTORS):

CONTRACTOR EQUIPMENT	QUANTITY	CONTRACTOR WORK FORCE	QUANTITY

VERBAL DISCUSSIONS/INSTRUCTIONS

REQUEST FOR PROJECT ACTION

VISITORS

ACCIDENTS REPORTED TODAY _____
ACCIDENTS TO DATE _____

_____
E-S REPRESENTATIVE

_____
CLIENT REPRESENTATIVE

CS-109(7/90)

PROBLEM IDENTIFICATION REPORT

FORM H

DATE _____

DAY | S | M | T | W | TH | F | S |

Project _____ Job No. _____

Contractor _____

Subject _____

WEATHER	Sunny	Clear	Overcast	Rain	Snow
TEMP.	To 32	32-40	50-70	70-85	85 up
WIND	Still	Moderate	High	Report No.	
HUMIDITY	Dry	Moderate	Humid		

PROBLEM DESCRIPTION (Reference Daily Report No.): _____

PROBLEM LOCATION - REFERENCE TEST RESULTS AND LOCATION (Note: Use sketches on back of form as appropriate): _____

PROBABLE CAUSES: _____

SUGGESTED CORRECTIVE MEASURES: _____

APPROVALS:

QA ENGINEER: _____

PROJECT MANAGER: _____

DISTRIBUTION: 1. Proj. Mgr.
2. Field Office
3. File
4. Owner

QA Personnel Signature _____

Wiley-Fisk Form 8-3

CORRECTIVE MEASURES REPORT

FORM I

DATE _____

DAY | S | M | T | W | TH | F | S |

Project _____ Job No._____

Contractor_____

Subject _____

WEATHER | | | | | |

TEMP. | | | | | |

WIND | | | | |

HUMIDITY | | | | |

CORRECTIVE MEASURES UNDERTAKEN (Reference Problem Identification Report No.): _____

RETESTING LOCATION: _____

SUGGESTED METHOD OF MINIMIZING RE-OCCURRENCE: _____

APPROVALS:

QA ENGINEER: _____

PROJECT MANAGER: _____

DISTRIBUTION: 1. Proj. Mgr.
2. Field Office
3. File
4. Owner

QA Personnel
Signature _____

EXHIBIT B

ESTABLISHING HORIZONTAL AND VERTICAL CONTROL, AND SITE GRID SYSTEM

ESTABLISHING HORIZONTAL AND VERTICAL CONTROL, AND SITE GRID SYSTEM

1.0 INTRODUCTION

This guideline presents a method for establishing horizontal and vertical controls creating a grid system for field surveys at a project site. It is imperative that this procedure be performed accurately, as all topographic and site maps will be based on these controls and creating a grid system for field surveys. This grid will be used for horizontal control of sampling points.

2.0 METHODOLOGY FOR HORIZONTAL AND VERTICAL CONTROL POINTS

1. Procedures for Establishing Horizontal Primary Control:
    a. research the State Plan Coordinate Data or any other applicable horizontal control monuments;
    b. at the project site, recover the above-mentioned monuments;
    c. establish reference points on the primary traverse;
    d. turn angles and measure distances from the reference points to the horizontal control point; and
    e. compute closures and adjust the traverse.
2. Procedures for Establishing Vertical Primary Control:
    a. research monuments for vertical control if different that those previously found;
    b. recover the monuments in the field;
    c. set the project benchmarks;
    d. run a level line from the monuments to the set project benchmarks and back;
    e. reduce field notes and adjust the benchmark elevations; and
    f. prepare the recovery sketches.

3.0 METHODOLOGY FOR ESTABLISHING A GRID SYSTEM

1. Set up convenient grid lines onsite from the previously established horizontal control lines (see Establishing Horizontal and Vertical Control Guidance Procedure).
2. Mark lines at the specified grid interval with ribbon or wooden stakes.
3. Use prisms to create right angle lines.
4. Mark the right angle at the specified grid interval with ribbon or wooden stakes.
5. Record all information and sketches in a field notebook.

ATTACHMENT 3

CONTRACTOR/CONSULTANT PREQUALIFICATION FORM

CONTRACTOR'S QUALIFICATION STATEMENT

The undersigned certifies under oath the truth and corrections of all statements and all answers to questions made hereinafter.

Submitted to: _____

Address: _____

_____

Submitted by: _____

Name: _____

Address: _____

__ Corporation __ Partnership __ Individual
__ Joint Venture __ Other

GENERAL INFORMATION

1. How many years has your organization been in business as a General Contractor?

   _____

2. How many years has your organization been in business under its present name?

   _____

3. Under what other or former names has your organization operated?

   _____
   _____
   _____
   _____

4. If a corporation answer the following:
   a. Date of incorporation:
   b. State of incorporation:
   c. President's name:
   d. Vice-President's name(s):
   e. Secretary's name:
   f. Treasure's name:

5. If an individual or partnership answer the following:
   a. Date of organization:
   b. Name and address of all partners (State whether general of limited partnership):

6. If other than a corporation or partnership, describe organization and name principals:

7. List states and categories in which your organization is legally qualified to do business. Indicate registration or license numbers, if applicable. List states in which partnership or trade name is filed.

QUALIFICATIONS

8. List the work you normally perform with your own forces.

9. Have you ever failed to complete any work awarded to you? If so, note when, where, and why:

10. Within the last five years, has any officer or partner of your organization ever been an officer of partner of another organization when it failed to complete a construction contract? If so attach a separate sheet of explanation.

11. List major construction projects your organization has in process, giving the name of project, owner, architect, contract amount, percent complete, and scheduled completion date. Use a separate sheet if required.

12. List the major projects your organization has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion, and percentage of the cost of the work performed with your own forces. Use a separate sheet if required.

13. List the construction experience of the key individuals of your organization. Use a separate sheet if required.

REFERENCES

14. List three Trade References:

15. List three Bank References:

16. Name of Bonding Company and name and address of agent:

FINANCIAL DATA

17. Attach a financial statement, audited if available, including Contractor's latest balance sheet and income statement showing the following items:

    a. Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses):

b. Net Fixed Assets:

c. Other Assets:

d. Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries, and accrued payroll taxes):

e. Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus, and retained earnings):

18. Name of firm preparing financial statement and date thereof:

19. Is this financial statement for the identical organization named on page one?

20. If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidary).

21. Will this organization act as guarantor of the contract for construction?

CONTRACTOR SAFETY DATA

22. Workers Compensation Insurance

a. Please obtain from your insurance agent (or state fund, if applicable, your interstate Experience Modification Rates (EMRs) for the last three rating periods. If you do not have an interstate rating, obtain your intrastate EMRs. Then complete the following data.

	Effective Dates	Modification Rate
Current policy year		
1 year previously		
2 years previously		

b. Are the above rates interstate or intrastate?_____If intrastate, which state?_____

c. Is your firm self-insured for workers compensation? ____yes ____no

d. Furnish a letter from your insurance agent, insurance carrier, or state fund (on their letterhead) verifying the EMR data listed above.

23. OSHA Recordable Incidents

a. Using your firm's OSHA 200 Log from last year, complete the following information:

- Total number of fatalities from columns 1 and 8 _____
- Total number of recordable injuries and illnesses on OSHA 200 Log _____

b. Provide total employee hours worked last year by your firm (include field and office personnel) _____

c. If you did not complete OSHA 200 Log last year, specify reason below:

_____

_____

d. What is your Firm's Standard Industrial Classification (SIC) code? _____

24. Safety Program

a. Provide copy of the table of contents from your firm's written safety program.

b. Do you conduct safety audits of job sites? ____yes ____no _____frequency

c. Describe safety training provided to:

Field Supervisors

_____

_____

Field Workers

_____

_____

_____

CERTIFICATION

25. Dated this _____ day of _____ 19____.
(Date) (Month) (Year)

Name of Organization: _____

By: _____

Title: _____

26. M_____ being duly sworn deposes and says that he/she is the _____ of _____
(Title) (Company)
and that answers to the foregoing questions and all statements therein contained are true and correct.

Subscribed and sworn before me the _____ day of _____ 19____.
(Date) (Month) (Year)

Notary Public: _____

My Commission Expires: _____

END OF DOCUMENT