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DIVISION 1 GENERAL REQUIREMENTS

SECTION 01000

SITE DESCRIPTION AND PROJECT BACKGROUND

1.0 GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01000

B. Site Specific Requirements: Section 01501

1.2 PROJECT BACKGROUND

A. From 1984 through 1989, the Los Angeles Department of Health Services (LADHS) issued several Notices of Violation to the Cooper Drum Company as a result of incidents involving the release of hazardous substances at the Site. The LADHS required the Cooper Drum Company to conduct investigations of soil and groundwater. In 1989, the California Department of Health Services, now known as the Department of Toxic Substances Control (DTSC), also collected soil samples. In June 2001, the U.S. Environmental Protection Agency (U.S. EPA) added the Cooper Drum Company Site (Site) to the National Priorities List (NPL) of hazardous wastes sites requiring remedial action. URS completed a remedial investigation/feasibility study (RI/FS) report for the Site in May 2002.

B. The principal COCs identified in the groundwater are 1,2,3-trichloropropane (TCP), TCE, and 1,2-dichloroethane (1,2-DCA) and a semivolatile compound 1,4-dioxane. This compound was recently detected at the site, April 2004, after completion of the ROD in September 2002, and has consequently impacted the RD. Eight other COCs identified in the RI/FS are vinyl chloride (VC), 1,2-dichloropropane (1, 2-DCP), 1,1-dichloroethane (1,1-DCA), cis-1, 2-dichloroethene (cis-1, 2-DCE), PCE, trans-1,2-dichloroethene (trans-1,2-DCE), 1,1-DCE, and benzene. The groundwater plume is characterized by high levels of cis-1, 2-DCE and TCE. Arsenic and metals found in groundwater at concentrations exceeding drinking water standards are considered to be naturally occurring.

C. The principal VOC contaminants in the soil are the same 11 VOCs listed for groundwater. The non-VOCs in the soil are benzo (a) pyrene, PCBs (Aroclor-1260 and Aroclor-1254), lead, benzo(b)fluoranthene, dibenz(a,h)anthracene, benzo(a)anthracene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene. Soil lead concentrations of 1,920 to 3,240 milligrams per kilogram (mg/kg) were detected in subsurface and surface soils.

1.3 SITE DESCRIPTION

A. The Site is located at 9316 South Atlantic Avenue in South Gate, Los Angeles County, California. It is identified as EPA ID CAD055753370 (Latitude 33 56’ 49” N, Longitude 118 11’42”W). The Site, which consists of 3.3 acres of mixed residential, commercial, and industrial land use, is 10 miles south of Los Angeles and approximately 1,600 feet west of the Los Angeles River (Figure 1-1). Site facilities include drum processing and storage areas, an office, a warehouse, and maintenance buildings. The former hard-wash area (HWA) is in the northeastern area of the Site, which includes a covered shed area. The present-day HWA is on the eastern end of the drum processing building, which is referred to as the Drum Processing Area (DPA) in this report. The Site layout, including the HWA and DPA, is shown on Figure 1-2. All buildings have concrete floors, and the entire facility has been asphalt-paved since

1986. The Tweedy School on the adjacent property has been closed since 1988 because of a concern that children attending the school could be exposed to contamination migrating off site.

END OF SECTION

SECTION 01010

SUMMARY OF WORK

1.0 GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Project Coordination and Meetings: Section 01039

B. Protection of Work and Property: Section 01545

C. Traffic Regulation: Section 01570

D. Material and Equipment: Section 01600

1.2 SCOPE OF WORK

A. The work covers construction work specifically shown on the Contract Drawings and described herein.

1.3 CONTRACTOR'S DUTIES

A. Except as specifically noted, provide and pay for:

1. Labor, materials and equipment.
2. Tools, construction equipment, machinery and fuel.
3. Water, heat, and utilities required for construction.
4. Other facilities and services necessary for proper execution and completion of work.

B. Pay legally required sales, consumer use and other taxes as may be required by law.

C. Give required notices.

D. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of work.

E. Promptly submit written notice to Engineer of observed variance of Contract Documents from legal requirements. It is not Contractor's responsibility to make certain that drawings and specifications comply with codes and regulations.

F. Enforce strict discipline and good order among employees.

G. Do not employ:

1. Unfit persons.
2. Persons not skilled in assigned task.

1.4 CONTRACTOR FURNISHED

A. Labor, materials and equipment required for the project.

B. Water for construction, fire protection and all field offices.

C. All gates, barricades, fences, handrails, guardrails, and security required by the Contract or by laws and regulations.

D. Sanitary facilities adequate for all workers and complying with all codes and regulations.

E. Shelter and drying facilities for workmen.

F. Guards, masks, shields, protective clothing, rain gear, and other equipment required by law, ordinance, labor contracts, OSHA and other regulations for the maintenance of health and safety.

G. First Aid Kits and equipment required by law and regulations.

1.5 PERMITS AND LICENSES

A. The Owner shall secure and pay for all Department of Fisheries and Game permits, Flood Control Permit, State Highway permits, Water Pollution Control, Army Corps of Engineers, railroad permits, and shall pay the fee prescribed for all permanent franchises, permits, licenses and easements.

B. The Contractor shall acquire and pay for all specialty permits such as general building permits, electrical permits, plumbing permits, transportation permits, burning permits, wage and hour regulations permits, and all other permits of a temporary nature relating to the construction of the project.

C. Exceptions to above general permit requirements.

1. The contractor shall:

a. Obtain the City of Southgate permits.

b. Arrange for disposal of excess material on property.

c. Pay for disposal of excess material.

d. Obtain and pay for alternative excess earthwork material disposal permits.

1.6 TYPE AND EXTENT OF WORK

A. All work incidental and necessary to the completion of the work described herein and shown on the drawings shall be completed under the bid items listed in the Bid Form and no other compensation will be allowed.

1.7 WORK UNDER SEPARATE CONTRACTS

A. As provided in Article 25 of the General Conditions the Owner may award separate contracts. Successful bidders should anticipate the work under these separate contracts as indicated on the drawings. Cooperation between successful bidders for completion of the work as defined in the individual contracts, especially where the work is to be completed in the same general area, is expected of all parties concerned.

B. Bidders are cautioned to anticipate reasonable delays due to this construction by others under the separate contracts. In addition, bidders are cautioned to anticipate the effect of this construction work on the General Conditions in the areas where one or more contracts are scheduled. Changes in soil or water conditions because of construction work performed by others under these separate contracts shall not be the basis for a claim to the Owner.

C. Contractors shall include allowances in their prices bid to allow for the above factors, delays, inconveniences, etc., and these items will not be a basis for a claim for a time extension and/or additional compensation.

D. At locations where these separate contracts are joined to form a completed system, the Contractor last completing the work at the point of connection, as determined by the Engineer, shall be responsible for making said connection.

1.8 OWNER FURNISHED PRODUCTS

A. Owner will furnish no material unless specifically called for in other sections of the specifications or the drawings.

1.9 CONSTRUCT WORK IN STAGES

A. As required in specifications agreed with owners and reflected in the contract schedule.

B. Order of work as noted on drawings.

1.10 USE OF PREMISES

A. Limitation:

1. The Contractor shall confine his apparatus, storage of materials, and construction operations to such limits as may be directed by the Owner, and shall not unreasonably encumber the premises with his materials.
2. The Contractor shall enforce any instructions of the Owner regarding signs, advertising, fires, danger signals, barricades, and smoking, and shall require all persons employed on the work to comply with all building, post or institutional regulations while on the premises.
3. The Contractor shall not permit any part of any structure to be loaded with a weight that will injure its safety.

B. Confine operations at site to areas permitted by:

1. Laws.
2. Ordinances.
3. Permits.
4. Contract Documents.
5. Right-of-Way.

* * * END OF SECTION * * *

SECTION 01039

PROJECT COORDINATION AND MEETINGS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Job Site Administration: Section 01043

C. Cutting and Patching: Section 01045

D. Field Engineering: Section 01050

E. Preconstruction Meetings: Section 01210

F. Progress Meetings: Section 01220

1.2 POLICY IN PRACTICE

A. Engineer is the Owner's Advisor and Consultant:

1. Inspection and Testing Laboratories are to furnish data and guidance only and may make no decisions involving changes in the Contract.

2. All job located problems shall be handled through the Resident Engineer or Inspector.

B. Owner's desires and instructions are to be channeled through the Engineer regarding all phases of the Contract.

C. Contract related communication from Contractor shall be handled through the Engineer.

D. Coordination of all subcontractors is the responsibility of the Contractor.

E. Documents of the Contract are directed to the Contractor and not to the subcontractors involved.

F. The Contractor is solely responsible for construction methods and the results thereof regardless of any advice, information, methodology or scheduling unless such advice, methodology or scheduling is written into the Contract or given in writing by the Engineer or the Owner.

1.3 COORDINATION OF TRADES AND SUBCONTRACTORS

A. Coordination is the responsibility of the Contractor. He shall assure coordination with suppliers, electrical contractors, mechanical contractors and all trades to the end that:

1. All necessary equipment, work and structures are scheduled, installed and tested in proper sequence.

2. He shall assure that electrical and mechanical equipment, wiring and control equipment, piping and plumbing, grading and landscaping and all problems of supply, installation and scheduling are

coordinated and that the relations of all elements are carried out in an orderly manner in accordance with the Contract.

3. Contractor shall coordinate all suppliers of equipment, controls and electrical supplies before submittal of shop drawings.

1.4 COORDINATION OF UTILITIES

A. Contractor shall schedule and supply utilities as required in the Contract.

1.5 PUBLIC AGENCIES

A. Contractor shall coordinate his schedule and activities with the Owner, the Engineer and various agencies involved as the necessity arises and as required by the Contract:

1. Power.
2. Water.
3. Sewer.
4. Electrical.
5. Other Utilities.
6. Police.
7. Fire.
8. Schools.
9. County.
10. City.
11. State.
12. Other public agencies.

* * * END OF SECTION * * *

SECTION 01043

JOB SITE ADMINISTRATION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Project Coordination: Section 01039

C. Protection of Work and Property: Section 01545

D. Traffic Regulation: Section 01570

1.2 REMOVAL OF DEBRIS, CLEANING, ETC.

A. The Contractor shall at all times keep the construction area clean and orderly and upon completion of the work shall leave all buildings broom clean and all parts of the work clean and free of rubbish or excess material of any kind.

B. Windows, doors, hardware, woodwork, fixtures, equipment, walls and floors shall be left clean and free of stains, paint or roofing splashes or other mars or defects.

C. Upon completion, the site of all work or equipment and material storage areas shall be restored to substantially their original condition.

D. Miscellaneous debris, rocks, etc., resulting from the work shall be removed and disposed of in a manner satisfactory to the Owner.

E. The site shall be left in a clean and neat condition.

1.3 TESTS

A. Where the Specifications require work to be specifically tested or reviewed, it shall not be tested or covered up without timely notice to the Engineer of its readiness for inspection, unless the Engineer waives such notice.

B. Should any such work be covered up without such notice, approval or consent, it must, if required by the Engineer, be uncovered for examination at the Contractor's expense.

C. Where work is to be tested, all necessary equipment shall be set up and the work given a preliminary test so that any and all defects may be discovered and repaired prior to calling out the Engineer for the test.

1.4 OWNER SHALL DETERMINE PRECEDENCE

A. Whenever, in his opinion, it is necessary to do so, in order to insure proper completion of the Contract for construction and installation, the Owner shall determine the order of precedence and the time and season at which any portion or portions of the work shall be commenced and carried on.

B. The Owner may schedule a sequence of the work when it is in locations where the Owner is doing other work by his own forces, or by other contract, or when other work may be affected by work under this Contract, in order that conflict may be avoided and the work under these Specifications be coordinated with that under other contracts or with other work being done in connection with or growing out of operations of the Owner.

C. Nothing herein contained shall be taken to relieve the Contractor of any of his obligations or liabilities under this Contract.

1.5 COMMENCEMENT OF WORK ON PUBLIC AND PRIVATE RIGHT-OF-WAY

A. Work shall not be started on any public or private right-of-way until clearance is given to the Contractor by the Engineer.

B. It will be the responsibility of the Contractor to comply with any special requirements of any permits or easements for the project acquired by the Owner.

* * * END OF SECTION * * *

SECTION 01045

CUTTING AND PATCHING

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Project Coordination: Section 01039

C. Demolition: Section 02050

1.2 METHODS

A. Execute cutting (including excavating), fitting or patching of work, required to:

1. Make several parts fit properly.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of Contract Documents.
4. Install specified work in existing construction.

B. Do not endanger any work by cutting or altering work or any part of it.

C. Do not cut or alter work of another contractor.

1.3 SUBMITTALS

A. Submit written notice to Engineer requesting consent to proceed prior to cutting which affects structural safety of project, or work of another contractor.

B. Submit notice to Engineer, designating time work will be uncovered, to provide for observation.

1.4 PAYMENT FOR COSTS

A. Contractor shall pay for all costs caused by ill timed, unnecessary or defective work or work not conforming to Contract Documents, including costs for additional services of Engineer.

2. PRODUCTS

2.1 MATERIALS

A. For replacement of work removed: Contractor shall comply with Specifications for type of work to be done.

3. EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of work, including elements subject to movement or damage during construction.

3.2 PREPARATION (PRIOR TO CUTTING)

A. Provide shoring, bracing and support as required to maintain structural integrity of all portions of the project.

3.3 PERFORMANCE

A. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances, and finishes.

B. Execute excavating and backfilling as specified in Excavating and Backfilling.

C. Restore work that has been cut or removed.

* * * END OF SECTION * * *

SECTION 01050

FIELD ENGINEERING

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Jobsite Administration: Section 01043.

B. Summary of Work: Section 01010.

1.2 CONSTRUCTION STAKING BY ENGINEER

A. Unless otherwise provided, the URS Engineer will stake out locations of the property and provide an elevation benchmark.

B. The Contractor's request for staking shall be in writing and shall outline schedule for staking requirements. Any schedule changes shall be provided in writing.

C. Request for stakes shall be a minimum of five working days in advance of need to start staking operations.

1.3 GENERAL REQUIREMENTS

A. The Contractor shall protect and preserve in their original position all stakes, points, or marks set for the work.

B. If any stakes and markings are destroyed or defaced by the Contractor's operations before their use is ended; the full cost of replacing them will be at the Contractor's expense.

C. The Contractor shall provide sufficient and safe facilities to enable the Engineer or Contractor's surveyor to set the control points, together with such tools and materials and render such competent assistance as may be reasonably and customarily required.

D. Working operations shall be suspended at different points for such brief and reasonable time as may be required for giving of lines and grades, taking measurements and making inspections. Such delays shall be considered incidental to the Contract and no additional compensation will be allowed.

E. Any claim by the Contractor for extra compensation by reason of alterations or reconstruction work allegedly due to error in the Engineer's line and grade, will not be allowed unless the original control points set by the Engineer still exist, or unless other satisfactory substantiating evidence to prove the error is furnished to the Engineer.

F. The Contractor shall transfer lines and grades from the points given to his own work at his own expense.

1.4 REQUIREMENTS FOR PIPELINES

A. Where line and grade is carried by stringline in the case of pipeline construction, not less than three (3) points shall be in use at one time.

B. Grades shall be checked by the Contractor and if the points do not line up, the work shall be immediately stopped, and the cause remedied before proceeding with the work. The Contractor shall not receive any additional payment for "standby time" while surveys are being checked.

C. Other methods of transferring line and grade may be used providing that such methods can be checked by the Engineer at not less than three points in each section of pipe before backfilling is started. Permission to use any specific method will not relieve the Contractor of his responsibility to meet any requirement of other sections of this Specification.

D. Line and grade shall be checked for each piece of pipe laid.

1.5 REQUIREMENTS FOR STRUCTURES

A. Horizontal base line and benchmark will be provided by the Engineer.

B. Contractor shall lay out the work from these points.

1.6 CONTRACTOR PROVIDED STAKES

A. Staking when performed by Contractor shall be done by qualified licensed surveyors.

B. Prior to the Contractor conducting any survey work, the Contractor shall submit to the Owner evidence of the qualifications of the person(s) he will assign to do the survey work for the project. The Owner reserves the right to disallow the person(s) selected by the Contractor for surveying if, in the Owner's opinion, the person is not qualified to do the work. The Contractor shall select another surveyor and submit qualifications to the Owner until a qualified person is approved by the Owner.

C. Control points shown on the drawings or outlined in the Special Provisions shall be utilized to stake out the project. The Engineer will provide the Contractor with a copy of survey field notes, when appropriate.

D. Field notes shall be kept in standard bound notebooks in a clear, orderly manner consistent with standard engineering practice including titles, numbering and indexing.

E. The Contractor shall provide the Owner with a copy of all field notes including references to monuments and property corners.

F. The Contractor shall provide the Engineer with copy of grade sheets, prior to construction work on any specific portion of the project.

* * * END OF SECTION * * *

SECTION 01070

ABBREVIATIONS AND SYMBOLS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Definitions: General Conditions

1.2 ABBREVIATIONS

A. Whenever the following abbreviations are used on the plans, specifications, proposals and contracts, they shall be construed to mean the words and terms as listed below.

B. Duplicate Definitions shall be interpreted in context of use.

A

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti Friction Bearing Manufacturers Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AGMA	American Gear Manufacturer Association
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Assoc.
ASAE	American Society of Agriculture Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association

B

BTU	British thermal unit
BTUH	British thermal units per hour

C

C	Centigrade/Celsius
CBMA	Certified Ballast Manufacturers Assoc.
CFM	Cubic feet per minute
CFS	Cubic feet per second
CPM	Critical path method
CRSI	Concrete Reinforcing Steel Institute

D

DFP	Douglas Fir Plywood Association
DIPRA	Ductile Iron Pipe Research Association

E

EA	Each
EEO	Equal Employment Opportunity
EPA	Environmental Protection Agency (Federal)

F

F	Fahrenheit
FED SPEC	Federal Specification
FHWA	Federal Highway Administration
FPM	Feet per minute
FT,FT^2,FT^3	Foot, square feet, cubic feet

G

GA	Gage, gauge
GAL	Gallon
GALV	Galvanized
GPD	Gallons per day
GPH	Gallons per hour
GPM	Gallons per minute

H

HOA	Hand-off-auto
HP	Horsepower
HR	Hour
HT	Height
Hz	Hertz

I

ID	Inside Diameter
IEEE	Institute of Electrical and Electronics Engineers
IN,IN^2,IN^3	Inch, square inches, cubic inches
IPCEA	Insulated Power Cable Engineers Assoc.
ISA	Instrument Society of America

J

JIC	Joint Industry Conference of Hydraulic Manufacturers

K

KV	Kilovolt
KVA	Kilovolt ampere
KVAR	Reactive kilovolt amperes
KW	Kilowatts
KWH	Kilowatt hours

L

L	Length
LB	Pounds
LF	Linear feet
LS	Lump Sum

M

M	Thousand
mA	Milliamperes
MBTUH	One thousand British thermal units per hour
MGD	Million gallons per day
mg/l	Milligrams per liter
MIN	Minute
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
MV	Millivolts
MVA	Megavolt amperes

N

NAMM	National Association of Metal Manufacturers
NBFU	National Bureau of Fire Underwriters
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NPC	National Plumbing Code
NPT	National pipe thread
NRS	Non-rising stem
NLMA	National Lumber Manufacturers Assoc.

O

OD	Outside diameter
OECI	Overhead Electric Crane
OSHA	Occupational Safety and Health Act
OZ	Ounce

P

PCA	Portland Cement Association
ph	Hydrogen ion concentration
PH	Phase
PPM	Parts per million
PSF	Pounds per square foot
PSI	Pounds per square inch
PSIG	Pounds per square inch gauge
PT	Pint
PVC	Polyvinyl chloride

R

RPM	Revolutions per minute

S

SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Manufacturers Association
SCFM	Standard cubic feet per minute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SQFT	Square foot
SQIN	Square inch
SQMI	Square mile
SSPC	Steel Structures Painting Council

U

UBC	Uniform Building Code
UL	Underwriter's Laboratory
UPC	Uniform Plumbing Code

V

V	Volt

W

WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

* * * END OF SECTION * * *

SECTION 01090

REFERENCE STANDARDS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. All Divisions: As referenced

1.2 AUTHORITY

A. Contractor is responsible to conform to all codes and regulations legally in effect at the location of the project.

B. Contractor shall conform to all requirements and regulations of the authority administering such codes and regulations.

1.3 REFERENCE CODES

A. Contractor shall conform to all codes and sections thereof as may be referred to in the specifications.

B. Referenced codes are, by such reference, incorporated into this Contract as if set forth herein in full.

1.4 SPECIFICATIONS INCORPORATED BY REFERENCE

A. Where Federal, ASTM, or any other standard specifications are referred to, or included by reference, the latest issue and/or amendment thereto published at the date of issue of the Advertisement for Bids shall be incorporated in the Contract by said reference as if set forth herein in full.

* * * END OF SECTION * * *

SECTION 01210

PRECONSTRUCTION CONFERENCES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Project Coordination and Meetings: Section 01039

C. Job Site Administration: Section 01043

D. Progress Meetings: Section 01220

E. Material and Equipment: Section 01600

1.2 SCHEDULE

A. Not more than five days after notice to proceed but earlier if practicable, the Owner will schedule a preconstruction meeting.

B. Present at the meeting to represent the Contractor shall be at least the official in charge of the project, the project superintendent, a representative with authority to speak for each of his principle subcontractors, and other representatives as he may deem expedient.

C. The Owner and/or his representatives shall be present as required.

D. Proceedings of meeting to be recorded by the owner and distributed to interested parties.

1.3 AGENDA

A. Both Owner and Contractor shall be prepared to speak to the following, as necessary:

1. Name and Field Address of Job Superintendent
2. Emergency Phone and/or operator (24 hrs a day)
3. Date of Construction Start
4. Date of Notice to Proceed
5. Notification of Utilities Concerned
6. Coordination with other contractors
7. Permits: County, City, and Government Agencies as required
8. Inspector: name, authority
9. Field office (location)
10. Shop Drawing Submittals
11. Responsibility for lines and grades

12. Minimum wage rates and posting of wage rate determination
13. Equal employment opportunities and posting of EEO poster. Use of local labor.
14. Weekly payrolls when required
15. Schedule of Values
16. Periodic monthly payments including date for submittal
17. Construction progress schedule (bar graph or C.P.M.)
18. Safety Requirements and Special Hazards
19. Insurance and Bonds
20. Traffic Control
21. Construction Signs
22. Drawings revised to conform to construction records
23. Beneficial occupancy
24. Retention of Contract records
25. Guarantees and warranties
26. Operation and Maintenance Manuals
27. Non-Discrimination Notice
28. Project Signs
29. Testing
30. Progress Meetings
31. Complaint Procedure
32. Job Photos
33. Other matters concerning construction

* * * END OF SECTION * * *

SECTION 01220

PROGRESS MEETINGS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Project Coordination: Section 01039

C. Project Record Documents: Section 01720

1.2 MEETINGS

A. Hold Called Meetings as progress of Work dictates.

B. Location of meetings: As designated during preconstruction conference.

C. Attendance:

1. Engineer and/or his Consultants.
2. Owner (optional)
3. Contractor
4. Other contractors (if any).
5. Subcontractors as pertinent to agenda.
6. Safety Representative (Optional).
7. Representatives of Governmental or other Regulatory Agencies.

1.3 MINIMUM MEETING AGENDA:

A. Review, approve minutes of previous meeting.

B. Review work progress since last meeting.

C. Note field observations, problems and decisions.

D. Identify problems, which impede planned progress.

E. Review off-site fabrication problems.

F. Develop corrective measures and procedures to regain planned schedule.

G. Revise Construction Schedule as indicated.

H. Plan progress during next work period.

I. Coordinate projected progress with other contractors.

J. Review status of outstanding submittals and expedite as required to maintain schedule.

K. Maintaining of quality and work standards.

L. Review safety and security issues.

M. Review change orders and proposals

N. Review request for information (RFI) status

O. Review changes proposed by Owner for:

   1. Effect on Construction Schedule
   2. Effect on Completion Date

P. Complete other current business.

* * * END OF SECTION * * *

SECTION 01300

SUBMITTALS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Material and Equipment: Section 01600

1.2 SUMMARY

A. Section Includes: Submitting Shop Drawings, Product Data, and Samples, and other submittals related to products.

1.3 DEFINITIONS

A. Manufacturer's Instructions: Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product; Manufacturers Instructions are not prepared especially for the Work.

B. Shop Drawings: Drawings, diagrams, schedules and other data specially prepared for the Work to illustrate some portion of the Work.

C. Product Data: Illustrations, standard schedules, performance charts, brochures, diagrams and other information to illustrate materials or equipment for some portion of the Work.

D. Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

E. Special Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged, and will be incorporated in the Work.

1.4 PROCEDURES

A. Deliver submittals to Engineer at address listed on cover of Project Manual, unless another mutually agreeable place is designated.

B. Submit submittals in ample time for each to serve submittals intended purpose.

C. Submit submittals which are specified or reasonably required for construction, operation, and maintenance of the Work;

D. Deliver submittals under acceptable transmittal form which identifies:

1. Submittal date.
2. Project and Contractor.
3. Subcontractor and major supplier, when appropriate.
4. Reference submittal to Contract Documents by Drawing, detail, and/or Specification section numbers, as appropriate.
5. Variations from Contract Documents when variations are included in submittal.

E. Submit specified number of copies of submittal.

F. Provide or furnish products and execute the Work in accordance with accepted submittals, unless in conflict with Contract Documents.

G. When minor deviations from Contract Documents are accepted, modify Contract Documents in accordance with the Conditions of the Contract.

1.5 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Submit Shop Drawings, Product Data, Samples, and other pertinent information in sufficient detail to show compliance with specified requirements.

B. Check, verify, and revise submittals as necessary to bring them into conformance with Contract Documents and actual field conditions.

1. Determine and verify quantities, dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.

2. Coordinate submittal with other submittals and with the requirements of the Contract Documents.

C. After completion of checking, verification, and revising; stamp, sign and date submittals indicating review and approval; and submit to Engineer.

1. Stamp and signature indicate Contractor has satisfied shop drawing review responsibilities and constitutes Contractor's written approval of shop drawing.

2. Shop drawings without Contractor's written approval will be returned for resubmission.

D. Shop Drawings: Submit 4 copies: One will be returned with reviewer's comments and stamp

E. Product Data and Manufacturer's Instructions: Submit 4 copies. Excise or cross out non-applicable information and clearly mark applicable information with citations to and terminology consistent with Contract Documents.

1. Copies will be returned with reviewer's comments and stamp.

F. Samples: Submit 2 samples labeled with reference to applicable Contract Documents. Label will be returned with reviewer's selection when appropriate, comments and stamp. Samples will not be returned unless return is requested in writing and additional sample is submitted.

G. Special Samples: Submit 1 sample labeled with reference to applicable Contract Documents. Sample and 1 label will be returned for installation in the Work.

H. Assume risk of expense and delays when proceeding with work related to required submittals without review and acceptance.

1.6 ENGINEER’S REVIEW

A. Engineer's review of submittals shall not release Contractor from Contractor's responsibility for performance of requirements of Contract Documents. Neither shall Engineer's review release Contractor from fulfilling purpose of installation nor from Contractor's liability to replace defective work.

B. Do not consider submittals as Contract Documents. Purpose of submittals is to demonstrate how Contractor intends to conform with the design concepts.

C. Engineer’s review of shop drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents.

1. Engineer's review does not extend to:

a. Accuracy of dimensions, quantities, or performance of equipment and systems designed by Contractor.

b. Contractor's means, methods, techniques, sequences, or procedures except when, specified, indicated on the Drawings, or required by Contract Documents.

c. Safety precautions or programs related to safety which shall remain the sole responsibility of the Contractor.

D. Except as may be provided in subsequent specifications, a submittal will be returned within 30 days as either "Accepted as Noted," "Revise and Resubmit," or an appropriate combination.

1. When a submittal cannot be returned within that period, Engineer will, within a reasonable time after receipt of the submittal, give notice of the date by which that submittal will be returned.

E. Revise and correct submittals returned as "revise and resubmit” and resubmit. Direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

F. Engineer will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.

G. Costs incurred by Owner as a result of additional reviews of a particular submittal after the second time it has been reviewed shall be borne by Contractor. Reimbursement to Owner will be made by deducting such costs from Contractor's subsequent partial payments.

1.7 MINOR OR INCIDENTAL PRODUCTS AND EQUIPMENT SCHEDULES

A. Shop Drawings of minor or incidental fabricated products will not be required, unless requested.

B. Submit tabulated lists of minor or incidental products showing the names of the manufacturers and catalog numbers, with Product Data and Samples as required to determine acceptability.

1.8 SUBMITTALS FOR INFORMATION OR RECORD ONLY

A. Submit 4 copies of each. None will be returned.

1.9 MILL TEST REPORTS

A. Submit 4 certified copies of factory and mill test reports for record only. No copies will be returned.

B. Do not incorporate Products in the Work which have not passed testing and inspection satisfactorily.

C. Pay for mill and factory tests.

1.10 REINFORCING STEEL

A. Submit reinforcing steel fabrication and setting drawings for information or record only. No copies will be returned.

B Note deviations and variations as specified for Shop Drawings.

1.11 TUNNELS, JACKING, AND BORING

A. Submit detailed description of tunneling or jacking operations as Shop Drawings.

B. Include indications of:

1. Equipment to be used.
2. Detailed schedule for performing the Work.
3. Safety precautions to be taken.
4. Compliance with applicable Laws and Regulations.
5. Monitoring of railroad track or roadway movement.
6. Contingency plan for correcting movement.
7. Other pertinent information on items required to perform the Work.

1.12 MANUFACTUR'S INSTRUCTIONS

A. Submit manufacturer's instructions whenever made available by manufacturers and when installation, erection, or application in accordance with manufacturer's instructions are required by the Specifications.

B. Submit manufacturer's instructions prior to installation, erection, or application of equipment and other project components.

C. Submit manufacturer's instructions in accordance with requirements for Product Data.

2. PRODUCTS

Not Used

3. EXECUTION

Not Used

END OF SECTION

SECTION 01400

QUALITY CONTROL

1. GENERAL

1.1 SUMMARY

A. Section Includes: Quality control requirements and procedures for products and workmanship; sampling and testing of materials; testing of equipment; requirements for testing laboratories; procedures and limitations of inspection; and related matters.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. E 329 Standard Practice for Use in the Evaluation of Testing and Inspection Agencies as Used in Construction.

1.3 PRODUCTS AND WORKMANSHIP

A. Provide new products of specified quality equal to the accepted samples.

B. Perform and complete work in thorough manner.

1. Call Engineer's attention to apparent errors, conflicts, discrepancies, or omissions in Contract Documents and request clarification of the Contract Documents before commencing Work activity.

2. Engineer will issue written clarification or interpretation of requirements of the Contract Documents.

C. When specified, products will be tested and inspected either at point of origin or at Work site.

1. Notify Engineer in writing well in advance of when products will be ready for testing and inspection at point of origin.

2. Do not construe that satisfactory tests and inspections at point of origin is final acceptance of products. Satisfactory tests or inspections at point of origin do not preclude retesting or reinspection at Work site.

D. Do not ship products which require testing and inspection at point of origin until testing and inspection has been completed in accordance with 1.3 C.

1.4 AUTHORITY AND DUTIES OF OWNER’S REPRESENTATIVE OR INSPECTOR

A. Owner's Representative or Inspector employed or returned by Owner or Engineer is authorized to inspect the Work.

B. Inspections may extend to entire or part of the Work and to preparation, fabrication, and manufacture of products for the Work.

C. Deficiencies or defects in the Work that have been observed will be called to the Engineer’s, Owner’s, and Contractor's attention.

D. Inspector will not:

1. Alter or waive provisions of Contract Documents.
2. Inspect Contractor's means, methods, techniques, sequences, or procedures for construction.
3. Accept portions of the Work, issue instructions contrary to intent of Contract Documents, or act as foreman for Contractor.
4. Supervise, control, or direct Contractor's safety precautions or programs, or inspect for safety conditions on Work site, or of persons thereon, whether Contractor's employees or others.

E. Inspector will:

1. Conduct on-site observations of the Work in progress to assist Engineer in determining when the Work is, in general, proceeding in accordance with Contract Documents.
2. Report to Engineer whenever Inspector believes that Work is faulty, defective, does not conform to Contract Documents, or has been damaged; or whenever there is defective material or equipment; or whenever Inspector believes the Work should be uncovered for observation or requires special testing. Engineer issues any notice of non-compliance if required.

1.5 INSPECTION

A. Material and equipment, and workmanship shall be subject to inspection and rejection when not in conformance with Contract Documents regardless if the Contractor has completed the work.

B. Remove defective work and products from Work site, whether in place or not, and replace or renew with work, material or equipment in conformance with Contract Documents. Replacement materials will be subject to the shop drawing submittal process as described in Section 01300.

C. Questions concerning acceptability of materials, classification of materials, and execution of the Work will be decided by Engineer.

D. Facilitate inspection by maintaining proper facilities and providing safe access to the Work, to shops where products are in preparation, and to warehouses and storage yards where products are stored.

E. Engineer's Observation of Work That will be Covered Up:

1. When directed to allow observation of work before it is covered up, provide timely notification of work readiness and allow Engineer reasonable time to observe such work before covering it up.
2. Uncover, at Contractor's cost, work covered up for which Engineer was not given timely notification or reasonable time to conduct observations.
3. Engineer may specify time requirements for timely notification and for performing observations.

1.6 SAMPLING AND TESTING

A. General:

1. Prior to delivery and incorporation in the Work, submit listing of sources of materials, when specified in Sections where materials are specified.
2. When specified in Sections where products are specified,
   a. Submit sufficient quantities of representative samples of character and quality required of materials to be used in the Work for testing or examination.
   b. Test materials in accordance with standards of national technical organizations.

B. Sampling:

1. Furnish specimens of materials when requested.
2. Do not use materials that are required to be tested until testing indicates satisfactory compliance with specified requirements Engineer has been provided written documentation of said compliance.
3. Specimens of materials will be taken for testing necessary to determine quality of material.
4. Assist Engineer in preparation of test specimens at site of Work, such as soil samples and concrete test cylinders.

C. Testing:

1. Owner will employ and pay for services of independent testing laboratory to perform routine tests of materials to confirm compliance with requirements of Contract Documents. Exception area follows:
   a. Mill tests, soil compaction test and other specified tests shall be paid for by Contractor.
2. When protesting failed tests of material in place or to be used, the contractor shall take additional specimens and have specimens tested as his own expense.

a. When original test proves to have been in error, file claim for reimbursement of direct costs for sampling and testing.

3. If retesting is required due to initial unsatisfactory result, the Contractor shall pay for all tests.

D. Test Standards:

1. Perform sampling, specimen preparation, and testing of materials in accordance with specified standards, and when no standard is specified, in accordance with standard of nationally recognized technical organization.
2. Physical characteristics of materials not particularly specified shall conform to standards published by ASTM, where applicable.

1.7 TESTING LABORATORY SERVICES

A. Qualification of Laboratory:

1. Meets "Recommended Requirements for Independent Laboratory Qualification", published by American Council of Independent Laboratories.
2. Meets requirements of ASTM E 329.
3. Has authorization to operate in state in which Project is located. .
4. Will submit copy of report of inspection of facilities made by Materials Reference Laboratory of NBS during most recent tour of inspection, with memorandum of remedies of deficiencies reported by inspection.
5. Has documentation verifying testing equipment is calibrated at reasonable intervals by devices of accuracy traceable to NBS or accepted values of natural physical constants.

B. Laboratory Duties:

1. Cooperate with Engineer and Contractor.
2. Provide qualified personnel.
3. Notify Engineer and Contractor, in writing, of response time needed to schedule testing or inspections after receipt of notice.
4. Perform specified inspections, sampling and testing of materials and methods of construction in accordance with specified standards to ascertain compliance of materials with requirements of Contract Documents.
5. Promptly notify Engineer and Contractor of observed irregularities or deficiencies of construction.
6. Promptly submit written report of each test and inspection; one copy each to Engineer, Owner, Contractor, and one copy to file of Project Record Documents. Each report shall include:
   a. Date issued.
   b. Project title and number.
   c. Testing laboratory name, address and telephone number.
   d. Name and signature of laboratory inspector.
   e. Date and time of sampling or inspection.
   f. Record of temperature and weather conditions.
   g. Date of test.
   h. Identification of product and Specification section.
   i. Location of sample or test in Project.
   j. Type of inspection or test.
   k. Results of tests and compliance with Contract Documents.
   l. Interpretation of test results, when requested by Engineer.

C. Limitations of Authority of Testing Laboratory: Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.
2. Approve or accept portion of Work.
3. Perform duties of Contractor.

1.8 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel and provide access to construction and manufacturing operations.

B. Secure and deliver to laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.

C. Provide to laboratory preliminary mix design proposed to be used for concrete, and other material mixes that require control by testing laboratory.

D. Furnish copies of product test reports.

E. Furnish incidental labor and facilities:

1. To provide access to construction to be tested.
2. To obtain and handle samples at Work site or at source of product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory in advance of when observations, inspections and testing is needed for laboratory to schedule and perform in accordance with their notice of response time.

2. PRODUCTS

Not Used

3. EXECUTION

Not Used

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Project Coordination: Section 01039

B. Testing Requirements: Various Sections

1.2 CONTRACTOR WILL PAY FOR SERVICES OF AN INDEPENDENT TESTING LABORATORY FOR:

A. Soils gradation, moisture density standards determination, and in place density tests per Division 2.

B. Concrete: Mix design, consistency, air content, yield, compressive test cylinder casting and compression testing per Section 03300.

C. Other materials and/or workmanship specified in Divisions 2, 3, 9, and 11 through 16.

1.3 LIMITATION

A. Employment of a testing laboratory shall in no way relieve the Contractor of his obligation to perform work in accordance with the Contract.

1.4 QUALIFICATION OF LABORATORY

A. Meet basic requirements of ASTM E329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction".

B. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection; with memorandum of remedies of any deficiencies reported by inspection.

C. Testing Equipment:

1. Calibrated at maximum 12 month intervals by devices of accuracy traceable to National Bureau of Standards.

2. Submit copy of certificate of calibration, made by accredited calibration agency.

1.5 LABORATORY DUTIES, AUTHORITY AND LIMITATION

A. Cooperate with Engineer and Contractor.

B. Provide qualified personnel promptly on notice.

C. Perform specified inspections, sampling and testing of materials and methods of construction:

1. Comply with specified standards; ASTM, AWWA other recognized authorities, and as specified.

2. Ascertain compliance with requirements of Contract Documents.

D. Promptly notify Engineer, and Contractor, of irregularities or deficiencies of work which are observed during performance of services.

E. Promptly submit 2 copies of report of inspections and tests to Engineer, in addition to those required by the Contractor including:

1. Date issued.
2. Project title and number.
3. Testing Laboratory name and address.
4. Name and signature of Inspector.
5. Date of inspection of sampling.
6. Record of temperature and weather.
7. Date of test.
8. Identification of product and specification section.
9. Location in project.
10. Type of inspection or test.
11. Results of test.
12. Observations regarding compliance with Contract Documents.

F. Perform additional services as required.

G. Laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on, requirements of Contract Documents.
2. Approve or accept any portion of work.

1.6 RESPONSIBILITIES OF CONTRACTOR

A. Cooperate with laboratory personnel and provide access to work.

B. Provide to laboratory, preliminary representative samples of materials to be tested in required quantities.

C. Furnish copies of mill test reports.

D. Furnish casual labor and facilities:

1. To provide access to work to be tested.
2. To assist laboratory personnel to obtain and handle samples at the site.
3. To facilitate inspections and tests.
4. For laboratory's exclusive use for storage and curing of test samples.

E. Notify laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory or agency, the sample or samples of materials to be tested shall be selected by such laboratory or agency, or the Engineer, and shipped to the laboratory by the Contractor at his expense.

* * * END OF SECTION * * *

SECTION 01501

SITE-SPECIFIC REQUIREMENTS

1.0 GENERAL

1.1 REGULATORY REFERENCES

A. The following are relevant regulations to the project:

1. 29 CFR 1910 Occupational Safety and Health Standards

2. 29 CFR 1926 Safety and Health Regulations for Construction

3. 40 CFR 261.24 Toxicity Characteristic Concentrations of Hazardous Wastes (Section 02447)

4. 40 CFR 107,171-177 Hazardous Materials Transport (Section 02215)

5. 40 CFR 268 Land Disposal Restrictions (Section 02215)

1.2 PERMITS

A. All required permits, as detailed in Section 01010 Summary of Work, shall be obtained prior to mobilization.

1.3 WORK DAYS AND HOURS

A. The normal work days and hours for this project shall be Monday through Friday, excluding federal holidays, from 7:00 a.m. to 5:00 p.m. Access to the work site may be restricted to these hours and days. Work during other than normal hours and days must be coordinated in advance with the Engineer.

1.4 PROJECT CONDITIONS

A. The Contractor shall prepare a schedule indicating dates for implementation and termination of each temporary utility. The Contractor is responsible for providing temporary connections to, and maintenance of, utilities. The point of connection to these utilities will be as directed by the Engineer.

B. Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

1.5 CONTRACTOR STAGING AREA

A. The staging area for the Contractor will be designated by the Engineer and the Tenants' Staff. The staging area will be used for staging equipment and construction activities.

2.0 PRODUCTS

2.1 MATERIALS

A. General

1. Provide materials suitable for the use intended.

2.2 EQUIPMENT

A. General

1. Provide new equipment; if acceptable to the Engineer, undamaged, previously-used equipment in serviceable condition may be used. Provide equipment suitable for the use intended.

B. Temporary Toilet Units

1. Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Contractor shall provide service of toilet units during the project at regular intervals as required to maintain in functional condition.

C. First Aid Supplies

1. Comply with governing regulations.

3.0 EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.

B. Provide wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

C. Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.

D. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near and at the site.

3.2 COLLECTION AND DISPOSAL OF WASTE

A. Collect clean waste from construction areas and elsewhere daily. Comply and enforce the requirements of NFPA 241 for removal of combustible waste material and debris. Do not hold materials more than seven days during normal weather or three days when the temperature is expected to rise above 80 degrees Fahrenheit (27 degrees Celsius). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

B. Grossly contaminated PPE shall be rinsed with potable water to remove contaminated soils/waste, double bagged, and placed in on-site dumpsters. All other non-contaminated PPE shall be disposed of

in on-site dumpsters without rinsing and bagging. Rinse water shall be placed in drums and disposed as wastewater.

C. Contractor shall collect wastewater from the decontamination area.

1. All wastewater shall be temporarily stored at the decontamination pad. The wastewater will be stored in DOT-approved 55-gallon drums.

2. Wastewater storage containers shall be labeled on the outside with secured signs made of weather-resistant material.

3. Solid particles shall be settled out of all wastewater generated during field efforts. Once solids have been separated, wastewater shall be appropriately disposed.

4. Discharge of wastewater from each storage drum shall be conducted within 90 days from the start of accumulation (CCR Title 22, 66262.34), when the drum is near capacity, or at the completion of the project. For logistical purposes, additional storage drums may be used during periods when wastewater is generated rapidly and in large quantities.

5. The following information on all generated wastewater shall be documented with date and time of generation, date and time of discharge to treatment plant, estimated volume, the origin, analytical results for lead and chromium, and remarks, if any (e.g., suspended solids, odor, color, etc.).

** End of Section **

SECTION 01545

PROTECTION OF WORK AND PROPERTY

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Access and Haul Roads: Section 01550

B. Temporary Controls: Section 01560

1.2 PUBLIC AND PRIVATE PROPERTY

A. The Contractor shall protect and maintain all underground or aboveground utilities and structures affected by the work and any damage shall be repaired and restored by the Contractor to the satisfaction of the Owner.

B. The Contractor will be responsible for all damage to roads, highways, ditches, bulkheads, walls, bridges, culverts, utilities, barricades, lights, or other property, caused by the work, whether such damage be at the site of the work or caused by transporting or hauling to or from the work; and he shall repair or replace, or arrange for the repair or replacement of all such damage to the satisfaction of the Owner. Any material damaged by the Contractor's operations shall be replaced with new material.

C. Whenever construction work under this Contract is undertaken on easement, right-of-way, or franchise, all work shall be confined to the limits of such easement, right-of-way, or franchise, and accomplished so as to cause the least amount of disturbance and a minimum amount of damage.

D. Completion of work across private property shall be carried out in one continuous operation of construction of the facilities with the immediate restoration and cleanup of the construction area. If the Contractor fails to perform such construction and restoration continuously as herein provided, the Owner may give the Contractor a written notice to so perform, and in event of failure by the Contractor to complete such construction and restoration within 72 hours of such notice, the Owner may complete the installation and restoration on such private property to the extent the Owner deems advisable and the cost of all work, labor, materials, and expenses incurred by the Owner in so doing shall be paid by the Contractor and may be deducted from any monies due or to become due, the Contractor.

E. Particular care shall be exercised to see that the topsoil from the trench is preserved and replaced in its original location. It shall be the Contractor's responsibility to strip such topsoil from the trench, or construction area, and stockpile it in such a manner that it may be replaced, by him, upon completion of construction.

F. The Contractor shall not remove, even temporarily, any trees or shrubs that exist on easements across private property or in parking strips, without first having notified the property owners or authorities maintaining same.

G. Ornamental trees and shrubbery shall be carefully removed with the earth surrounding their roots, wrapped in burlap and replanted in their original positions within 48 hours. Ornamental trees or shrubbery destroyed, or damaged, by the Contractor, whether on public or private property shall be replaced by the Contractor with material of the same species, size and equal quality, and no additional compensation will be allowed for such replacement.

H. It is expressly understood that the Contractor shall in particular restore all such easements and rights-of-way to a condition equal to its original condition and in a condition satisfactory to the property owners and the Engineer. It is also understood that any private improvements made in public rights-of-way are included in the above category.

1.3 TREES

A. All existing trees and shrubs which are to be protected and are damaged during construction shall be trimmed or replaced by the Contractor or a certified tree company under permit from the jurisdictional agency or owner and to the satisfaction of said agency and/or owner.

B. The Contractor shall immediately notify the Engineer and jurisdictional agency and/or owner if any tree which is to be protected is damaged by his operations. If, in the opinion of said agency or the owner, the damage is such that replacement is necessary, the Contractor shall replace the tree at his own expense.

C. Replacement trees shall be of a like size and variety as the tree damaged, or, if of a smaller size, the Contractor shall pay to the owner of said tree a compensatory payment acceptable to the tree owner not to exceed the cost of replacing the tree as determined from quotes obtained by the tree owner from a minimum of two local nurseries. The size of the replacement trees shall be not less than 1-inch diameter nor less than 6 feet in height.

D. When trimming is permitted, symmetry of the tree shall be preserved. No stubs or splits or torn branches shall be left. Clean cuts shall be made close to trunk or large branch. Spikes shall not be used for climbing live trees. All cuts over 1-1/2 inches in diameter shall be coated with an asphaltic emulsion material.

1.4 EASEMENTS

A. Reference numbers of easements are shown on drawings.

B. The Contractor shall meet and fulfill all covenants and stipulations of each easement obtained by the Owner for this project.

C. Copies of all easements and special covenants are on file in the office of the Owner, which is incorporated in this Contract by this reference, as if set forth herein in full.

1.5 ACQUISITION OF EASEMENTS

A. The Owner has obtained or is in the process of obtaining the easements required for this project.

B. If at the time of Bids on this Contract, the Owner has not obtained all of the easements, it is anticipated that there may be additional stipulations and covenants on the remaining easements. It is also anticipated that the Owner may purchase certain items on easements, such as large trees within the permanent easement, thereby relieving the Contractor from the responsibility of restoring or protecting same. All bidders shall base their bids upon full restoration of all property within the easements unless otherwise specifically stated.

1.6 COVENANTS ON EASEMENTS NOT LISTED

A. Upon completion of obtaining the remaining easements, if any, the Owner and the successful Bidder will negotiate a Change Order to the Contract for any additional stipulations not payable under a unit bid price under this Contract.

B. Work shall not be started on any private right-of-way or easement until clearance is given the Contractor by the Engineer.

1.7 EASEMENT RELEASE

A. Where work is done on easements the Contractor shall obtain a written statement (see following form) of satisfactory restoration from each property owner involved, and furnish a copy of said statement to the Engineer. The statement will be required before the work will be accepted by the Owner, provided, however, that where the Contractor contends that the property owner is making unreasonable demands, he shall submit a list of such demands to the Engineer in writing. If in the opinion of the Engineer, such demands are unreasonable, the Engineer shall so notify the Owner and if the Owner approves, the Contractor may be excused from the necessity of obtaining a written statement of satisfactory restoration from the property owner making such unreasonable demand.

EASEMENT NO. _____

CONTRACT NO. _____

PROPERTY OWNER'S APPROVAL OF EASEMENT RESTORATION

I
We, the undersigned owner(s) of property identified as

_____
(Address or Property Description)

do hereby approve and accept the restoration work done by

_____
the Contractor on the construction of pipelines on easements over
and across my (our) property.

SIGNED _____

_____

DATE _____

1.8 CARE OF EXISTING FACILITIES

A. The Contractor shall take adequate precautions to protect existing sidewalks, curbs, pavements, utilities, adjoining property, and structures, and to avoid damage thereto, and he shall at his own expense completely repair any damage thereto caused by his operation.

B. Access for fire fighting equipment shall be maintained at all times.

1.9 SHORING, BRACING, ETC.

A. The Contractor shall shore up, brace, under-pin, and protect as may be necessary, all foundations and other parts of all existing structures adjoining the site of the Project, which are in any way affected by the excavation or other operations connected with the completion of the work under this Contract.

B. Whenever any notice is required to be given by the Owner or the Contractor to any adjoining or adjacent land owner or other party before commencement of any work under this Contract, such notice shall be given by the Contractor.

C. The Contractor shall indemnify the Owner and save it harmless from any damages on account of settlements or the loss of lateral or subjacent support of adjoining property and from all loss or expense and all damages for which the Owner may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

1.10 EMERGENCIES

A. Whenever the Contractor's work endangers the safety of life or property including adjoining property or property in the immediate proximity of the Project, the Contractor shall take all reasonable precautions to prevent threatened loss or injury there from.

1.11 EXISTING UTILITIES/FACILITIES - UNDERGROUND AND OVERHEAD

A. The Contractor shall protect existing utilities/facilities, both overhead and underground.

1.12 TEMPORARY FENCE

A. The Contractor shall be responsible for the erection of temporary fence as required to protect his own work area.

B. The Contractor shall be responsible for erection and maintenance of temporary fencing or other facilities as required to retain periodic security of existing fenced areas.

C. Temporary fencing on facilities shall remain in place until the permanent fencing, as originally installed, is replaced under the restoration requirements of the Contract or as shown on the Contract Drawings.

* * * END OF SECTION * * *

SECTION 01550

ACCESS AND HAUL ROUTES

1. ROUTES

1.1 PRIVATE ACCESS

A. Where required by the Contract or choice of the Contractor access may be over private land.

B. Access will be maintained by and at the expense of the Contractor.

C. Comply with local regulations and permits.

D. Comply with all legal requirements to include as a minimum written permission of private owners.

E. Control dust, noise and traffic, in compliance with local laws and regulations.

F. Leave private property in condition satisfactory to the Owner and indicated by written release.

1.2 PUBLIC ACCESS AND HAUL ROUTES

A. Comply with all laws and regulations.

B. All streets in the construction area used by Contractor's trucks or any other equipment hauling material to and from the area whether within the Contract limits or adjacent thereto shall be kept clean and shall be serviced by continuous use of sprinkling trucks to allay dust. Any mud generated in public areas due to construction or transportation activities will be tracked offsite by the Contractor.

C. Unsurfaced roads and streets may receive an application of dust oil to allay dust.

D. Dust control shall continue until streets are accepted by the public agency responsible for maintenance or the Contractor is relieved of responsibility by such agency.

E. Sprinkling and dust oiling shall be at the Contractor's expense except that dust oil will be paid if so called out in the Contract and a unit bid item is provided.

F. Any damage to roadway surfaces from the direct or indirect result of the Contractor's operation shall be repaired by the Contractor to the satisfaction of the responsible agency.

* * * END OF SECTION * * *

SECTION 01560

TEMPORARY CONTROLS

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Project Coordination: Section 01039

C. Job Site Administration: Section 01043

D. Protection of Work and Property: Section 01545

E. Access and Haul Routes: Section 01550

F. Traffic Regulation: Section 01570

1.2 LAWS

A. Requirements of federal, state and local statutes and regulations dealing with temporary controls described in this section shall be strictly adhered to by the Contractor.

1.3 CONSTRUCTION CLEANING

A. The Contractor shall keep the site of the work and other areas used by him in a neat and clean condition, and free from any accumulation of rubbish.

B. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the work site, and shall establish regular intervals of collection and disposal of such materials and waste.

C. Keep his haul roads free from dirt, rubbish, and unnecessary obstructions resulting from his operations.

D. Equipment and material storage shall be confined to areas approved by the Engineer.

E. Disposal of all rubbish and surplus materials shall be off the site of construction, at the Contractor's expense, all in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws.

1.4 AIR POLLUTION CONTROL

A. The Contractor shall not discharge smoke, dust or other contaminants into the atmosphere that violate the regulations of any legally constituted authority.

B. The Contractor shall furnish all labor, equipment, and means required and shall carry out effective measures wherever and as often as necessary to prevent his operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity.

C. The Contractor shall comply with specific requirements of air quality control laws.

D. The Contractor shall be responsible for any damage resulting from any dust originating from his operations.

E. The dust abatement measures shall be continued until the Contractor is relieved of further responsibility by the Owner.

1.5 EROSION CONTROL

A. Contractor shall provide temporary erosion control work as necessary or as required by state and local agencies during the life of the contract. This work is intended to provide prevention, control, and abatement of water pollution/erosion within the limits of the project, and to minimize damage to the work, adjacent property, streams, and other bodies of water. If site size exceeds 1 acre, contractor shall prepare and submit a Storm Water Pollution Prevention Plan (SWPPP).

B. The Contractor shall coordinate this temporary water pollution/erosion control work with the permanent drainage and erosion control work that may be specified in the Contract to the extent practicable to ensure that effective and continuous water pollution/erosion control is maintained during the construction of the Project.

C. Clearing and grubbing operations shall be so scheduled and performed that grading operations and permanent erosion control features can follow immediately. If the project conditions do not permit this scheduling, temporary water pollution/erosion control measures will be required between successive construction stages.

D. The area of excavation, borrow, and embankment operations in progress will be limited commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other permanent erosion control measures current according to the accepted schedule.

E. If the Engineer determines that water pollution and/or erosion could occur due to seasonal limitations, the nature of the material, or the Contractor's progress, temporary water pollution/erosion control measures shall be taken immediately.

F. The Engineer may require the Contractor's operations to be scheduled so that permanent erosion control features will be installed concurrently with or immediately following grading operations.

G. Compliance with the requirements of this section shall not relieve the Contractor from his responsibility to comply with other provisions of the contract.

1.6 NOISE CONTROL

A. Comply with state and local requirements as to allowable noise levels during construction.

B. Equip all internal combustion engines in vehicles and construction equipment with effective mufflers.

C. Prevent noise disturbance to adjoining property owners and the public.

D. Construction operations shall be restricted between the hours of 7:00 AM and 5:00 PM without specific approval by the Owner except in emergencies.

1.7 SANITARY PROVISIONS

A. The Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees and the Engineer as may be necessary to comply with the requirements and regulations of the agencies or organizations having jurisdiction over sanitary and health conditions and of other bodies or offices having jurisdiction thereover. He shall permit no public nuisances.

B. The Contractor shall establish a regular daily collection of all sanitary and organic wastes.

C. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the site in a manner satisfactory to the Owner and in accordance with all laws and regulations pertaining thereto.

1.8 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture.

B. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

1.9 PROVISION FOR WATER COURSES

A. The Contractor shall provide for the flow of all water courses, sewers or drains, intercepted or disturbed by the Contractor during the progress of the work, and shall replace the same in as good condition as he found them or shall make such final provisions for them as necessary.

B. The Contractor shall not obstruct the gutter of any street, but shall use all proper measures to provide for the free passage of surface water.

C. The Contractor shall make provisions to take care of all surplus water, mud, silt, or other runoff pumped from excavations or resulting from sluicing or other operations, and shall be responsible for any damage, of whatever nature, resulting from his failure so to provide.

D. No direct payment shall be allowed for the above work. Payment for the cost thereof shall be included in the prices bid for the various items that comprise the improvement.

E. All work adjacent to or in the vicinity of streams, lakes, or such other water courses shall be accomplished in accordance with the requirements of the Departments having jurisdiction.

1.10 ARCHAEOLOGICAL OR CULTURAL RESOURCES

A. The Contractor is advised that construction work within this Contract is subject to the provisions of state and federal laws and regulations pertaining to the preservation of archaeological and cultural resources.

B. In the event that any archaeological or cultural resources are uncovered during the course of construction, all work shall cease until an inspection and evaluation of the site has been made by an archaeologist to insure that archaeological data are properly preserved. The Contractor shall notify the Owner who will in turn notify the proper authorities.

C. The Contractor should anticipate reasonable delays while the archaeological investigations are being made and should make allowance for these delays under the appropriate bid items. No additional compensation will be allowed.

* * * END OF SECTION * * *

SECTION 01570

TRAFFIC REGULATION

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Access and Haul Roads: Section 01550

1.2 MATERIALS AND CONTRACT

A. Signs, warnings, light signals, bypass layouts, scheduling and routes shall conform to the requirements of U.S. Department of Transportation Federal Highway Administration "Manual on Uniform Traffic Control Devices", latest edition, as amended by local or state agency.

1.3 MAINTENANCE OF TRAFFIC

A. The Contractor shall conduct his work so as to interfere as little as possible with public travel, and shall at his own expense provide and maintain suitable bridges, detours, or other temporary facilities for the accommodation of public or private travel including mail delivery, and shall give reasonable notice to the owners of private drives before interfering with them; provided, however, that such maintenance of traffic will not be required where the Contractor has obtained permission from the owners or tenants of private property, or the proper public authority, or both, to obstruct traffic within the said limits and time agreed upon.

B. Access for fire fighting equipment, police and ambulance services shall be provided at all times and the Contractor shall keep the local authorities informed at all times of the location of construction operations and fire lanes.

C. The Contractor shall also notify the authorities in charge of any municipal, private, or school transportation systems at least 48 hours in advance, of road closures that will force a change in the regular routing of the transportation system. The Contractor shall also provide maintain suitable detour routes for the system.

D. Highway and arterial crossings shall be made in such a way that no more than half of the roadway is closed to traffic at any time, except where suitable detours or other arrangements are agreed to by the agency having jurisdiction.

1.4 COMPLIANCE WITH LOCAL REQUIREMENTS

A. The Contractor shall comply with all applicable state and local requirements for closure of streets.

B. He shall provide barriers, guards, lights, signs, temporary bridges, flagmen and watchmen, advising the public of detours and construction hazards.

C. He shall also be responsible for compliance with additional public safety requirements which may arise during construction.

D. He shall furnish and install, and upon completion of the work, promptly remove all temporary signs and warning devices.

1.5 TRAFFIC CONTROL PLAN

A. Not less than ten days before beginning construction, the Contractor shall prepare and submit a general construction traffic control plan for the entire project, showing how detour routes will be signed and controlled.

B. The traffic control plan shall include and make provision for at least the following items:

1. Maintain at least one lane of traffic during construction in all streets and roads wherever possible.
2. Employ flagpersons to direct traffic as required to assure safe vehicular traffic.
3. Provide for the protection of pedestrians at all times.
4. Provide, install, and maintain all signs, barricades, posts, guards, and notices whenever a street must be completely closed.
5. Provide for passage of local vehicles to businesses and homes.
6. Provide for passage and access of emergency vehicles, police, fire, and disaster units at all times. Assume liability for any damages resulting from failure to provide said access.
7. Revise and update specific traffic control plan to reflect changes in the project schedule as required by the Owner.

1.6 STORAGE OF MATERIALS AND EQUIPMENT

A. Materials or equipment shall not be stored where it will interfere with the free and safe passage of public traffic.

B. The Contractor shall remove all equipment and other obstructions from that portion of the roadway to be opened for use by public traffic at the end of each day's work and at other times when construction operations are suspended for any reason.

C. Materials or other obstructions shall not be placed within 20 feet of fire hydrants, which shall at all times be readily accessible to the fire department, nor within ten feet of United States mailboxes.

1.7 MAINTENANCE OF POSTAL SERVICE

A. The Contractor shall be responsible for determining and complying with the United States Postal Department's requirements for maintaining postal service within the project area and along related detour routes.

B. Where required by street closures or excessive interferences, the Contractor shall move mailboxes to temporary locations designated by the postal service and, when such closures are terminated, shall return the mailboxes to locations and conditions satisfactory to the owners and the postal service.

C. Other mailboxes removed or damaged by the Contractor shall be placed to the satisfaction of the owners and the postal service within 24 hours of their removal or damage.

* * * END OF SECTION * * *

SECTION 01600

MATERIAL AND EQUIPMENT

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Project Coordination: Section 01039

B. Submittals: Section 01300

1.2 PRODUCTS LIST

A. As soon as possible but not more than thirty (30) days after date of Notice to Proceed, submit to Engineer five (5) copies of complete list of all products, which are proposed for installation as substitutions or product options.

B. Tabulate list by each specification section.

1.3 CONTRACTOR'S OPTIONS

A. Unless otherwise specifically provided, all workmanship, equipment, materials and articles incorporated in the work covered by the Contract are to be new and of the best available grade of their respective kinds.

B. For products specified only by reference standards, select any product meeting standards, by any manufacturer.

C. For products specified by naming one or more products, but indicating the option of selecting equivalent products by stating "or equivalent" after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.

D. For products specified by naming only one product and manufacturer, there is no option, and no substitution will be allowed.

1.4 SUBSTITUTIONS

A. Within thirty (30) days after Notice to Proceed, Engineer will consider formal requests from Contractor for substitution of products in place of those specified.

B. Submit request for substitution in accordance with requirements for submittal of shop drawings (Section 01300) and the following additional requirements.

1. For construction methods:

a. Detailed description of proposed method.

b. Drawings illustrating methods.

2. Itemized comparison of proposed substitution with product or method specification.

3. Data relating to changes in construction schedule.

4. Accurate cost data on proposed substitution in comparison with product or method specified.

C. In making request for substitution, Contractor represents:

1. He has personally investigated proposed product or method, and determined that it is equivalent or superior in all respects to that specified.
2. He will provide the same guarantee for substitution as for product or method specified.
3. He will coordinate installation of accepted substitution into work, making such changes as may be required for work to be complete in all respects.
4. He waives all claims for additional costs related to substitution which consequently becomes apparent.
5. Cost data is complete and includes all related costs under his Contract, but excludes costs under separate contracts and Engineer's redesign costs. Contractor agrees to pay for all costs under separate contracts and Engineer's redesign costs.

D. Substitutions will not be considered if:

1. They are indicated or implied on shop drawings or project data submittals without formal request submitted in accord with Section 01300.
2. Acceptance will require substantial revision of Contract Documents.

E. The above shall not be construed to mean that any substitution for materials and equipment will be allowed. The Engineer reserves the right to reject and disapprove any request he deems irregular or not in the interest of the Owner.

1.5 MATERIAL CERTIFICATION

A. Upon request of the Engineer, the Contractor's material suppliers may be required to furnish a certification from a recognized testing laboratory, certifying that the material supplied is in full conformance with the Contract Documents.

1.6 ADDITIONAL ENGINEERING COSTS

A. Additional engineering costs accruing as a result of checking and/or redesign of substitutions will be charged to the Contractor and billed by the Owner at the Engineer's current established rates.

1.7 INSTALLATION

A. All materials, appliances, fixtures, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with such instructions as are commonly furnished by the manufacturers, unless herein specified to the contrary.

B. The Contractor shall use experienced millwrights, acceptable to the Engineer, in the installation and aligning of the equipment.

C. At least one copy of the installation instructions shall be furnished to the Engineer no later than four days after the equipment arrives on site.

D. Manufacturers' instructions for handling, protecting, installation, lubrication and alignments of the equipment, shall be followed to the letter and these installation instructions shall be considered a part of this Contract, with attendant penalties for insufficient performance.

E. No piping or valves shall be supported by means of its connection to any mechanical equipment. Pipe connections to equipment must be disconnected upon request to permit inspection and determination that the piping is not transmitting stresses to the equipment.

F. All motor flexible couplings shall be disconnected and checked with an indicator for misalignment after all other installation work has been completed unless the equipment installation instructions specifically prohibit this.

G. The Contractor must allow a representative of the Owner to observe the indicator readings and approve or disapprove prior to recoupling.

1.8 PUMPS AND PIPING

A. All pump and piping installations shall fully meet the standards of the Hydraulic Institute.

* * * END OF SECTION * * *

SECTION 01650

TESTING AND STARTING OF SYSTEMS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Testing Laboratory Services: Section 01410

B. Contract Closeout: Section 01700

C. Operation and Maintenance Data: Section 01730

1.2 RESPONSIBILITY

A. Testing, startup and operation shall not be cause for claims for delay by the Contractor and all expenses accruing therefrom, shall be deemed to be incidental to the Contract.

B. The Contractor shall provide all materials, supplies and labor necessary to efficiently complete the testing, startup and operation.

C. All power and utility bills shall be paid by the Contractor up to and including the day of final acceptance of the Contract by the Owner. If not paid, these charges shall be treated as claims against the Contractor (Refer to Section 01039, Paragraph 1.4).

D. If the Owner chooses to commence operations prior to final acceptance, the Owner will assume payment of all power and utility charges effective the day that operation is assumed by the Owner and notice is given in writing.

1.3 SCHEDULE

A. Placing all phases of the project in service shall consist of three parts: testing, starting and operations.

B. Not less than thirty (30) days before anticipated time for beginning the testing, the Contractor will submit to the Engineer for approval, a complete plan for:

1. Schedules for tests.
2. Detail schedules of procedures for startup.
3. Complete schedule of events to be accomplished during startup.
4. Schedule operator training as specified.
5. An outline of work remaining under the Contract that will be carried out concurrently with the operation phases.

C. Notify the Engineer of the approximate date that water, electrical, and natural gas will be required for operation.

1.4 TESTING

A. Testing shall consist of individual tests and checks made on equipment intended to provide proof of performance of units and proper operation of unit controls together with such necessary tests whether or not described elsewhere in these Specifications to assure proper alignment, size, condition, capability, strength, proper adjustment, lubrication, pressure, hydraulic tests, leakage tests and all other checks deemed necessary by the Engineer to determine that all materials and equipment are of specified quality, properly situated, anchored and in all respects ready for use.

B. All gravity sewer pipe and pressure piping shall be tested as required by these specifications and applicable codes.

C. Tests on individual items of equipment, pipelines, vessels, structures, tanks, controls and other items shall be as described in various sections describing such items.

D. Testing will be done by the Contractor in the presence of an Inspector designated by the Engineer. Records of all official tests will be made by the Inspector.

E. During tests, the Contractor shall correct any defective work discovered or that is not in first class operating condition.

1.5 STARTUP

A. Startup shall consist of testing by a simulated operation, all operational equipment and controls. The purpose of these tests shall be to check that all equipment will function under operating conditions, that all interlocking controls and sequences are properly set and that the facility will function as an operating unit.

B. Checks for leakage of tanks, piping, valves, gates and all other hydraulic and pneumatic systems and structures will be made.

C. The test shall continue until it is demonstrated that all dysfunctions of controls and machinery are corrected.

D. The startup shall not begin until all tests required by these Specifications have been completed and approved by the Engineer.

E. The Contractor may, if approved by the Engineer, conduct the hydraulic testing of pumps, aerators and other equipment requiring large volumes of liquid simultaneously with the startup test. If required by the Owner, the Contractor shall dispose of the water used by pumping to waste.

1.6 OPERATION

A. Operation of the facility shall be immediately started after completion of testing and startup and after satisfactory repairs and adjustments have been made and providing supply and disposal facilities furnished by others are available. If these facilities are not available, the plant will be closed down and no further testing or operation by the Contractor will be required. The Contractor, however, will be responsible that all details required by the Contract shall remain in good order until final acceptance of the whole Contract.

B. The facility will be operated by personnel placed on the project by the Owner who will perform all duties and operate all equipment.

C. Taking possession and use of the facility shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents.

D. If such prior use increases or causes refinishing of completed work, the Contractor shall be entitled to such extra compensation or extension of time or both, as the Engineer may determine.

* * * END OF SECTION * * *

SECTION 01700

PROJECT CLOSEOUT

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Project Coordination: Section 01039

B. Protection of Work and Property: Section 01545

C. Testing and Starting of Systems: Section 01650

D. Final Cleaning: Section 01710

E. Project Record Documents: Section 01720

F. Operation and Maintenance Data: Section 01730

1.2 SUBSTANTIAL COMPLETION

A. Contractor:

1. After testing and startup, submit written certification to Engineer that Project or designated portion of Project is substantially complete.

2. Submit list of items to be completed or corrected.

B. Engineer will make an inspection after receipt of Contractor's certification, together with Owner's representative.

C. If it appears to the Engineer that work is substantially complete:

1. The Engineer may request of and the Contractor shall prepare and submit to Engineer, a list of items to be completed or corrected as determined by the inspection.

2. When the Engineer considers the work to be substantially complete, the Engineer may, with the Owner's approval, issue a Certificate of Substantial Completion, with appropriate conditions, accompanied by a list of the items to be completed and corrected, as verified and amended by Engineer. Omission of any item from the list shall not relieve the Contractor from responsibility to complete all the work in accordance with the Contract.

3. Owner occupancy of Project or designated portion of Project:

   a. Contractor shall perform final cleaning in accordance with Section 01710.

   b. Owner may use all or part of the work within the time designated in the Certificate of Substantial Completion, upon notice to the insurance company or companies as provided in Article 21 of the General Conditions.

4. Contractor shall complete all the work within the time designated in the Certificate, or if not so designated within a reasonable time.

D. Should the Engineer consider that work is not substantially complete:

1. He shall notify the Contractor, in writing stating reasons.

2. Contractor shall complete work and send second written notice to Engineer certifying that Project or designated portion of Project is substantially complete.

E. Warranties: Under Article 29.1 of the General Conditions guarantee and warranty periods begin with the date of final acceptance. However, in connection with any specific equipment certified by the Engineer as completed and its use or operation thereof for its intended purpose is assumed by the Owner, the warranty period for such equipment shall begin with the beginning date of such use or operation.

1.3 FINAL INSPECTION

A. The Contractor shall submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been completed in accordance with Contract Documents.

3. Equipment and systems have been tested in presence of Owner's representative and are operational.

4. Project is completed, and ready for final inspection.

B. Engineer will make final inspection within a reasonable time after receipt of certification.

C. Should Engineer consider that work is complete in accordance with requirements of Contract Documents, he shall request Contractor to make project closeout submittals.

D. Should Engineer consider that work is not complete:

1. He shall notify Contractor, in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to Engineer certifying that work is complete.

3. Engineer will reinspect work.

1.4 REINSPECTION COSTS

A. In addition to any overtime inspection due under Article 15 of the General Conditions, should Engineer be required to perform second inspections because of failure of work to comply with original certifications of Contractor, Owner will compensate Engineer for additional services as stated in said article and charge the Contractor for such fees at the Engineer's currently established billing rate.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: To requirements of Section 01720

B. Operation and Maintenance Data: To requirements of Section 01730

C. Guarantees and bonds required by these specifications: See Articles 22 and 29 of General Conditions and specific equipment or material specifications.

D. Spare parts and Maintenance Materials as specified in Section 01730.

E. Easement Release: Section 01545

F. At the close of the Contract the Contractor shall:

1. Remove all electrical, sanitary, gas, telephone, water, offices and any other temporary service equipment that may remain.
2. Arrange for transfer of utlities' accounts to the Owner's name.

G. Deliver evidence of compliance with requirements of governing authorities:

1. Certificates of Inspection:
   a. Elevators.
   b. Mechanical:
      (1) As required by codes.
   c. Electrical:
      (1) State or city as required.
      (2) Megger by Electrical Subcontractor.

1.6 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit final statement of accounting to Engineer.

B. Statement shall reflect all uncompleted adjustments:

1. Additions and deductions resulting from:
   a. Previous Change Orders.
   b. Cash Allowances.
   c. Unit Prices.
   d. Other Adjustments.
   e. Deductions for Uncorrected Work.
   f. Penalties and Bonuses.
   g. Deductions for Liquidated Damages.
2. Unadjusted sum remaining due.

1.7 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit final application in accordance with requirements of General Conditions.

1.8 FINAL CERTIFICATE FOR PAYMENT

A. Engineer will issue Final Certificate in accordance with provisions of General Conditions.

B. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Final Certificate for Payment, in accordance with provisions of General Conditions and existing laws.

1.9 POST-CONSTRUCTION INSPECTION

A. Prior to expiration of one year from Date of Substantial Completion or Final Acceptance, Engineer may make visual inspection of Project in company with Owner and Contractor to determine whether correction of work is required, in accordance with provisions of General Conditions.

B. For guarantees beyond one year, Engineer will make inspections at request of Owner, after notification to Contractor.

C. Owner will promptly notify Contractor, in writing, of any observed deficiencies.

* * * END OF SECTION * * *

SECTION 01710

FINAL CLEANING

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

B. Project Coordination: Section 01039

C. Cutting and Patching: Section 01045

D. Temporary Controls: Section 01560

E. Project Closeout: Section 01700

1.2 GENERAL REQUIREMENTS

A. Maintain premises and public properties free from accumulations of waste, debris, and rubbish caused by operations.

B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave project clean and ready for occupancy.

C. Pipeline and work on public rights-of-way shall be kept cleaned up as specified in Division 2 for the work involved.

1.3 SAFETY REQUIREMENTS

A. Standards: Maintain project in accord with the applicable federal, state and local safety standards.

B. Hazards Control:

1. Store volatile wastes in covered metal containers, and remove from premises daily.
2. Prevent accumulation of wastes which create hazardous conditions.
3. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws:

1. Do not burn or bury rubbish and waste materials on project site unless approved by local fire and air pollution authorities.
2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
3. Do not dispose of wastes into streams or waterways.

2. PRODUCTS

2.1 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

3. EXECUTION

3.1 DURING CONSTRUCTION

A. Execute cleaning to insure that grounds and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

D. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.2 FINAL CLEANING OF STRUCTURES

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.

D. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

E. Broom clean paved surfaces; rake clean other surfaces of grounds.

F. Clean windows.

G. Replace air conditioning filters if units were operated during construction.

H. Clean ducts, blowers and coils, if air conditioning units were operated without filters during construction.

I. Maintain cleaning until project is occupied by Owner.

3.3 FINAL CLEANUP OF PIPELINES

A. Final cleanup work shall be completed as closely behind the construction work as it is physically possible to do.

B. Unless otherwise specifically provided in writing only those portions of the completed work will be included in the partial pay estimates where, in the Engineer's opinion, the cleanup work has been satisfactorily completed.

C. Refer to specific sections for detail requirements for cleanup of pipelines.

3.4 GENERAL CLEANUP

A. Before final acceptance, the Contractor shall remove and obliterate, insofar as feasible, all objects or disturbances of the ground which mar the landscape and were caused by his operations, whether or not part of the improvement.

B. Rubbish, excess materials, temporary structures, and discarded equipment shall be removed and disposed of.

C. Temporary haul roads shall be scarified and bladed to blend with surroundings.

D. Remove snags, down trees, brush, and stumps.

E. Fill holes and grade to smooth land contours. Shape ends of cuts and fills to fit adjacent terrain.

F. Hand rake disturbed areas to remove loose objects including rock and clods in excess of two inches in any dimension.

G. Sweep pavement, curb and gutter, sidewalks and driveways.

* * * END OF SECTION * * *

SECTION 01720

PROJECT RECORD DOCUMENTS

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Project Coordination: Section 01039

B. Operation and Maintenance Data: Section 01730

1.2 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:

1. Contract Drawings.
2. Project Manual.
3. Addenda.
4. Reviewed Shop Drawings.
5. Change Orders.
6. Other Modifications to Contract.
7. Field Test Records.
8. Maintenance Data Delivered with Equipment.

B. Store documents in field office, apart from documents used for construction.

C. Provide files and racks for storage of documents.

D. Maintain documents in clean, dry, legible condition.

E. Do not use record documents for construction purposes.

F. Make documents available at all times for inspection by Engineer and Owner.

1.3 RECORDING

A. Do not permanently conceal any work until required information has been recorded.

B. Keep documents current.

C. Contract Drawings: Legibly mark to record actual construction:

1. Depths of various elements of foundation in relation to variances from plan.
2. Horizontal and vertical location of underground utilities and appurtenances and references to permanent surface improvements.

3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
4. Field changes of dimension and detail.
5. Changes made by Change Order or Field Order.
6. Details not on original Contract Drawings.

D. Specifications and Addenda: Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or Field Order.
3. Other matters not originally specified.

E. Shop Drawings: Maintain as record documents; legibly annotate drawings to record changes made after review.

1.4 SUBMITTAL

A. At completion of project, deliver record documents to Engineer.

B. Accompany submittal with transmittal letter, in duplicate, signed by the Contractor, or his authorized representative.

* * * END OF SECTION * * *

SECTION 01730

OPERATION AND MAINTENANCE DATA

1. GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Testing and Starting of Systems: Section 01650

B. Material and Equipment: Section 01600

C. Contract Closeout: Section 01700

1.2 DATA

A. The Contractor shall furnish the Engineer with six (6) bound copies of maintenance data on all machinery and equipment furnished under this Contract. The manuals shall include the following:

1. Equipment operating and maintenance instructions.
2. Parts list, including diagrams and cut-a-way sections.
3. Assembly and disassembly instructions.
4. Equipment specifications and guaranteed performance data.
5. Name, address and telephone of vendor and spare parts sources.
6. Factory parts list with interchangeability listings of all component sources and original manufacturer's part number.
7. Manufacturers' warranties.
8. Recommendations for preventative maintenance.
9. Step by step operating and startup procedures.

B. Wiring diagrams of all control circuits actually supplied and installed shall be included.

1.3 QUALITY

A. Data shall be bound in first quality, heavy, permanent type binders. The Contractor shall submit the binding he proposes to furnish to the Engineer for his approval before assembling all of the material.

B. Manuals shall be assembled and indexed so that information on any piece of equipment can be readily found.

1.4 FORM

A. The operating and maintenance instructions shall be the first item listed for each piece of equipment. It shall include, in addition to necessary details, a "summary of maintenance" substantially in the following format:

1. Name of Item: _____

2. Name of Manufacturer: _____

   Address: _____

3. Name Plate Information: _____

4. Nearest Local Representative: _____

   Address: _____

   Telephone No.: _____

5. Maintenance Date or

Requirements	Frequency	Lubrication	Remarks

6. Spare Parts List (to be kept on hand)

7. Type of Lubricant (if required)

   Shell: _____

   Standard: _____

   Texaco: _____

   Union: _____

   Other: _____

B. The second item of each listing shall be a detailed narrative description of both the equipment and control circuits and a description of the recommended method for troubleshooting.

C. The third item of each listing shall be the lubrication chart followed by drawings, charts and details.

* * * END OF SECTION * * *

DIVISION 2 SITE CONSTRUCTION

SECTION 02010

SUBSURFACE INVESTIGATION

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Shoring: Section 02150

1.2 SOILS REPORTS

A. Any data on soil and/or subsurface conditions shown in the Plans or Specifications is not to be taken as a representation, but is based on limited information and is at best only an opinion; consequently, such data cannot be considered precise or complete and there is no guarantee as to its completeness, accuracy, or precision.

B. A copy of any available reports may be inspected at the office of the Engineer if so stated in section "Information for Bidders."

C. These reports were obtained only for use by the Engineer in design and are not a part of the Contract Documents.

D. Additional Investigation:

1. Contractor should visit the site and acquaint himself with site conditions before submitting a bid and the submission of a bid will be prima facie evidence that he has done so.

2. Prior to bidding, Contractor may make his own subsurface investigations to satisfy himself with site and subsurface conditions.

1.3 QUALITY ASSURANCE

A. The Contractor shall readjust work performed that does not meet technical or design requirements.

B. The Contractor shall make no deviations from the Contract Documents without specific and written approval of the Owner.

C. The Contractor shall be responsible for obtaining approval from responsible agency or property owner before performing any exploratory excavations.

* * * END OF SECTION * * *

SECTION 02050

DEMOLITION

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Site Clearing: Section 02110

1.2 PROTECTION

A. Streets, roads, adjacent property and other work to remain shall be protected throughout the work.

B. Any material damaged by Contractor's operations shall be replaced with new material by the Contractor.

* * * END OF SECTION * * *

SECTION 02110

SITE CLEARING

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Demolition: Section 02050

B. Protection of Work and Property: Section 01545

1.2 PROTECTION

A. Streets, roads, adjacent property and other work to remain shall be protected throughout the work.

1.3 MEASUREMENT AND PAYMENT

A. All work included in this section shall be incidental to other portions of the work.

2.0 PRODUCTS

2.1 MATERIALS

A. Materials shall be at the Contractor's option.

3.0 EXECUTION

3.1 SURVEY STAKING IN UNCLEARED EASEMENTS

A. If the Engineer's controls or stakes are damaged or destroyed, the cost of replacement shall be at the expense of the Contractor.

3.2 CLEARING

A. Clearing work shall be performed within the confines of the area indicated on the Drawings, or in the Specifications.

B. Debris resulting from said clearing shall be disposed of by the Contractor and the right-of-way cleaned up in a neat and workmanlike manner.

C. No logs, stumps, rocks, etc., shall be left lying in the right-of-way or on adjacent property without specified written approval by the Owner.

D. All trees shall be felled within the area to be cleared except those marked to be left standing, or required by easement stipulations or by contract to be left standing, shall be close cut parallel to the ground, removed and disposed of at the expense of the Contractor.

E. No trees or shrubbery in public right-of-way shall be cut except by approval of the Engineer.

3.3 GRUBBING

A. All trees or stumps within five (5) feet of the pipeline shall be removed.

B. Grubbing will be performed where designated on the drawings or as specified herein and shall include removal from the ground of all stumps, roots, buried logs and other vegetation not otherwise provided for and the removal and disposal of the refuse.

C. In areas to be filled to a depth of three (3) feet or more above the natural ground all tree stumps and brush shall be cut off not more than three (3) inches from the ground and removed.

D. Where unsuitable surface material is to be removed, complete grubbing will be required.

3.4 DAMAGED VEGETATION

A. Neatly trim torn limbs and trunk and severed roots.

B. Apply wound paint to aboveground wounds.

C. Remove and replace in kind all vegetation damaged extensively.

3.5 DISPOSAL

A. Contractor shall comply with all laws and rules that govern burning and shall secure necessary permits.

B. When burning is permitted, it shall be done under the constant care of competent watchmen such that surrounding property or vegetative cover is not damaged.

C. Contractor may sell any saleable material.

D. Material not burned or sold shall be hauled to a disposal site secured by the Contractor at his expense.

* * * END OF SECTION * * *

SECTION 02150

SHORING

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Subsurface Investigation: Section 02010

1.2 SUMMARY

A. The work specified in this section includes installation of temporary support for trenches and excavation areas.

B. The Contractor shall design, furnish, install, and maintain a system of temporary supports, including all bracing and associated items, to retain excavations in a safe manner, to control ground movements and to control groundwater inflows. Upon completion of the required excavation and pipe installation, the Contractor shall remove the support system, as specified, and backfill the excavations.

C. The Contractor shall have sole responsibility for sizing the excavations to accommodate shoring, bracing, pipe and pipe installation to the specified lines, grades and tolerances.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

1. ASTM A 36 - Specification for Structural Steel.
2. ANSI/AWS D1.1 - Structural Welding Code.

1.4 SUBMITTALS

A. Submittals shall be made a minimum of six weeks before any work referred to in the submittals is scheduled to commence.

B. Shop drawings shall be submitted for excavation support systems, groundwater cut-off walls, and other related information as requested by the Engineer and in accordance with Section 6705 of the California Labor Code. As a minimum, the following information shall be submitted:

1. Name and qualifications of person responsible for excavation support system design.
2. Details of shoring and bracing or other provisions for worker protection from hazards of caving ground.
3. Design assumptions and calculations.
4. Methods and sequencing of excavation and installation of staged excavation support.
5. Proposed locations of stockpiled excavated material.
6. Minimum lateral distance from the crest of slopes for vehicles and stockpiled excavated materials.
7. Anticipated difficulties and proposed resolutions.

8. Backfilling of voids as required to minimize ground movement and protect adjacent property.

9. Control of water, method of maintaining bottom stability, and protection of subgrade.

C. Construction: The Contractor shall submit the following to the Engineer at the times indicated.

1. Written daily progress reports shall be submitted during excavation and construction of trenches. The progress reports shall have field logs recorded at intervals of one foot during excavation and shall be submitted to the Engineer within one working day of preparation. As a minimum, the logs shall include:

a. The date, starting time, and finish time.

b. Equipment used.

c. Theoretical "neat-line" and actual quantities of excavated material and descriptions of excavated material.

d. Any unusual conditions, breakdowns, and delays, including problems with support.

e. Depth of excavation, vertical alignment, and geologic conditions encountered.

f. Detailed description of the support installed, including sizes, lengths, and spacing.

g. Dewatering rates, pumping rates, inflow conditions.

h. Deformation monitoring results, and record of action taken by the designer of record and the contractor if predicted deflections are exceeded.

2. Results of all material and field tests shall be submitted at the end of each shift, and results of lab tests within one week of completing each test.

D. Post-Construction: Within 15 days of backfill of excavations, the Contractor shall submit a detailed as-built location plan of all remaining buried shoring members including size, location, and cutoff elevation.

E. Reports and Records: The following shall be submitted on each day that measurements are made:

1. Excavation monitoring data of horizontal and vertical deflections of supports.

2. Settlement and deformation monitoring data.

1.5 QUALITY CONTROL, TESTS, AND INSPECTIONS

A. Quality control, testing, and inspection shall be provided as required by the Contractor's design engineer and in accordance with approved submittals. The Contractor's design engineer shall visit the site to observe the work in progress on at least a weekly basis or more frequently if required by the Engineer.

B. The Contractor shall coordinate with the Engineer regarding additional quality assurance testing to be provided at the Owner's discretion. The Contractor shall permit free access during construction of shoring systems for the Owner's testing staff.

C. All work shall be performed in the presence of the Engineer, unless the Engineer has granted prior approval in writing to perform such work in his absence.

1.6 DESIGN CRITERIA

A. As a minimum all excavation support systems shall be designed in accordance with CAL-OSHA, OSHA and Caltrans requirements.

B. The size type and design of shoring and protection methods are the Contractor's responsibility, and are subject to review and approval by the Engineer. Shoring options include but are not limited to:

1. Interlocking Sheetpiles.
2. Soldier Piles and Lagging.
3. Trench Boxes.
4. Speed Shores.
5. Secant Piles.
6. Structural Deep Soil Mix.

C. In all areas, excavation support systems shall be designed by the Contractor's design engineer to support earth pressure, unrelieved hydrostatic pressures, bottom heave, utility loads, equipment, applicable traffic loads, and other surcharge loads in such manner as will allow safe construction and will prevent damage to adjacent structures (including existing pipelines and utilities) and injury to workers and the public. In addition, the installation of excavation support systems shall not cause a disruption to public convenience or access.

D. Excavation support systems shall be designed to be compatible with the geologic conditions described in the Geotechnical Data Report and the Geotechnical Baseline Report, including any adjacent slope support structures. Recommended minimum lateral earth pressures and maximum side slopes for selected conditions are summarized in the Geotechnical Baseline Report.

E. Excavation support systems shall be designed to minimize horizontal and vertical movements to within allowable values, and to protect adjacent utilities from damage.

F. Excavation support systems shall be designed for control of water, maintaining bottom stability and protection of subgrade.

G. Excavation support system shop drawings and design calculations shall be prepared by a Civil or Structural Engineer registered in the State of California who has a minimum of five years experience in the design of soil retaining structures.

H. The Engineer's approval of the Contractor's plans and methods of construction will not relieve the Contractor of the responsibility for the adequacy of the design, installation or resulting excavation support performance.

1.7 WARRANTY

A. The Contractor shall be solely responsible for, and bear the sole burden of cost for any and all damages resulting from improper shoring or failure to shore.

B. The safety of workmen, the protection of adjacent structures, property and utilities, and the installation of adequate supports for all excavations shall be the sole responsibility of the Contractor.

C. The design, planning, installation and removal of all shoring shall be accomplished in such a manner as to maintain stability of the required excavation and the prevent movement of soil that may cause

damage to adjacent shoring systems, structures and utilities, damage or delay the work, or endanger life and health.

2.0 PRODUCTS

2.1 MATERIALS

Structural Steel: ASTM A36 or better, unless approved otherwise.

A. Steel sheet piles: ASTM A857.

B. Timber Spacers and Shims: Hardwood as defined by AASHTO.

C. Timber Subjected to Flexural Loading: Structural grade or better with minimum allowable flexural strength of 1100 psi.

D. All timber and structural steel used for the supporting systems, whether new or used, shall be sound and free from defects, which may impair their strength.

3.0 EXECUTION

3.1 GENERAL

A. Trench excavations and site development shall commence only after receiving a favorable review of applicable submittals by the Engineer. Install excavation support systems in accordance with submittals, which have been reviewed by the Engineer.

B. Before beginning construction, adequately protect existing structures, utilities, trees, shrubs, and other existing facilities. The repair of or compensation for damage to existing facilities shall be at no additional cost to the Owner.

C. Excavations shall be performed in accordance with the requirements of Section 02315 EXCAVATION, GRADING, and FILL, and in sequence with installation of shoring and bracing in a manner that limits settlement of surrounding ground and adjacent conduits, structures, or roads and so as to offer no hazard to building movement or occupancy, train, truck or automobile operations.

D. The Contractor shall notify the Engineer not less than 15 days before beginning any excavation. Excavations and construction for site development shall not extend beyond the property lines and limits of disturbance shown on the Plans.

E. The Contractor shall conduct all excavation, shoring, temporary facilities, materials storage, and construction traffic within construction easements established for this project. All work shall be in accordance with the applicable permit.

F. All welding shall conform to the applicable provisions of ANSI/AWS D1.1.

G. The Contractor shall provide temporary safety railing and fencing around all excavations.

H. The maximum height of unsupported sidewall span shall be in accordance with OSHA regulations, 29 CFR Part 1926 – Excavation Standards.

I. Tolerances: Unless more stringent tolerances are noted or required on shop drawings, the location of the excavation supports shall be within 3 inches of that shown on the shop drawings.

3.2 GROUNDWATER CONTROL

A. Positive groundwater control using wells, well points or a combination of cut off walls and sumps is required for all excavations. The Engineer shall be advised of any changes made to accommodate field conditions and upon completion of system installation, Shop Drawings shall be revised and resubmitted.

B. Open pumping from sumps shall not result in boils, softening of the ground, or loss of fines. Sumps, subdrains, drain blankets, wells, and well points shall be installed as necessary, using suitable filters or screens so that fines are not removed from the formation.

3.3 SOLDIER PILES AND LAGGING INSTALLATION

A. Piles in predrilled holes shall be installed to the tip elevations shown on accepted Shop Drawings. Casing, drilling mud, or other method of support shall be provided to prevent caving of holes and loss of ground.

B. After soldier pile has been seated plumb in the drill hole, it shall be encased with concrete from the tip to the bottom level of the final excavation. Concrete strength shall placed by means of a tremie system, if needed. Piles shall be vibrated. The remainder of the pile bore shall be encased with slurry.

1. Timber, steel, or precast concrete lagging of sufficient thickness shall be provided to withstand lateral earth pressures.
2. Lagging with no gap between adjacent boards shall be installed. As installation progresses, voids between the excavation face and the lagging shall be backfilled with sand or pea gravel packed into place. Lagging shall be packed with materials such as hay, burlap, or geotextile fabric where necessary to allow drainage of groundwater without loss of ground due to piping.
3. A geotextile fabric shall be provided for filtration purposes.

3.4 INTERNAL BRACING SUPPORT SYSTEM

A. The internal bracing support system shall include wales, struts, and/or shores.

1. Struts with intermediate bracing shall be provided as needed to enable them to carry maximum design load without distortion or buckling.
2. Web stiffeners, plates, or angles shall be included as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.
3. All bracing support members shall be installed and maintained in tight contact with each other and with the surface being supported.
4. Bracing members shall be preloaded by jacking struts to 50 percent of the design load, if necessary, to control shoring movement. Bracing members shall be preloaded in accordance with methods, procedures, and sequence as described in the submittals. Excavation work shall be coordinated with installation of bracing and preloading. Steel shims and steel wedges shall be welded or bolted in place to maintain the preloading force in the bracing after release of the jacking equipment pressure. Support and preload shall be installed immediately after installation and prior to continuing excavation.
5. Procedures that produce uniform loading of bracing member shall be used without eccentricities or overstressing and distortion of members of system.

B. Tiebacks shall be used where proposed in conjunction with or in lieu of struts, bracing and shores, designed and installed in accordance with recommendations of the Post Tensioning Institute. On-site tests shall be performed to demonstrate adequacy of tiebacks for subsurface conditions. Tieback lengths shall be adequate to obtain anchorage behind potential failure plane of excavation.

1. Conduct proof-tests, performance tests and lift-off tests of the tieback systems to verify capacity and lock-off load.

3.5 STEEL SHEET PILING

A. Steel sheet piling shall be used only where the existing subsurface conditions are suitable for installation of sheet piling to the full depth of penetration required, and to proper alignment and plumbness, without damage to the sheet piling or rupture of its interlocks.

B. Sheet piles shall be driven in plumb position with each sheet pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, bearing tightly against original ground. Sheet piles shall be driven to the depth indicated on the shop drawings. Care shall be exercised in driving so that interlocking members can be extracted without damaging adjacent structures or utilities. The methods of driving, cutting, and splicing shall conform to the Shop Drawings.

3.7 INVERT TREATMENT

A. Trench Invert treatment shall comply with County Standard Construction Specifications.

3.8 INSTRUMENTATION AND SETTLEMENT MONITORING

A. Performance of excavation support system shall be monitored for both horizontal and vertical deflections.

B. If excessive settlement or deflections of supports occur that exceed those values predicted by the Contractor's shoring designer or otherwise allowable values, modifications to the excavation and shoring approach will be required. Revised shop drawings and calculations shall be submitted to the Engineer. Changes to excavation sequence and shoring shall be implemented as may be necessary at no additional cost to the Owner.

3.9 REMOVAL OF SUPPORT SYSTEM

A. Excavation support shall not be removed until support can be removed without damage to existing facilities, completed work, or adjacent property.

B. As a minimum, excavation support shall be removed between the existing adjacent surface grade and 2 feet below the adjacent surface grade. As-built Drawings shall be prepared showing precise locations and depths of all temporary shoring and bracing elements that remain in place.

C. Excavation support shall be removed in a manner that will maintain support as excavation is backfilled and will not leave voids in backfill. Removal of the support system shall be performed in a manner that will not disturb the pipeline, the compacted backfill, adjacent construction or facilities or cause the loss of compaction.

D. Voids left by shoring system or voids created by the removal of the shoring system shall be filled with controlled density fill, lean concrete, or cement grout, as approved by the Engineer to provide soil support between backfill zone and the native soil.

E. Sheet piling removal shall be performed in a manner that will avoid “vibro-consolidation” of sandy or granular material below the excavation that could lead to settlement of the pipeline or other works of construction.

F. All support system elements removed from the excavation shall remain the property of the Contractor and shall be removed from the site.

END OF SECTION

SECTION 02210

EXCAVATION AND GRADING

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Confirmation and Characterization of Sampling for Excavations: Section 02447

1.2 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422	(1992) Method for Particle-size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. [2,700 kN-m/cu.m.])
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

(1972) California Bearing Ratio

1.3 DEFINITIONS

1.3.1 Satisfactory Materials

A. Fill material shall be predominantly granular soil with at least 30% non-expansive silt and clay content, free of debris and organic matter, contain no rocks or cement particles greater than ¾-inches in largest dimension, and have a Plasticity Index of less than 15 and a minimum R-value of 20 according to the CA bearing.

1.3.2 Unsatisfactory Materials

A. Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in ASTM D 2487 as Pt, OH, and OL are unsatisfactory.

1.3.3 Cohesionless and Cohesive Materials

A. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

1.3.4 Wet Soil

A. Wet soil is defined as soil containing more than 25% moisture by weight.

1.3.5 Degree of Compaction

A. Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated below as a percent of laboratory maximum density.

1.3.6 Cleanup Standards

A. The following list shall be used to determine when excavations are complete as determined through confirmation sampling as detailed in Section 02447 (Confirmation and Characterization Sampling for Excavations). At a minimum, the Contractor shall ensure that excavations meet cleanup standards or as directed by the Engineer.

Constituent	**Cleanup Standards (mg/kg)**
Metals	
Lead	212
PCBs	
Aroclor-1254	0.87
Aroclor-1260	0.87
PAHs	
Benzo(a)anthracene	3.78
Benzo(b)fluorathene	3.78
Benzo(k)fluoranthene	3.78
Benzo(a)pyrene	0.38
Chrysene	37.3
Indeno(1,2,3-cd)pyrene	3.78
Dibenz(a,h)anthracene	0.62

1.4 SUBMITTALS

A. Approval is required for submittals with a “GA” designation; submittals having an “FIO” designation are for information only. The following shall be submitted in accordance with the Basic Contract.

1. Satisfactory Materials (include Modified Proctor Results), GA. Certified test reports and analysis certifying that the satisfactory materials proposed for use at the project site conform to the specified requirements, and for all tests conducted in accordance with paragraph FIELD TESTING CONTROL. Results of testing shall be submitted with the Contractors Daily Quality Control Reports.

2. Health and Safety Plan, GA.

3. Project Schedule, GA. Contractor shall submit a Project Schedule. The Project Schedule shall include the following activities:

   - Excavation, restoration, and grading;
   - Sampling and analysis for confirmation and disposal samples;
   - Transportation and disposal;

4. Daily Activity and Quality Control Reports, GA. Contractor shall submit Daily Quality Control Reports.

1.5 SUBSURFACE DATA

A. Subsurface soil information is provided in Section 01000 SITE DESCRIPTION AND PROJECT BACKGROUND. These data represent the best subsurface information available.

2.0 PRODUCTS

2.1 BORROW MATERIAL

A. Borrow material shall be selected to meet requirements and conditions of the particular fill for which it is to be used. The following material definitions are considered to be satisfactory. Material that does not meet the following criteria shall be considered unsatisfactory.

2.1.1 Selection

A. Borrow materials shall be obtained from sources outside the limits of the Site. Borrow materials shall be subject to approval. The Contractor shall submit certification indicating that borrow material is environmentally clean. The source of borrow material shall be the Contractor's responsibility. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, shall pay all royalties and other charges involved, and shall bear all the expense of developing the sources, including rights-of-way for hauling.

2.1.2 Select Granular Backfill

A. Select granular backfill shall be satisfactory materials as defined in paragraph SATISFACTORY MATERIALS.

2.1.3 Fill Remaining in Excavations

A. Material that is left in-place in the excavations shall be considered below remedial action levels when confirmation sampling results indicate that concentrations in the soil are less than cleanup levels, or as directed by the Engineer.

3.0 EXECUTION

3.1 EXCAVATION

3.1.1 General

A. Following receipt and approval of sampling results, excavated material shall be transported directly to appropriate landfills as specified in Section 02215 TRANSPORT AND DISPOSAL. Excavations carried below the depths indicated, without specific directions, shall, except as otherwise specified, be refilled to the proper grade with satisfactory material as directed. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Excavations shall be kept free from water while construction therein is in progress. Excavation must stop during rain. Material required for fills in excess of that produced by excavation within the grading limits shall meet requirements as detailed in paragraph BORROW MATERIAL.

3.1.3 Excavation Area and Volume

A. The soils contained within the Site exhibit concentrations above the cleanup standards. These areas are shown in Drawing C-2. Historical sampling results are shown on Figures 4-1and 4-2 of the Basis of Design Report. The area, depth, and volume of soil excavation for the planned excavation is an area of 9,575 sf by 2.5 to 5 feet bgs for a total of approximately 1,155 cy (in place).

Several small structures exist at the site that are located near or within the excavation areas. These include underground electric lines that supply power to extraction and monitoring wells, water conveyance pipes. The soil remedial action, including excavation and backfilling activities, shall not remove and/or damage any of the existing structures.

3.1.4 Excavation Confirmation Sampling and Additional Excavation

A. Confirmation sampling will be performed during primary excavation activities to ensure that soils with contamination levels exceeding the soil cleanup levels have been excavated. Confirmation samples will be collected from the excavation floors and walls. Along the floor of the excavation, soil samples will be collected on 20-foot centers, and sidewall samples will be collected at 40-foot intervals. Soil samples should also be collected on the perimeter of the excavation to confirm that the surface contamination surrounding the excavation is below the established cleanup levels.

B. Confirmation sampling and analysis shall be in accordance with Excavation Work Plan Section 02447. If the result from any of these samples indicates that soil in the excavation floor is greater than cleanup goals, then the Engineer shall be notified. If the Engineer approves, excavation shall be continued vertically to remove an additional 1 foot, the sample point located at the center of the area. The additional floor excavation area shall not exceed the lateral limits of excavation. If additional excavation area is larger than the lateral limits, then additional floor excavation will be done within the original excavation lateral limits. One sample shall then be collected from the center of each area where additional vertical excavation was completed. If the result from any of these additional samples indicates that soil in the excavation floor contains a concentration above cleanup goals, then the Engineer shall again be notified. If the Engineer approves, excavation shall be continued vertically to remove an additional 1 foot as described above. This process shall be repeated with the approval of the Engineer until all the sample points indicate concentrations less than cleanup goals.

3.1.5 Soil Characterization for Disposal

A. Soil disposal characterization samples shall be analyzed as detailed in Sections 01010 SUMMARY OF WORK and 02247 CONFIRMATION AND CHARACTERIZATION SAMPLING FOR EXCAVATIONS.

3.1.6 Soil and Debris Management

A. Following soil classification, soil, and debris shall be transported off-site for disposal at an approved location. Transport and disposal shall be conducted as detailed in Section 02215. Documentation to release any and all materials from the site shall be signed by the generator.

3.1.7 Decontamination

A. The contractor will designate an area to temporarily store excavated soil prior to transport to the TSD facility and to conduct decontamination activities. The contractor shall size the area based on the requirements to complete the removal action effectively and efficiently. The contractor will line the area with a minimum of 20-millimeter (mm) polyethylene plastic sheeting or another material approved by EPA. The area will be bermed such that any runoff will not be able to leave or enter the bermed area. The contractor may separate the two areas. If the contractor separates the decontamination site from the soil stockpile site, the requirements to construct each area will be followed. The decontamination portion of the area will be constructed in a manner where liquids from the decontamination activities can be easily collected

3.2 BACKFILL ADJACENT TO STRUCTURES

A. Backfill adjacent to structures shall be placed and compacted uniformly in such manner as to prevent wedging action or eccentric loading upon or against the structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the fill. During backfilling operations and in the formation of embankments, equipment that will overload the structure in passing over and compacting these fills shall not be used.

3.3 PREPARATION OF GROUND SURFACE FOR FILL

A. All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish, and other unsatisfactory material within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, or broken up, as directed, in such manner that the fill material will bond with the existing surface. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the specified density. Final fills shall have a smooth transition between the filled area and the undisturbed areas, and shall match the existing grade to slope for drainage upon completion.

3.4 FILLS AND EMBANKMENTS

A. Fills and embankments shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the shape of the typical sections indicated or shall meet the requirements of the particular case. Fill shall be satisfactory material. The material shall be placed in successive horizontal layers of 6 inches in compacted depth, for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlaying lift is placed. Moisture content of the fill or backfill material shall be adjusted by wetting or aerating, as required.

3.5 COMPACTION

A. Each layer of the fill or embankment shall be compacted to at least 90% for cohesionless soils and 85% for cohesive soils of laboratory maximum dry density (as determined by ASTM D 1557).

3.6 FINISHED EXCAVATION AND FILLS

A. All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage. Surfaces other than those that are to be paved shall be finished not more than 0.15 foot above or below the established grade or approved cross section.

3.7 FIELD TESTING CONTROL

A. Testing shall be the responsibility of the Contractor and shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Field density tests shall be performed on every 1,200 square feet of each 1-foot lift placed. If an excavation is less than 1,200 square feet, then testing is required for every 6-inch lift placed. Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2922. All compaction test results shall be submitted to the Contracting Officer in the Daily Quality Control Reports.

3.8 PROTECTION

A. Newly graded areas shall be protected from traffic and from erosion. Any 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. All work shall be conducted in accordance with the environmental protection requirements of the State of California and this contract.

-- End of Section --

SECTION 02215

TRANSPORTATION AND DISPOSAL OF HAZRDOUS MATERIALS

1.0 GENERAL

1.1 REFERENCES

A. The documents listed below form a part of this specification to the extent referenced:

1. 40 CFR 261, Identification of Hazardous Wastes
2. 40 CFR 263, Transportation of Hazardous Wastes
3. 40 CFR 268, Land Disposal Restrictions
4. 40 CFR 300, National Oil and Hazardous Substances Pollution Contingency Plan
5. Federal Register 59-47982, Universal Treatment Standards
6. CCR Title 22, Section 66261.24

1.2 SUBMITTALS

A. Approval is required for submittals with a “GA” designation; submittals having an “FIO” designation are for information only.

1. Health and Safety Plan (HASP), GA. The Contractor will prepare a HASP in accordance with the requirements presented in Section 8.0 (HASP Requirements) of the RD/RA Plan. As part of the HASP, the Contractor shall submit a safety plan that addresses loading transport vehicles with contaminated soils requiring CAMU placement or off-site disposal. This shall be a part of the Remedial Action Work Plan.

2. Transportation & Disposal Plan, GA. Contractor shall submit a transportation and disposal plan, which details safety precautions, identifies all applicable permits and transport routes, and describes the means to transport contaminated soil from FT003 to the on-base CAMU and the selected off-base landfill. This shall be part of the Remedial Action Work Plan.

3. Disposal Recordkeeping; FIO. The contractor will be required to submit to the Engineer all of the following

   - The name/location/type of the landfill selected for each soil unit;
   - Receipts issued by the landfill upon acceptance of the waste; and
   - All waste manifests signed by 60 CES/CEVC and chain-of-custody forms prepared to transport the waste to the selected landfill.

4. Certificates of Disposal; FIO. Receipts issued by the landfill upon acceptance of the waste, within 90 days of initial shipment. Receipt of these certificates will be required for final payment.

5. Packaging Certification; GA. Packaging certification documents shall be furnished to the Travis CEV Compliance Staff for review a minimum of 1 day prior to transporting hazardous material and shall include the following:

- Truck inspection log forms that will provide a checklist for the Contractor to verify that each vehicle has been completely decontaminated and is in good operating condition before entering or departing the remedial action work site.

- Draft hazardous waste manifests.

- Draft land disposal restriction notifications.

- Draft bill of ladings for hazardous materials.

- Lists of corresponding proposed labels, packages, marks, and placards to be used for shipment.

- Waste profiles, and supporting waste analysis documents.

- Generator copies of hazardous waste manifests, land disposal restriction notifications, bill of ladings, and supporting waste analysis documents shall be furnished when the shipments depart the site and proceed to the disposal destination.

2.0 PRODUCTS

A. Not Applicable.

3.0 EXECUTION

3.1 GENERAL

A. Material to be disposed off site shall be transported via authorized transport vehicles.

3.2 OFF-SITE MATERIAL TREATMENT/DISPOSAL LOCATIONS

A. The maximum total threshold limit concentration (TTLC) and soluble threshold limit concentration (STLC) soil concentrations shall be used to determine the appropriate class of landfill (Class I or Class II) for that unit of soil.

3.3 PREPARING TRANSPORT VEHICLES

A. The Contractor shall inspect and log each transport vehicle using the truck inspection log forms described in Section 1.2 (Submittals), certifying that the vehicle is clean prior to entering the Site. Transport vehicles shall be prepared for loading in accordance with applicable California State laws. Each transport vehicle shall be inspected by the Contractor to determine if it is suitable for transporting the material. Transport vehicles shall be sealed, if necessary, around openings on the vehicle, particularly belly-dump gates, to prevent material from spilling from the vehicle. Transport vehicles shall be fitted with a tarp or other covering device to prevent wind dispersal of material during transport. The tarp or approved covering device shall also prevent precipitation or other fluids from contacting the materials after loading and en route to the destination.

3.4 LOADING TRANSPORT VEHICLES

A. Vehicle loading shall be conducted in such a manner so as to minimize spillage of material and the generation of dust. The contractor shall be held responsible for the cost of clean-up of all contamination caused by soil transport activities. If wetting agents are used to control dust, such agents shall only be used to the extent necessary to avoid unnecessary weight increases through the

addition of such wetting agents. Vehicles shall be loaded so that a reasonable (e.g., 5%) safety margin exists to ensure that the vehicle will not be overweight, recognizing that weight restrictions may vary from County to County, where the vehicle will travel.

3.5 POST-LOADING VEHICLE CLEANING AND INSPECTION

A. The contractor shall ensure that soil and debris have been removed from exterior surfaces of each transport vehicle. Exterior surfaces shall be cleaned to remove mud and other material adhering to exterior surfaces by sweeping, scraping, or other means that do not use fluids. The Contractor shall inspect each transport vehicle, and a truck inspection log form will be filled out to certify that the truck is clean on exterior surfaces and in compliance with applicable state laws prior to leaving the Site. The Contractor will submit truck inspection log forms to the Engineer prior to transportation of hazardous material to ensure that the completion of each truck inspection log forms will result in a vehicle that complies with the applicable state laws.

3.6 SPILLS OR RELEASES

A. In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), or pollutant or contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the contractor shall notify the Engineer immediately. If the spill exceeds a reporting threshold, the contractor shall follow the pre-established procedures for immediate reporting to the Engineer.

END OF SECTION

SECTION 02222

EXCAVATION, TRENCHING, AND BACKFILLING FOR SVE PIPING

1.0 GENERAL

1.1 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. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
2. ASTM D 422 (1992) Particle-Size Analysis of Soils
3. ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
4. ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
5. ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System

1.2 DEFINITIONS

1.2.1 Degree of Compaction

A. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

1.3 SUBMITTALS

A. Approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with the Contract Documents:

1. Field Density Tests; GA. Testing of Backfill Materials; GA.Copies of all laboratory and field test reports within 24 hours of the completion of the test.

2.0 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

A. Satisfactory materials shall consist of any material classified by ASTM D 2487 as GW, GP, GM, SW, SP, ML and SM.

2.1.2 Unsatisfactory Materials

A. Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 3 inches, and materials classified in ASTM D 2487, as GC, SC, CL. MH, CH, PT, OH, and OL. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

2.1.3 Cohesionless and Cohesive Materials

A. Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

2.1.4 Unstable Material

A. Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

2.1.5 Initial Backfill Material

A. Initial backfill shall consist of satisfactory materials free from rocks 1 inch or larger in a dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

2.1.6 Plastic Marking Tape

A. Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 11500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified below and shall bear a continuous printed inscription describing the specific utility.

Yellow: Air Vacuum Systems

Red: Electrical

3.0 EXECUTION

3.1 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site and shall be disposed of in accordance with paragraph DISPOSAL OF EXCESS EXCAVATED MATERIAL. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost. Any water removed from the trench shall be handled as contaminated and disposed of accordingly.

3.1.1 Trench Excavation

A. The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench

walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 4 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.1.1.1 Bottom Preparation

A. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 1 inch or greater in an dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.2 Removal of Unstable Material

A. Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with satisfactory granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

3.1.1.3 Excavation for Appurtenances

A. Excavation for manholes, catch-basins, inlets, or similar structures shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. Removal of unstable material shall be as specified above. 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 just before the concrete or masonry is to be placed.

3.1.1.4 Disposal of Excess Excavated Material

A. Any excess excavated material, after completion of trenching and backfilling operations, shall be disposed of by placement into D.O.T. approved roll off boxes or bins. Handling, storage, sampling, profiling, and disposal shall be performed in accordance with Section 02215 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS. Composite soils from each roll off box shall be analyzed for contaminants by the appropriate method as specified in 02447 Confirmation and Characterization Sampling for Excavations.

3.1.1.5 Stockpiles

A. Stockpiles of satisfactory and other backfill materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such

material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Owner. Locations of stockpiles of satisfactory materials shall be subject to prior approval of the Engineer.

3.2 BACKFILLING AND COMPACTION

A. Backfill material shall consist of satisfactory material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 90 percent maximum density for cohesionless soils, unless otherwise specified.

3.2.1 Trench Backfill

A. Trenches shall be backfilled to the grade shown. The trench shall not be backfilled until all specified tests are performed.

3.2.1.1 Replacement of Unstable Material

A. Unstable material removed from the bottom of the trench or excavation shall be replaced with satisfactory material placed in layers not exceeding 6 inches loose thickness.

3.2.1.2 Bedding and Initial Backfill

A. Bedding shall be of the type and thickness shown on the Design Drawings. Initial backfill material shall be placed and compacted with approved tampers to a height of at least three inches above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.1.3 Final Backfill

A. The remainder of the trench shall be filled with satisfactory material. Backfill shall be deposited in layers of a maximum of 8 inch-loose thickness, and compacted to 90 percent maximum density for cohesive soils and 95 percent maximum density for cohesionless soils. Backfill shall be placed up to the elevation at which the requirements in Sections 02551 BITUMINOUMS PAVING FOR ROADS, STREETS, AND OPEN STORAGE AREAS and 02579 RESTORATION OF RIGID PAVEMENTS, respectively, control. Water flooding or jetting methods of compaction will not be permitted.

3.2.2 Backfill for Appurtenances

A. After the manhole, catch basin, inlet, or similar structure has been constructed, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 SPECIAL REQUIREMENTS

A. Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.3.1 Air Vacuum Lines

A. Trenches shall be of a depth to provide a minimum cover of 30 inches from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.3.2 Plastic Marking Tape

A. Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown.

3.4 TESTING

A. Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Owner.

3.4.1 Testing Facilities

A. Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Engineer. The first inspection shall be at the expense of the Owner. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

3.4.2 Testing of Backfill Materials

A. Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 1557. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

3.4.3 Field Density Tests

A. Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 50 linear feet of pipe installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic yards of material used. Field in-place density shall be determined in accordance with ASTM D 1556. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Engineer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Owner.

**End of Section **

SECTION 02234

BASE COURSE

1 GENERAL

1.1 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. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) ASTM C 29 (1991a) Unit Weights and Voids in Aggregate
2. ASTM C 117 (1990) Materials Finer Than No. 200 Sieve in Mineral Aggregates by Washing
3. ASTM C 131 (1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
4. ASTM C 136 (1993) Sieve Analysis of Fine and Coarse Aggregates
5. ASTM D 75 (1987; R 1992) Sampling Aggregates
6. ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
7. ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft.)
8. ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
9. ASTM D 4318 (1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
10. ASTM E 11 (1987) Wire-Cloth Sieves for Testing Purposes
11. STATE OF CALIFORNIA DEPARTMENT OF TRANSPORATION Standard Specification Aggregate Base Section 26

1.2 DEGREE OF COMPACTION

A. Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated herein as percent laboratory maximum density.

1.3 SUBMITTALS

A. Approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with the Contract Documents:

1. Equipment; GA. List of proposed equipment to be used in performance of construction work, including descriptive data.
2. Sampling and Testing; GA. Copies of Test Results.

1.4 SAMPLING AND TESTING

A. Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor subject to approval. If the Contractor elects to establish testing facilities of his own, no work requiring

testing will be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities shall be at the expense of the Owner and any subsequent inspections required because of failure of the first inspection will be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. The materials shall be tested to establish compliance with the specified requirements.

1.4.1 Sampling

A. Sampling for laboratory testing shall be in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Engineer.

1.4.2 Tests

1.4.2.1 Sieve Analysis

A. Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

1.4.2.2 Liquid Limit and Plasticity Index

A. Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Density Tests

A. Density shall be measured in the field in accordance with ASTM D 1556.

1.4.2.4 Wear Test

A. Wear tests shall be made in conformance with ASTM C 131.

1.4.2.5 Weight Per Cubic Foot of Slag

A. Weight per cubic foot of slag shall be determined in accordance with ASTM C 29.

1.4.3 Approval of Material

A. The source of the material shall be selected 21 days prior to the time the material will be required in the work. Tentative approval of the source will be based on an inspection by the Engineer. Tentative approval of material will be based on tests of samples for the specific job. Final approval of both the source and the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course.

1.5 EQUIPMENT

A. All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

2.0 PRODUCTS

2.1 MATERIALS

Aggregates shall conform to Caltrans Class II specifications.

3.0 EXECUTION

3.1 OPERATION OF AGGREGATE SOURCES

A. All clearing, stripping and excavating work involved in the opening or operation of aggregate sources shall be performed by the Contractor. Aggregate sources shall be opened to working depth in a manner that produces excavation faces that are as nearly vertical as practicable for the materials being excavated. Materials excavated from aggregate sources shall be obtained in successive cuts extending through all exposed strata. The methods of operating aggregate sources and the processing and blending of the material may be changed or modified by the Engineer when necessary in order to obtain material conforming to specified requirements. Aggregate sources on private lands shall be conditioned in agreement with local laws and authorities.

3.2 STOCKPILING MATERIAL

A. Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Engineer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING MATERIA

A. Prior to constructing the base course, the underlying course shall be cleaned of all foreign substances. The underlying course shall conform to the requirements of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR SVE PIPING. Ruts or soft, yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the base course. Stabilization shall be accomplished by mixing base-course material into the underlying course, and compacting by approved methods. The stabilized material will be considered as part of the underlying course and shall meet all requirements for the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the base course is placed.

3.4 GRADE CONTROL

A. The finished and completed base course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the site of the work.

3.5 MIXING AND PLACING MATERIALS

A. The materials shall be mixed and placed in such a manner as to obtain uniformity of the base material and at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory base course.

3.6 LAYER THICKNESS

A. The compacted thickness of the base course shall be as indicated. When a compacted layer of 6 inches is specified, the material may be placed in a single layer; when a compacted thickness of more than 6 inches is required, no layer shall exceed 6 inches nor be less than 3 inches when compacted.

3.7 COMPACTION

A. Each layer of the base course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure such that the water content is within plus or minus 2 percent of optimum water content as determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least 95 percent of laboratory maximum density. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.8 EDGES OF BASE COURSE

A. Approved material shall be placed along the edges of the base course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 1 foot width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the base course, as directed.

3.9 SMOOTHNESS TEST

A. The surface of each layer shall not show deviations in excess of 1/2 inch when tested with a 10 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.10 THICKNESS CONTROL

A. The completed thickness of the base course shall be in accordance with the thickness and grade indicated on the drawings. The thickness measurement shall be made by test holes, at least 3 inches in diameter through the course. The completed base course shall not be more than 1/2 inch deficient in thickness nor more than 1/2 inch above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness of the base course is 1/2 inch or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 1/2 inch. The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch of the thickness shown.

3.11 MAINTENANCE

A. The base course shall be maintained in a satisfactory condition until accepted.

** End of Section **

SECTION 02447

CONFIRMATION AND CHARACTERIZATION SAMPLING FOR EXCAVATIONS

1.0 GENERAL

1.1 REFERENCES

A. Section 2210, Excavation and Grading

B. The documents listed below form a part of this specification to the extent referenced:

1. CCR Title 22 Section 66261.24

2. U.S. EPA SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition, Update III.

1.2 SUBMITTALS

A. Approval is required for submittals with a “GA” designation; submittals having an “FIO” designation are for information only.

1. Sampling Test Results, FIO. Copies of test results to be included in the Contractor's Daily Quality Control Reports.

2.0 PRODUCTS

Not Applicable.

3.0 EXECUTION

3.1 GENERAL

A. Unless stated otherwise in this section, all work will be performed in accordance with the Project Quality Assurance Project Plan (QAPP). A copy of the QAPP is available from the Engineer if further clarification is desired.

3.2 SAMPLING LOCATIONS

A. Confirmation sampling locations are indicated on the Design Drawings and described the Excavation Work Plan and the associated Sample Analysis Plan.

3.2.1 Confirmation Sampling

A. The soil identified with concentrations of the constituents of concern above the cleanup goals will be excavated in a phased effort. Initially, soil will be removed to 1foot bgs. Confirmation samples will be collected from the excavation floors and walls. Along the floor of the excavation, soil samples will be collected on 20-foot centers, and sidewall samples will be collected at 40-foot intervals. Soil samples should also be collected on the perimeter of the excavation to confirm that the surface contamination surrounding the excavation is below the established cleanup levels. The confirmation sample results determine whether cleanup standards have been met or whether additional excavation is required. If additional excavation is required, subsequent sampling shall be performed as detailed in Section 02210 Excavation and Grading.

3.3 TESTING

A. Confirmation samples for excavation areas shall be analyzed for PCBs, PAHs, and lead using U.S. EPA Method SW8082, SW8310, and SW7421, respectively. Additional testing shall be performed as described below.

3.3.1 Soil Characterization Sampling for Landfill Disposal

A. The soil samples shall be used in classifying the type of landfill needed for the ultimate disposal of the soil that does not meet cleanup levels. The Waste Extraction Test procedure defined in Appendix 2 of 22 CCR 66261 will be used to determine the soluble threshold limit concentration (STLC). SW846 Method 1311 will be used as the toxicity characteristic leaching procedure (TCLP).

3.4 SOIL DISPOSAL CLASSIFICATION

A. Excavated soil will be classified for ultimate disposal as one of the following:

- Clean (concentrations below site cleanup levels);
- Class II Landfill; or
- Class I Landfill.

The ultimate disposal location of the soil will depend on the soil acceptance sample results, as is detailed in Section 02215.

3.5 SAMPLING TECHNIQUES

A. The Contractor will follow the decontamination and sampling procedures specified in the Excavation Work Plan when collecting soil samples. Soil samples will be collected to confirm that the contamination above the cleanup goals in the soil has been removed during the removal action activities and that the areas immediately outside the excavation are below the cleanup goals. Locations for sampling are established by standards of confirmation requirements. These requirements are described as follows: (1) For narrow excavation areas (less than four feet in width), such as pipeline excavations, soil samples will be collected at 20-foot intervals below the invert of former underground piping; (2) For larger excavations, soil samples will be collected on 20-foot centers, and side wall samples will be collected below the zone of contamination at 40-foot intervals. Soil samples should also be collected on the perimeter of the excavation to confirm that the surface contamination surrounding the excavation is below the established cleanup levels. Field duplicate samples and equipment blank samples will be collected at a minimum frequency of 10% of all normal samples. One temperature blank will be included in each cooler used for shipment of samples. The contractor's SAP shall address pertinent details of sampling, sample handling, sample preservation, sample chain-of-custody, quality control, sample shipping procedures and equipment decontamination.

3.6 ANALYTICAL PROCEDURES

A. All analyses shall be performed by a laboratory, which is certified by the California Department of Health Services for the analytical method listed below. In addition, all analytical and QA/QC procedures shall be accomplished in accordance with the Project’s Quality Assurance Project Plan (QAPP). The information in the tables listed below can be found in the SAP but are provided for convenient reference in the field.

B. Reporting limits for all COCs shall meet those found in the SAP. If wastes are to be disposed, further analytical testing may be necessary in accordance with the accepting disposal facility's requirements.

C. All results (field and quality control (QC) samples) shall be reported in hardcopy. Section 01300 contains additional details regarding the desired format. The results shall be in a standard format where all QC samples can be traced back to a preparation batch.

END OF SECTION

SECTION 02551

BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS

1.0 GENERAL

1.1 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. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) ASTM C 29 (1991a) Unit Weight and Voids in Aggregate
2. ASTM C 117 (1990) Materials Finer than (No 200) Sieve in Mineral Aggregates by Washing
3. ASTM C 131 (1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
4. ASTM C 136 (1984a) Sieve Analysis of Fine and Coarse Aggregates
5. ASTM D 75 (1987) Sampling Aggregates
6. ASTM D 140 (1988) Sampling Bituminous Materials
7. ASTM D 242 (1985; R 1990) Mineral Filler for Bituminous Paving Mixtures
8. ASTM D 946 (1982) Penetration-Graded Asphalt Cement for Use in Pavement Construction
9. ASTM D 2041 (1991) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
10. ASTM D 2216 (1990) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
11. ASTM D 3381 (1983) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
12. ASTM D 3515 (1989) Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
13. ASTM D 4791 (1989) Flat or Elongated Particles in Coarse Aggregate

1.2 SUBMITTALS

A. Approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with the Contract Documents:

1. Bituminous Pavement; GA. Copies of test results.

1.3 STRAIGHTEDGE

A. The Contractor shall furnish and maintain at the site, in good condition, one 12-foot straightedge for each bituminous paver. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.4 WEATHER LIMITATIONS

A. Unless otherwise directed, bituminous courses shall not be constructed when temperature of the surface of the existing pavement or base course is below 40 degrees F.

1.5 PROTECTION OF PAVEMENT

A. After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until the pavement has cooled to 140 degrees F.

1.6 THICKNESS AND SURFACE-SMOOTHNESS REQUIREMENTS

A. Finished surface of bituminous courses, when tested as specified below and in paragraph ACCEPTABILITY OF WORK, shall conform to the required thickness of existing paving and to surface-smoothness requirements specified.

1.6.1 Paving Thickness

A. The paving thickness of the completed surface shall not deviate more than 0.03 foot from the existing cross-section.

1.6.2 Surface Smoothness

A. When a 12-foot straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall vary not more than 1/4 inch from the straightedge.

1.7 GRADE CONTROL

A. Required elevations shall be established and maintained by means of line and grade stakes placed at site of work in accordance with the SPECIAL CLAUSES.

2.0 PRODUCTS

2.1 BITUMINOUS HOT MIX

A. Shall consist of coarse aggregate, fine aggregate, mineral filler, bituminous material, and approved additives, if required, in accordance with CalTrans asphalt specifications, or at the option of the Contractor, in lieu of developing a new job-mix formula (JMF) for surface course construction, the Contractor may use job-mix formulas for surface course construction currently in use by CalTrans for surface courses for primary road construction provided in each instance that the same materials proposed for use on this project are being used and provided the mix meets all criteria specified in CalTrans asphalt specifications.

2.1.1 Aggregates

A. Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screening, sand, and mineral filler, as required. The portion of materials retained on the No. 4 sieve shall be known as coarse aggregate, the portion passing the No. 4 sieve and retained on the No. 200 sieve as fine aggregate, and the portion passing the No. 200 sieve as mineral filler in accordance with ASTM C 117 and ASTM C 136.

2.1.1.1 Coarse Aggregate

A. Coarse aggregate shall consist of clean, sound, durable particles meeting the following requirements.

1. Percentage of loss shall not exceed 40 after 500 revolutions, as determined in accordance with ASTM C 131.

2. The dry weight of crushed slag shall not be less than 75 pcf, as determined in accordance with ASTM C 29.

3. Crushed gravel retained on the No. 4 sieve and each coarser sieve shall contain at least 75 percent by weight of crushed pieces having one or more fractured faces with the area of each face equal to at least 75 percent of the smallest midsectional area of piece. When two fractures are contiguous, the angle between planes of fractures shall be at least 30 degrees to count as two fractured faces.

4. Particle shape of crushed aggregates shall be essentially cubical. The quantity of flat and elongated particles in any sieve size shall not exceed 20 percent by weight, when determined in accordance with ASTM D 4791.

2.1.1.2 Fine Aggregate

A. Fine aggregate shall consist of clean, sound, durable particles including natural sand or crushed stone, slag, or gravel that meets requirements for wear and soundness specified for coarse aggregate. Fine aggregate produced by crushing gravel shall have at least 90 percent by weight of crushed particles having two or more fractured faces in the portion retained on the No. 30 sieve. This requirement shall apply to the material before blending with natural sand when blending is necessary. Quantity of natural sand to be added to the wearing- and intermediate-course mixtures shall not exceed 25 percent by weight of coarse and fine aggregate and material passing the No. 200 sieve. Natural sand shall be clean and free from clay and organic matter.

2.1.1.3 Mineral Filler

A. Mineral filler shall conform to ASTM D 242.

2.1.2 Bituminous Material

A. Asphalt cement shall conform to ASTM D 3381.

2.1.3 Additives

A. The use of additives such as antistripping and antifoaming agents is subject to approval.

2.2 PROPORTIONING OF MIXTURE

2.2.1 Job Mix Formula

A. The job mix formula (JMF) for the bituminous mixture shall conform to CalTrans specifications (1/2" maximum, medium aggregate). Bituminous mix that deviates more than 25 degrees F from the JMF shall be rejected. The JMF may be adjusted during construction to improve paving mixtures, as directed by the Engineer, without adjustments in the contract prices.

3.0 EXECUTION

3.1 BASE COURSE CONDITIONING

A. The surface of the base course will be inspected for adequate compaction and surface tolerances specified in Section 02234 BASE COURSE. Unsatisfactory areas shall be corrected.

3.2 EXISTING PAVEMENT CONDITIONING

A. Where construction requires cutting and replacing of flexible pavement, saw cutting shall be so accomplished that the remaining exposed edges of the existing paving shall conform vertically and horizontally to a straight line. Pavement and base course shall be removed to a point 1 foot back from each side of the trench.

3.3 PREPARATION OF BITUMINOUS MIXTURES

A. Rates of feed of aggregates shall be regulated so that the moisture content and temperature of aggregates will be within specified tolerances. Aggregates, mineral filler, and bitumen shall be conveyed into the mixer in proportionate quantities required to meet the JMF. Mixing time shall be as required to obtain a uniform coating of the aggregate with the bituminous material. Temperature of bitumen at time of mixing shall not exceed 300 degrees F. Temperature of aggregate and mineral filler in the mixer shall not exceed 325 degrees F when bitumen is added. Overheated and carbonized mixtures or mixtures that foam shall not be used.

3.4 WATER CONTENT OF AGGREGATES

A. Drying operations shall reduce the water content of mixture to less than 0.75 percent. The water content test will be conducted in accordance with ASTM D 2216; the weight of the sample shall be at least 500 grams. If the water content is determined on hot bin samples, the water content will be a weighted average based on composition of blend.

3.5 STORAGE OF BITUMINOUS PAVING MIXTURE

A. Storage shall conform to the applicable requirements of ASTM D 3515; however, in no case shall the mixture be stored for more than 4 hours.

3.6 TRANSPORTATION OF BITUMINOUS MIXTURE

A. Transportation from paving plant to site shall be in trucks having tight, clean, smooth beds lightly coated with an approved releasing agent to prevent adhesion of the mixture to the truck bodies. Excessive releasing agent shall be drained prior to loading. Each load shall be covered with canvas or other approved material of ample size to protect mixture from weather and to prevent loss of heat. Loads that have crusts of cold, unworkable material or that have become wet will be rejected. Hauling over freshly placed material will not be permitted.

3.7 SURFACE PREPARATION OF UNDERLYING COURSE

A. Prior to placing of the intermediate or wearing course, the underlying course shall be cleaned of all foreign or objectionable matter with power brooms and hand brooms.

3.8 TACK COATING

A. Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin coat of bituminous material conforming to Section 02558 BITUMINOUS TACK COAT.

3.9 PLACING

A. Bituminous courses shall be constructed only when the base course or existing pavement has no free water on the surface. Bituminous mixtures shall not be placed without ample time to complete spreading and rolling during daylight hours, unless approved satisfactory artificial lighting is provided.

3.9.1 General Requirements for Use of Mechanical Spreader

A. Range of temperatures of mixtures, when dumped into the mechanical spreader, shall be as determined by the Engineer. Mixtures having temperatures less than 225 degrees F when dumped into the mechanical spreader shall not be used. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course being laid will be smooth and continuous without tears and pulls, and of such depth that, when compacted, the surface will conform to the cross section indicated. Placing with respect to center line areas with crowned sections or high side of areas with one-way slope shall be as directed. Each lot of material placed shall conform to requirements specified in paragraph ACCEPTABILITY OF WORK. Placing of the mixture shall be as nearly continuous as possible, and speed of placing shall be adjusted, as directed, to permit proper rolling. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected.

3.9.2 Placing Strips Succeeding Initial Strips

A. In placing each succeeding strip after initial strip has been spread and compacted as specified below, the screed of the mechanical spreader shall overlap the previously placed strip 2 to 3 inches and be sufficiently high so that compaction produces a smooth dense joint. Mixture placed on the edge of a previously placed strip by the mechanical spreader shall be pushed back to the edge of the strip by use of a lute. Excess mixture shall be removed and wasted.

3.9.3 Handspreading in Lieu of Machine Spreading

A. In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. Spreading shall be in a manner to prevent segregation. The mixture shall be spread uniformly with hot rakes in a loose layer of thickness that, when compacted, will conform to required grade, density, and thickness.

3.10 COMPACTION OF MIXTURE

A. Rolling shall begin as soon after placing as the mixture will bear a roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. After initial rolling, preliminary tests of crown, grade, and smoothness shall be made by the Contractor. Deficiencies shall be corrected so that the finished course will conform to requirements for grade and smoothness specified herein. Grade and smoothness will be checked in each lot of completed pavement by the Engineer for compliance and will be evaluated as specified in paragraph ACCEPTABILITY OF WORK. After the Contractor is assured of meeting crown, grade, and smoothness requirements, rolling shall be continued until a mat density of 97.0 to 100.0 percent and a joint density of 95.0 to 100.0 percent of density of laboratory-compacted specimens of the same mixture is obtained in accordance with ASTM D 140 and ASTM D 2041. Places inaccessible to rollers shall be thoroughly compacted with hot hand tampers.

3.10.1 Correcting Deficient Areas

A. Mixtures that become contaminated or are defective shall be removed to the full thickness of the course. Edges of the area to be removed shall be cut so that sides are perpendicular and

parallel to the direction of traffic and so that the edges are vertical. Edges shall be sprayed with bituminous materials conforming to Section 02558 BITUMINOUS TACK COAT. Fresh paving mixture shall be placed in the excavated areas in sufficient quantity so that the finished surface will conform to grade and smoothness requirements. Paving mixture shall be compacted to the density specified herein. Skin patching of an area that has been rolled shall not be permitted.

3.11 JOINTS

3.11.1 General

A. Joints between old and new pavements, between successive work days, or joints that have become cold (less than 80 degrees C (175 degrees F)) shall be made to insure continuous bond between the old and new sections of the course. All joints shall have the same texture and smoothness as other sections of the course. Contact surfaces of previously constructed pavements coated by dust, sand, or other objectionable material shall be cleaned by brushing or shall be cut back as directed. When directed by the Engineer, the surface against which new material is placed shall be sprayed with a thin, uniform coat of bituminous material conforming to Section 02558 BITUMINOUS TACK COAT. Material shall be applied far enough in advance of placement of a fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

3.12 ACCEPTABILITY OF WORK

3.12.1 Surface Smoothness

A. After completion of final rolling, the compacted surface will be tested by the Engineer with a 12-foot straightedge. Measurements will be made perpendicular to and across all mats at distances along the mat not to exceed 25 feet. Location and deviation from straightedge of all measurements will be recorded. Any joint or mat area surface deviation which exceeds the tolerance given in paragraph SURFACE-SMOOTHNESS REQUIREMENTS by more than 50 percent shall be corrected to meet the specification requirements. The Contractor shall remove the deficient area and replace with fresh paving mixture at no additional cost to the Owner. Sufficient material shall be removed to allow at least 25 mm (1 inch) of asphalt concrete to be placed. Skin patching for correcting low areas or planing for correcting high areas shall not be permitted.

** End of Section **

SECTION 02558

BITUMINOUS TACK COAT

1.0 GENERAL

1.1 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. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) T 40 (1978; Rev 1986) Sampling Bituminous Materials

2. AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM) ASTM D 140 (1993) Sampling Bituminous Materials

3. ASTM D 633 (1987; R 1991) Volume Correction Table for Road Tar

4. ASTM D 977 (1991) Emulsified Asphalt

1.2 SUBMITTALS

A. Approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with the Contract Documents:

1. Tests; FI0. Copies of all test results, within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than 30 days before the material is required in the work.

1.3 EQUIPMENT, MACHINES AND TOOLS

1.3.1 General Requirements

A. All plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.

1.3.2 Power Brooms and Power Blowers

A. Power brooms and power blowers shall be suitable for cleaning the surfaces to which the tack coat is to be applied.

1.4 WEATHER LIMITATIONS

A. Tack coat shall be applied only when the surface to receive the tack coat is dry. Tack coat shall be applied only when the atmospheric temperature in the shade is 50 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application.

2.0 PRODUCTS

2.1 BITUMINOUS MATERIAL

A. Emulsified asphalt shall conform to ASTM D 977 Grade SS-1h.

3.0 EXECUTION

3.1 PREPARATION OF SURFACE

A. Immediately before applying the tack coat all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The area to be tacked shall also be dry and clean.

3.2 APPLICATION RATE

A. Bituminous material for the tack coat shall be applied in quantities of not less than 0.05 gallon nor more 0.15 gallon per square yard of pavement surface. The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Engineer.

3.3 APPLICATION TEMPERATURE

A. Tar application temperatures shall be within the following ranges as directed; Emulsions SS-1h 70-160 degrees F.

3.4 APPLICATION

A. Following preparation and subsequent inspection of the surface, the tack coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor, vertical cuts, and side of vaults shall be properly treated with the hand spray. Following application of the tack material and prior to application of the succeeding layer of pavement, the tack shall be allowed to cure and to obtain evaporation of any volatiles or moisture. Until the succeeding layer of pavement is placed, the tacked area shall be maintained by protecting the surface against damage and by repairing and retracing deficient areas at no additional cost to the Owner. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material. No smoking, fires, or flames other than the heaters that are a part of the equipment shall be permitted within 25 feet of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions.

3.5 FIELD QUALITY CONTROL

A. Samples of the bituminous material used will be obtained by the Contractor as directed, under the supervision of the Engineer. The sample will be retained and tested by the Owner at no cost to the Contractor.

3.6 SAMPLING AND TESTING

3.6.1 General Requirements

A. Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved.

3.6.2 Sampling

A. The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140 or AASHTO T 40.

3.6.3 Initial Sampling and Testing

3.6.3.1 Bituminous Materials

A. Sources from which bituminous materials are to be obtained shall be selected and notification thereof furnished the Engineer within 15 days after the award of the contract.

3.6.4 Sampling and Testing During Construction

A. Quality control sampling and testing shall be performed as required in paragraph FIELD QUALITY CONTROL.

** End of Section **

SECTION 02575

SEDIMENTATION CONTROL

1. REFERENCES

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. State Water Resources Control Board General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 99-08-DWQ)

1.2 GENERAL REQUIREMENTS

A. Contractor is responsible to conform to all codes and regulations legally in effect at the location of the project.

B. Contractor shall conform to all requirements and regulations of the authority administering such codes and regulations.

2.0 PRODUCTS

A. Not Applicable.

3.0 EXECUTION

A. Precautions will be taken to prevent the migration of excavated material off site; these will include placing stockpiles of excavated material onto one layer of polyethylene plastic sheeting and covering the stockpiles with polyethylene plastic sheeting. Berms will be constructed as necessary to divert runoff away from the stockpiles and to prevent the runoff from leaving the site or going to the Site drains.

* * * END OF SECTION * * *

SECTION 02576

FENCE AND CONCRETE REMOVAL

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Site Clearing: Section 02110

1.2 PROTECTION

A. Streets, roads, adjacent property and other work to remain shall be protected throughout the work.

B. Any material damaged by Contractor's operations shall be replaced with new material by the Contractor.

2.0 PRODUCTS

A. Not Applicable

3.0 EXECUTION

A. The Contractor shall remove the asphalt and concrete from the site covering the identified areas prior to initiation of the excavation of contaminated materials.

* * * END OF SECTION * * *

SECTION 02579

RESTORATION OF RIGID PAVEMENTS

1.0 GENERAL

1.1 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. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) ASTM C 31 (1991) Making and Curing Concrete Test Specimens in the Field
2. ASTM C 39 (1984) Test Method for Compressive Strength of Cylindrical Concrete Specimens
3. ASTM C 94 Specification for Ready-Mixed Concrete
4. ASTM C 136 (1992) Sieve Analysis of Fine and Coarse Aggregates
5. ASTM C 143 (1990a) Slump of Hydraulic Cement Concrete
6. ASTM C 150 (1992) Portland Cement
7. ASTM C 171 (1992) Sheet Materials for Curing Concrete
8. ASTM C 192 (1990a) Making and Curing Concrete Test Specimens in the Laboratory
9. ASTM C 231 (1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
10. ASTM C 260 (1986) Air-Entraining Admixtures for Concrete
11. ASTM D 75 (1987; R 1992) Sampling Aggregates
12. CORPS OF ENGINEERS (COE) COE CRD-C 104 (1980) Method of Calculation of the Fineness Modulus of Aggregate
13. COE CRD-C 300 (1990) Specification for Membrane-Forming Compounds for Curing Concrete
14. COE CRD-C 400 (1963) Requirement for Water for Use in Mixing or Curing Concrete
15. FEDERAL SPECIFICATIONS (FS) FS CCC-C-467 (Rev C) Cloth, Burlap, Jute (or Kenaf)
16. FS SS-S-200 (Rev E; Am 1) Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement

1.2 DESIGN

A. The concrete mixtures shall be designed to produce concrete having an average flexural strength of 4,000 psi at 28 days of age, determined in conformance with ASTM C 39, using standard cylindrical specimens. The concrete mixtures shall be designed to secure an air content by volume of 6 percent, plus or minus 1-1/2 percent, based on measurements made on concrete immediately after discharge from the mixer in conformance with ASTM C 231. Mix design studies and tests shall be made in accordance with ASTM C 78 and ASTM C 192, and the test results submitted for approval.

1.3 SUBMITTALS

A. Approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with the Contract Documents:

1. Patching System; GA. Three copies of the proposed mix design, prior to placement. The mix design shall indicate the weight of each ingredient of the mixture. No concrete shall be placed prior to approval of the proposed mix design. No deviation from the approved job-mix formula will be permitted without prior approval.

2. Patching System; GA. Three copies of test results, within 24 hours of physical completion of laboratory testing. Manufacturer's certifications may be submitted rather than laboratory test results for proposed materials. Certificates should certify compliance with the appropriate specification referenced herein. No materials shall be placed without prior approval from the Contracting Officer.

1.4 EQUIPMENT; APPROVAL AND MAINTENANCE

A. Dependable and sufficient equipment that is appropriate and adequate to accomplish the work specified shall be assembled at the site of the work a sufficient time before the start of paving to permit thorough inspection, calibration of weighing and measuring devices, adjustment of parts, and the making of any repairs that may be required. The equipment shall be maintained in good working condition.

1.5 SAMPLING AND LABORATORY TESTING OF MATERIALS

A. Sampling and testing shall be performed by an approved commercial laboratory or by the Contractor subject to approval. Should the Contractor elect to establish testing facilities, no work requiring testing shall be permitted until the Contractor's facilities have been inspected and approved. The first laboratory inspection shall be at the expense of the Owner and the cost of any subsequent inspection resulting from failure of the first inspection shall be at the expense of the Contractor. Such costs shall be deducted from the total amount due the Contractor. All testing shall be performed at no additional cost to the Owner.

1.5.1 Cement

A. Cement shall be tested as prescribed in the referenced specification under which it is furnished. Cement may be accepted on the basis of mill tests and the manufacturer's certification of compliance with the specification, provided the cement is the product of a mill with a record for the production of high-quality cement for the past 3 years.

1.5.2 Aggregate

A. Aggregate samples for laboratory testing shall be taken in conformance with ASTM D 75 and tested in accordance with ASTM C 136.

1.5.3 Joint-Sealing Materials

A. Joint-sealing materials shall be tested for conformance with the referenced applicable material specification in accordance with ASTM standards.

1.6 DELIVERY AND STORAGE OF MATERIALS

1.6.1 Cement

A. Cement may be furnished in bulk or in suitable bags used for packaging cements and shall be stored in a manner to prevent absorption of moisture.

1.6.2 Aggregates

A. Aggregates shall be handled and stored in a manner to avoid breakage, segregation, or contamination by foreign materials.

1.7 WEATHER LIMITATIONS

A. Concrete shall not be placed when weather conditions detrimentally affect the quality of the finished product. No concrete shall be placed when the air temperature is below 40 degrees F in the shade. When air temperature is likely to exceed 90 degrees F, the concrete shall have a temperature not exceeding 90 degrees F when deposited, and the surface of such placed concrete shall be kept damp with a water fog until the approved curing medium is applied.

2.0 PRODUCTS

2.1 MATERIALS

2.1.1 Coarse Aggregate

2.1.1.1 Composition

A. Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, or a combination thereof.

2.1.1.2 Quality

A. Aggregate as delivered to the mixers shall consist of clean, hard, unweathered, and uncoated particles. Dust and other coatings shall be removed from the coarse aggregates by adequate washing.

2.1.1.3 Particle Shape

A. Particles of the coarse aggregate shall be generally spherical or cubical in shape.

2.1.1.4 Size and Grading

A. The maximum nominal size of the coarse aggregate shall be 12 mm. (1/2 inch.) The coarse aggregate shall be well graded within the limits specified, and when tested in accordance with ASTM C 136, shall conform to the following grading requirements as delivered to the batching hoppers:

Sieve designation U.S. Standard square mesh	Percentage by weight passing
3/4 inch	100
1/2 inch	90-100
3/8 inch	40-70
No. 4	0-15
No. 8	0-5

2.1.2 Fine Aggregate

2.1.2.1 Composition

A. Fine aggregate shall consist of either natural sand, manufactured sand, or a combination of natural and manufactured sand, and shall be composed of clean, hard, durable particles.

2.1.2.2 Particle Shape

A. Particles of the fine aggregate shall be generally spherical or cubical in shape.

2.1.2.3 Grading

A. Grading of the fine aggregate as delivered to the mixer shall conform to the following requirements when tested in accordance with ASTM C 136.

Sieve designation U.S. Standard square mesh	Percentage by weight, passing
3/8 inch	100
No. 4	95-100
No. 8	80-90
No. 16	60-80
No. 30	30-60
No. 50	12-30
No. 100	2-10

In addition, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.40 nor more than 2.90.

2.1.3 Air-Entraining Admixture

A. Air-entraining admixture shall conform to ASTM C 260.

2.1.4 Cement

A. Cement shall be Portland cement conforming to ASTM C 150, Type I or II.

2.1.5 Curing Materials

2.1.5.1 Burlap

A. Burlap shall conform to FS CCC-C-467.

2.1.5.2 Curing Compound

A. Membrane-forming curing compound shall be a pigmented type conforming to COE CRD-C 300.

2.1.5.3 Waterproof Blanket Materials

A. Waterproof blanket materials shall conform to ASTM C 171, Type optional, color white.

2.1.6 Joint-Sealing Materials

A. Joint-sealing materials shall be tested for conformance with the referenced applicable material specification.

2.1.7 Water

A. Water shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances. Water approved by Public Health authorities for domestic consumption may be accepted for use without being tested.

3.0 EXECUTION

3.1 CONDITIONING OF EXISTING PAVEMENT

3.1.1 Preparation of Existing Concrete

A. In the area to be restored, the existing concrete shall be removed to a total depth of the rigid pavement and the subgrade shall be compacted to requirements specified in Section 02234 BASE COURSE. A vertical saw cut to the total depth of the existing pavement shall be made of the area to be repaired. The surface shall be thoroughly cleaned by sweeping or blowing with compressed air.

3.1.2 Preparation of Joints

A. Joint-sealing and expansion-joint materials shall be removed flush with the prepared surface, and, if on the pavement surface to be patched, shall be removed by sandblasting. The use of solvents will not be permitted. Care shall be used to prevent bonding of the adjacent concrete slabs at the location of the existing joints. Maintenance of these existing joints shall be accomplished by the use of fiberboard or other approved inserts of appropriate dimensions.

3.2 BATCHING, MIXING AND PROPORTIONING

3.2.1 Equipment

A. The Contractor shall provide adequate facilities for the accurate measurement and control of each of the materials entering the concrete. The Engineer shall have free access to the batching and mixing plant at all times. Mixing equipment shall be capable of combining the aggregate, cement, admixture, and water into a uniform mixture and discharging this mixture without segregation, in accordance with ASTM C 94.

3.2.2 Conveying

A. Concrete shall be conveyed from mixer to repair area as rapidly as practicable by methods that will prevent segregation or loss of ingredients.

3.2.3 Facilities for Sampling

A. Suitable facilities shall be provided for readily obtaining representatives samples of aggregate and concrete for uniformity test purposes. Necessary platforms, tools, and equipment for obtaining samples shall be furnished by the Contractor.

3.2.4 Mix Proportions

A. The proportions of materials entering into the concrete mixtures shall be in accordance with the approved job-mix formula. The proportions shall be changed whenever necessary to maintain the workability, strength, and standard of quality required, and to meet the varying conditions encountered during the construction. However, no changes will be made without prior approval of the Engineer.

3.2.5 Measurement

A. Equipment necessary to measure and control the amount of each material in each batch of concrete shall be provided. Bulk cement shall be weighed, but cement in unopened bags as packed by the manufacturer may be used without weighing. One bag of portland cement will be considered as weighing 94 pounds. Mixing water and air-entraining admixtures may be measured by volume or by weight. One gallon of water will be considered as weighing 8.33 pounds.

3.2.6 Workability

A. The slump of the concrete shall be maintained at the lowest practicable value, not exceeding 3 inches when tested in accordance with ASTM C 143.

3.3 PLACING

A. Concrete shall be placed within 45 minutes from the time all ingredients are charged into the mixing drum, before the concrete has obtained its initial set. The temperature of the concrete, as deposited in the form, shall be not less than 40 degrees F nor more than 90 degrees F. Concrete shall be deposited in such manner as to require a minimum of rehandling, and placement shall being such manner as to require a minimum of rehandling and in such a manner as to least disturb the epoxy-resin grout. The placing of concrete shall be rapid and continuous for each area. The concrete shall be thoroughly consolidated by tamping or by means of suitable vibrating equipment.

3.4 FIELD TEST SPECIMENS

3.4.1 General

A. Concrete samples shall be furnished by the Contractor, and shall be taken in the field and tested to determine the slump, air content, and strength of the concrete. Concrete cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed in service. The air content shall be determined in conformance with ASTM C 231. Test cylinders shall be molded and cured in conformance with ASTM C 39 and as specified below. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, and protecting test beams at the site and under the supervision of the Engineer. Curing facilities for test beams shall include furnishing and operating water tanks equipped with temperature-control devices that will automatically maintain the temperature of the water at 73 degrees F plus or minus 5 degrees F. The Contractor shall also furnish and maintain at the site, boxes or other facilities suitable for storing the specimens while in the mold at a temperature of 73 degrees F plus or minus 10 degrees F. Tests of the fresh concrete and of the hardened concrete cylinders shall be made by and at the expense of the Contractor.

3.4.2 Specimens for Strength Tests

A. Test cylinders shall be made each day that concrete is placed. Each group of test cylinders shall be molded from the same batch of concrete, and shall consist of four specimens to provide required flexural-strength tests at each test age. At the start of paving operations and each time the aggregate source, aggregate characteristics, or mix design is changed, one additional set of test cylinders shall be made.

3.5 FINISHING

A. Finishing operations shall be started immediately after placement of the concrete. The finished surfaces of patched areas shall have a surface texture approximating that of the adjacent undisturbed pavements.

3.6 CURING

3.6.1 General

A. Concrete shall be cured by protection against loss of moisture and rapid temperature changes for a period of not less than 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. The Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins. Failure to comply with curing requirements shall be cause for immediate suspension of concreting operations.

3.6.2 Burlap Curing

A. Immediately after the finishing operations have been completed and the concrete has set sufficiently to prevent marring the surface, the entire surface of the newly laid concrete shall be covered with approved wetted burlap that shall be kept wet for a period of not less than 24 hours. The surface of the newly laid concrete shall be kept moist until the burlap coverings are in place. Curing of the concrete shall be continued for the duration of the required curing period by this method or one of the methods specified below.

3.6.2.1 Waterproof-Paper Blankets or Impermeable Sheets

A. Immediately after removing the covering used for initial curing, the exposed concrete surfaces shall be moistened with a fine spray of water and then covered with waterproof-paper blankets, polyethylene-coated-burlap blankets, or impermeable sheets. Burlap of polyethylene-coated burlap shall be saturated with water before placing. Sheets shall be placed with the light-colored side up. Sheets shall overlap not less than 12 inches with edges taped or secured to form a completely closed joint. Coverings shall be weighted down to prevent displacement or billowing from winds. Tears or holes appearing during the curing period shall be immediately repaired by patching.

3.6.2.2 Membrane-Forming Curing Compound

A. Membrane-forming curing compound shall be applied immediately to exposed concrete surfaces after removing burlap coverings. The curing compound shall be applied with an overlapping coverage that will give a two-coat application at a coverage of not more than 200 square feet per gallon for both coats. When application is made by hand-operated sprayers, the second coat shall be applied in a direction approximately at right angles to the first coat. Concrete shall be properly cured at joints, but no curing compound shall enter joints that are to be sealed with joint-sealing compounds. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel, and that will be free from pinholes and other imperfections. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed at the coverage specified above and at no additional cost to the Owner. Areas covered with curing compound that are damaged by pedestrian and vehicular traffic or by subsequent construction operations within the specified curing period shall be resprayed at no additional cost to the Owner.

3.7 FINISH TOLERANCE

A. The finished surfaces of patched areas shall meet the grade of the adjoining pavements and shall not deviate more than 1/8-inch from a true plan surface within the patched area.

3.8 PAVEMENT PROTECTION

A. The Contractor shall protect the patched areas against damage prior to final acceptance of the work by the Owner. Traffic shall be excluded from the patched areas by erecting and maintaining barricades and signs until the completion of the curing period of the concrete.

3.9 JOINTS

A. Joints shall conform in detail and be in alignment with the existing joints. After curing of the concrete, the joints in the critical areas indicated shall be primed if and as recommended by the sealant formulator and shall then be sealed with joint-sealing material. Equipment for heating and installing sealers shall be indirect heating type with pressure-type pouring device, and devices for controlling and indicating the temperature of the sealers. Mixing of components of sealers and temperatures of application shall be as recommended by the particular sealer manufacturer. Sealer shall completely fill the joint without discontinuities and without formation of voids or entrapped air. Defective joints shall be satisfactorily replaced.

** End of Section **

SECTION 02610

PIPE AND FITTINGS

1.0 GENERAL

1.1 QUALITY ASSURANCE

A. Testing by Manufacturer:

1. Manufacturer shall test all materials as required by these Specifications and the standards referenced.
2. Manufacturer shall submit to the Engineer two (2) copies of all test results, which shall include a certification that materials to be delivered are represented by the samples tested, and that such delivered materials meet or exceed the specification requirements.
3. No material shall be delivered until test results and certifications are in the hands of the Engineer.
4. Engineer shall have free access to all testing and records pertaining to material to be delivered to the job site.
5. The Engineer may elect to be present at any or all material testing operations.

B. Joint tests are intended for qualification of joint design and shall be considered to be a qualification test to establish the adequacy of the manufacturer's joint design. The manufacturer shall certify that tests have been performed within the last year with pipes equivalent in size and design and that they have passed the test enumerated in the specifications. Tests may be waived for pipes of different strength class if joint design is the same as the pipe tested.

2.0 PRODUCT

2.1 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

A. Conform to ASTM D2241.

B. Pipe material shall be PVC 1120, PVC 1220 or PVC 2120.

C. Minimum wall thickness shall be equal or greater than a standard dimension ratio (SDR) of 21 unless otherwise specified.

D. Pipe shall bear the National Sanitation Foundation Seal for use to transport potable water.

2.2 STEEL PIPE (4 INCHES AND SMALLER)

A. Conform to ASTM A120.

B. Schedule 40, unless otherwise specified.

C. Fittings shall be malleable iron screw type conforming to ANSI B16.3.

D. Pipe and fittings shall be hot dipped, galvanized inside and out.

2.3 FLEXIBLE COUPLINGS

A. Use for connection between plain end pipe of same or different material.

B. Sleeve: Gray iron ASTM A126 Class B or ductile iron ASTM A536. Ends have a smooth inside taper for uniform gasket seating.

C. Followers: Ductile iron ASTM A536.

D. Gaskets: Grade 30 specially compounded rubber of all new materials.

E. Bolts and nuts: High strength low alloy steel with heavy, semi-finished hexagon nuts to AWWA C111 (ANSI-A21.11).

2.4 WATER SERVICE PIPE

A. Copper Tubing:

1. Copper tubing shall conform to the requirements of ASTM B88, Type K, annealed.
2. The tubing shall be coupled using flare-type compression fittings, conforming to the requirements of AWWA C800, minimum 150 psi working pressure.

B. Compression Couplings:

1. Compression couplings for use in connecting plain end water service pipes shall be applicable for the type of pipe being coupled.
2. Compression couplings shall have armored gaskets when similar metal pipes are being joined.

C. Insulating Couplings:

1. Insulating couplings shall be required at any point of connection of two dissimilar metallic pipes (i.e., copper to galvanized iron or steel).

2.5 POLYVINYL CHLORIDE (PVC) SEWER PIPE

A. Conform to ASTM D3034, SDR 35, or ASTM F789.

B. Joints shall conform to ASTM D3212 using a restrained rubber gasket conforming to ASTM F477.

C. Fittings shall be injection molded tees or factory solvent welded saddle tees. Saddles fastened to pipe with external bands are not acceptable on any new system, unless specifically approved by the Engineer.

D. All PVC sewer pipe shall be considered flexible conduit.

E. Maximum size - 12 inches.

2.6 GALVANIZED CORRUGATED STEEL PIPE

A. Conform to the requirements of AASHTO Designation M36, 16 gage unless otherwise provided.

B. Coated uniformly inside and out with asphalt coating to meet the requirements of AASHTO Designation M190.

C. Coupling band shall meet the requirements of AASHTO M36 and wide enough to cover at least two annular corrugations. Gasket shall be provided.

D. When specified, galvanized steel end sections shall be flared, beveled shop-assembled units to serve as structural, hydraulic and aesthetic end treatment to corrugated steel culverts by threaded rods, by riveting or bolting per manufacturer's standard procedure. End sections shall have a turned down lip or toe plate at the wide end to act as a cut-off. The material for the end section shall be galvanized steel meeting the requirements of AASHTO M36 or same gage as pipe.

2.7 LOCATING TAPE

A. All pipelines shall have a detectable locating tape laid at least 2 feet directly above the pipe. The tape shall be highly visible and shall be impervious to alkalis, acids, chemical reagents, and solvents found in the soil. The metallic core shall have a minimum thickness of 0.35 mils and a minimum overall thickness of 5 mils. Tape shall have imprinted continuously over its length in permanent ink a message in the form of "CAUTION WATERLINE BURIED BELOW." Maximum imprint length shall be 36 inches per message. Locating tape shall be a minimum of 3 inches wide.

3.0 EXECUTION

3.1 INSTALLATION

A. Install pipe in accordance with specification section for pipeline being installed.

* * * END OF SECTION * * *

SECTION 02671

SOIL VAPOR EXTRACTION AND MONITORING WELLS

1.0 GENERAL

1.1 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. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) ASTM C 150 (1995) Portland Cement
2. ASTM C 387 (1987; R 1995) Packaged, Dry, Combined Materials for Mortar and Concrete
3. ASTM D 1586 (1984; R 1992) Penetration Test and Split Barrier Sampling of Soils
4. ASTM D 1785 (1993) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
5. ASTM D 2488 (1993) Description and Identification of Soils (Visual-Manual Procedure)
6. ASTM D 5088 (1990) Decontamination of Field Equipment Used at Nonradioactive Waste Sites
7. ASTM D 5092 (1990) Design and Installation of Ground Water Monitoring Wells in Aquifers
8. ASTM D 5299 (1992) Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities
9. ASTM F 480 (1994) Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80
10. CODE OF FEDERAL REGULATIONS (CFR) 49 CFR 172 Hazardous Materials Table, Special
11. Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
12. ENVIRONMENTAL PROTECTION AGENCY (EPA) EPA 600/4-79/020 (1983) Methods for Chemical Analysis of Water & Wastes
13. FORESTRY SUPPLIERS (FSUP) FSUP-01 (1994) Model 5-21 Munsell Soil Color Charts (Set of Eight)
14. NSF INTERNATIONAL (NSF) NSF Std 14 (1965; Rev Nov 1990) Plastics Piping Components and Related Materials

1.2 SYSTEM DESCRIPTION

A. Each dual phase extraction well (DPE) shall be constructed to allow free air passage through the vadose zone in support of a soil vapor extraction system and extraction of groundwater from the perched zone. Contaminated soil vapors are to be removed by imposing a negative pressure (vacuum) on the subsurface surrounding the wells. Groundwater shall be extracted via submersible pumps. Correct installation of well casing, screens, and filter packs is critical to the success of the system.

B. Each monitoring well (MW) shall be constructed with one or two screen intervals, as specified in the Design Drawings, to evaluate the effectiveness of contaminant removal by DPEs in the contaminated zone.

C. The Contractor shall provide all material, equipment, and labor to install wells. The Drawings show the locations and depths of all DPEs and MWs.

1.3 PERFORMANCE REQUIREMENTS

A. Each DPE and MW shall be installed in a manner to prevent aquifer contamination by the drilling operation and equipment, prevent intra- and inter-aquifer contamination, and prevent vertical seepage of surface water adjacent to the well into the subsurface, especially the DPE intake zone.

1.4 SUBMITTALS

A. Approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted:

1. DPE and MW Installation Plan; GA. A RAWP and Construction QC Plan will be used to describe the drilling methods, sampling, and DPE and MW construction and well development. The following requirements are described in the RAWP and Construction QC Plan and shall be followed in the field. The plan includes a discussion of the following:
   a. Description of well drilling methods and installation procedures which include placement of casing, filter pack, and seal materials, drill cuttings and fluids disposal, and soil/rock sample disposition.
   b. Description of well construction materials, including blank and well screen casing, riser pipe, centralizers, tailpiece (if used), filter pack and filter pack gradation, bentonite, drilling fluid additives (if used), drilling water, cement, and well protective measures (surface or above ground well completions).
   c. Description of quality control procedures to be used for placement of well casing, filter pack, and seals in the boring, including depth measurements.
   d. Forms to be used for written boring logs, log of drilling operations, installation diagrams of wells, health and safety log forms, and well abandonment records.
   e. Description of contamination prevention and well materials and equipment decontamination procedures.
   f. Description of protective above ground or surface completion procedures.
   g. List of applicable publications, including standards.
   h. List of personnel assignments for this project, and personnel qualifications.
   i. Health and safety monitoring and procedures.
   j. Description of well decommissioning/abandonment procedures.
2. Catalog Data; FIO. Catalog data for DPE and monitoring well screens (to include the screen slot size), casing, riser pipe, filter pack material, bentonite, cement, centralizers, surface protective covers, well vaults, locking caps, airline oil filters for pneumatic drilling, and dedicated sampling equipment. Catalog data shall include any information, written or otherwise, supplied by the manufacturers or suppliers of the above listed items. Bentonite and cement data shall include laboratory test reports for the mix designs.
3. DPE and MW Installation Diagrams; FIO. As-built installation diagram for each DPE and monitoring well installed, prepared by the geologist present during well installation operations, within 30 working days of the completion of the well installation procedure.

4. Documentation and Quality Control Reports; FIO. Documentation and quality control reports as described in paragraph DOCUMENTATION AND QUALITY CONTROL REPORTS.

5. Borehole Logs; FIO. Original borehole logs, 5 working days after completion of the boring and well installation procedures.

6. Filter Pack Test Results; FIO. Filter pack material test results/sieve analyses/chemical analyses.

7. Qualifications; GA. Qualification documentation in accordance with paragraph QUALIFICATIONS.

8. Permits; FIO. A copy of all permits, licenses, or other requirements necessary for execution of the work. Before beginning work, the local United States Geological Survey office (USGS) and the County Department of Environmental Health (or appropriate department) shall be notified of the type and location of wells to be constructed, the method of construction and anticipated schedule for construction of the wells. A copy of all such correspondence shall be furnished to the government.

1.5 QUALIFICATIONS

A. A geologist with experience in hazardous waste projects, soil and rock logging, and DPE and MW installation shall be onsite and responsible for all geophysical and borehole logging, drilling, well installation, developing and testing activities. The field geologist shall work under the direction and supervision of a CA registered geologist. The driller shall be licensed in the state of CA, according to the state requirements. The log analyst shall be able to demonstrate competence through background, training, and experience when so called upon. The Contractor shall have a minimum of 2 years of well installation experience. The Contractor's staff shall include appropriate health and safety personnel and personnel qualified to perform the necessary chemical sampling as presented in the approved Sampling and Analysis Plan.

1.6 NOTIFICATION

A. The Engineer shall be notified 7 days prior to drilling. The Contractor shall be responsible for contacting the County Department of Environmental Health in accordance with the applicable reporting requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. DPE and monitoring well materials shall be stored and maintained in a clean, uncontaminated condition throughout the course of the project.

1.8 SITE CONDITIONS

A. Access to each DPE and MW site, including any utility clearance, is the responsibility of the Contractor. The Contractor shall visit each proposed well location to observe any condition that may hamper transporting equipment or personnel to the site. If clearing or relocation is necessary, the Contractor, and the Engineer, shall agree on a suitable clearing, or relocation plan.

2.0 PRODUCTS

2.1 WELL CASING

A. DPE casing/riser pipe, shall be new, 4-inch nominal internal diameter for the shallow well and 6-inch nominal internal diameter for the deep well, and MW casing/riser pipe shall be new 1 inch nominal internal diameter. All well casing/riser pipe shall be schedule 40 flush-joint threaded ASTM D 1785 polyvinyl chloride (PVC) pipe. This pipe shall also meet the requirements of NSF Std 14. Required fittings shall be ASTM F 480 flush thread male by female fittings. Gaskets, pop rivets, or screws shall not be used. A PVC locking cap, that threads or slips onto the top of the well casing, shall be provided.

2.2 WELL SCREEN

A. The design and construction of the DPE and MW screen shall be in accordance with the Drawings and paragraph SYSTEM DESCRIPTION. DPE screens shall consist of new commercially fabricated flush-joint threaded 4- and 6-inch nominal internal diameter schedule 40 PVC continuous slot (wire-wrapped), non-clogging design. MW screens shall be 1-inch nominal internal diameter in 5-foot lengths with standard PVC screens. Required fittings shall be ASTM F 480 flush thread male by female fittings. The screen shall be 0.020-inch slotted PVC. The screen length shall be as indicated on the Drawings. The bottom section of the screen shall be sealed watertight by means of a flush threaded end cap of the same material as the well screen and shall be within 6 inches of the open portion of the screen.

2.3 FILTER PACK

A. Filter pack shall consist of clean, washed, rounded to sub-rounded siliceous material free from calcareous grains or material. Organic matter, soft, friable, thin, or elongated particles are not permissible. The gradation of the filter pack shall be No. 3 silica sand. The uniformity coefficient of the filter pack material shall not exceed 2.5.

2.4 SAND BRIDGES

A. Sand bridges, as specified in the Drawings, shall consist of No. 30 silica sand.

2.5 CEMENT AND BENTONITE GROUT

A. Cement grout shall be a mixture of a maximum of 8 gallons of approved water per 94 lb bag of portland cement, which conforms to ASTM C 150, Type II. Not more than 5 percent by weight of bentonite powder shall be added to reduce shrinkage and to hold the cement in suspension prior to the grout set.

2.6 PROTECTIVE COVERS

A. Vaults for all DPEs shall be 17 inch x 30 inch x 30 inch (interior dimensions) precast concrete vaults with no floors. The vault shall have a galvanized adjustable frame and a torsion hinged, high impact, H-20 traffic rated, galvanized cover. Each DPE vault will have a companion vault set over the manifold about 18-24 inches from the DPE. The companion vaults shall be 10 inch x 17 inch x 30 inch (interior dimensions) precast concrete vaults with no floors. The vaults shall have a galvanized, high impact, H-20 traffic rated covers.

B. Vaults for vapor monitoring wells shall be a 12-inch diameter (interior dimensions) polyester/ fiberglass vault with no floor. The vault shall have a galvanized, high-impact, H-20-rated cover.

C. Vaults for two circuit manifold terminals shall be 24 inch x 30 inch x 30 inch (interior dimensions) precast concrete with no floors. The vaults shall have a galvanized, high impact, H- 20 rated covers.

2.7 CONTAINERIZATION OF DRILL CUTTINGS

A. Drill cuttings removed from borehole during drilling operations shall be contained in D.O.T. approved roll-off bins or drums. The bins or drums shall be provided by the Contractor and shall be used for storage until disposal is determined. The Contractor shall label each container and be responsible for transport and disposal of any generated hazardous materials offsite.

2.8 SAMPLE CONTAINERS

A. Cuttings and drive samples shall be placed in air-tight liter (pint) size glass containers or plastic zip-lock baggies and labeled with the project name, date of sample, DPE number and depth at which the sample was taken. Both the container and lid shall be labeled in permanent indelible ink. Jars shall be placed in partitioned cardboard boxes. Boxes shall be labeled with project number and well number. Containers and boxes shall be furnished by the Contractor.

3.0 EXECUTION

3.1 PROTECTION OF EXISTING CONDITIONS

A. The Contractor shall maintain existing survey monuments, monitoring wells, extraction wells, and associated piping and protect them from damage from equipment and vehicular traffic. Any items damaged by the Contractor shall be repaired by the Contractor. Monitoring wells requiring replacement due to Contractor negligence shall be re-installed at no additional cost to the Owner. Prior to excavation, the Contractor shall obtain written approval from local utility companies (if applicable) to drill at each site, to avoid disturbing buried utilities.

3.2 PREPARATION

3.2.1 Decontamination

A. The drill rig, drill rods, drill bits, augers, temporary casing, well developing equipment, tremie pipes, grout pumping lines, and other associated drilling equipment shall be cleaned with high pressure hot water/steam prior to drilling at each DPE and MW location. Decontamination shall be done in accordance with ASTM D 5088. Decontamination shall be performed at a central decontamination station. Cleaning shall be performed in an area that is remote from, and cross- or down-gradient, from the well being drilled. Screen and well casing shall be cleaned with high-pressure hot water immediately prior to installation in the well. The use of factory sealed (plastic wrapped) screen and well casing does not waive this requirement for preinstallation cleaning. Samplers shall be decontaminated in accordance with the Sampling and Analysis Plan and may be performed at each drill/work site with fluids collected and contained in DOT-approved 55-gallon drums. The water used for cleaning shall be from an approved source.

3.2.2 Decontamination Station

A. The Contractor shall construct a temporary decontamination pad on site. The pad shall be located at an area specified by the Engineer. The pad shall be bermed and slightly inclined towards a sump located in one of the back corners of the pad. Plastic sheeting shall line the pads and berms to contain decontamination water. Plywood sheeting, exterior grade, shall be placed over the plastic sheeting to prevent damage to the plastic and allow the drill rig and heavy equipment to use the pad. The minimum dimensions of the pad shall be the length and width of the drill rig, plus 4 feet per side to allow access and steam cleaning. Yellow ribbon shall be used to encircle the decontamination pad. Water collected in the sump shall be pumped using a "trash" pump to a 55-gallon drum labeled "Decontamination Pad Sump

Water." Solid waste shall be transferred to a separate 55-gallon drum labeled "Decontamination Pad Sump Sludge." The decontamination pads and associated wastes shall be removed from the site in accordance with 01700 CONTRACT CLOSEOUT.

3.3 INSTALLATION

3.3.1 Drilling Method

A. The Contractor shall use a 10-inch outside diameter (OD) hollow stem auger (HSA) for deep DPE drilling and an 8 inch OD HSA for shallow DPE and MW drilling and installation of the casing, filter pack, bentonite, etc. The drill rig shall be free from leaks of fuel, hydraulic fluid, and oil which may contaminate the borehole, ground surface or drill tools. During construction of the wells, precautions shall be used to prevent tampering with the well or entrance of foreign material. Runoff shall be prevented from entering the well during construction. If there is an interruption in work, such as overnight shutdown or inclement weather, the well opening shall be closed with a watertight uncontaminated cover. The cover shall be secured in place or weighted down so that it cannot be removed except with the aid of the drilling equipment or through the use of drill tools.

3.3.2 Sampling for Geotechnical Analysis

A. Samples shall be retrieved according to ASTM D 1586 at least every 5 feet or at a lithology change, whichever is first. Description and identification of soils shall be done in accordance with ASTM D 2488. Sampling shall be performed to allow completion of the documents described in paragraph Borehole Logs. No further testing is required.

3.3.3 Borehole Diameter and Depth

A. Borehole diameter is specified in paragraph INSTALLATION (3.3.1 Drilling Method). Depths of individual wells are indicated on the Drawings.

3.3.4 Screen, Well Casing/Riser Pipe Placement

A. The DPE and MW screen length shall be as shown on the drawings, with specified bottom cap securely attached, set to the appropriate depth. The bottom of the well screen shall be placed no more than 1 foot above the bottom of the drilled borehole. The well screen shall be placed in the appropriate location in the borehole so that the completed DPE and MW functions in accordance with paragraphs Section 1.2 – SYSTEM DESCRIPTION and Section 3.7 – WELL ACCEPTANCE.

B. The well screens shall be placed as specified on the drawings. The screen and well casing/riser pipe sections shall be joined by flush threaded watertight joints. The well casing/riser pipe shall extend upwards from the screen to an elevation appropriate for the surface completion described in paragraph PROTECTIVE COVER PLACEMENT. The well screen and riser pipe shall not be dropped or allowed to fall uncontrolled into the borehole. Screen and well casing/riser pipe shall be cleaned with high pressure hot water/steam just prior to installation; foreign material shall not remain on the screen and well casing before installation. The use of factory-sealed (plastic wrapped) screen, free from painted markings, does not waive requirements for pre-installation cleaning. Joints and fastenings shall be watertight and flush threaded; no solvent glue or setscrews shall be used. The well shall be plumb, and centered in the hole as vertical as possible without the use of centralizers. Temporary casing, hollow stem augers or other measures shall be used, as necessary, to prevent collapse of the boring against the well screen and well casing/riser pipe prior to placement of the filter pack and sealing materials. A loose fitted cap shall be installed on the top of the riser pipe.

3.3.5 Filter Pack Placement

A. After the screen and well casing have been placed in the hole, the approved filter pack shall be installed around the screen by filling the entire space between the screen and the wall of the hole over the selected screened interval. The lowermost 1 foot of filter pack shall be placed in the boring prior to installation of the well screen and shall serve as a base on which to rest the screen. A tremie pipe having an inside nominal diameter of not less than 1 inch, shall be lowered to the bottom of the annulus between the hole and well. The tremie pipe shall be cleaned with high pressure hot water/steam prior to each use. The tremie pipe shall be arranged so that water and filter pack material fed at uniform rates are discharged as the filter pack material fills the hole from the bottom up. The tremie pipe shall be raised at a rate that will keep the bottom of the pipe no more than 2 feet above the top of the surface of the filter pack or sand bridge level, and no more than 2 feet below the surface of the filter pack level at all times. Dumping filter pack material from the surface of the ground and agitating the well in an effort to settle the filter material will not be allowed. The filter pack shall be installed continuously and without interruption until the filter pack has been placed to a minimum of 2 feet above the top of the screen in the DPE and 0.5 feet above the top of the screen in the MW. The depth to the top of the filter pack and sand bridge shall be directly measured, and recorded. At no time shall any water be added to the filter pack or sand bridge to assist in movement through the tremie pipe. Filter pack material shall be protected from contamination prior to placement by either storing it in plastic lined bags, or in a location protected from the weather and contamination on plastic sheeting. Filter pack material shall be transported to the well site in a manner which prevents contamination by other soils, oils, grease, and other chemicals. Temporary drill casing, if installed, or auger shall be removed simultaneously with the above operation. Lifting of the riser pipe shall be minimized when withdrawing the temporary casing/auger. Filter pack material shall be placed in no greater than 3 foot lifts prior to retraction of the temporary casing/auger. A minimum of 0.5 foot of filter pack shall remain in the auger at all times during filter pack installation. Frequent measurements shall be made inside the annulus during retraction to ensure that the filter pack is properly placed. Record grout, filter pack, or sand bridge increment depths in a logbook and on the Well Construction Details form.

3.3.6 Sand Bridges

A. Sand bridges, 1 foot thick each and consisting of No. 30 silica sand, shall be placed between DPE and MW screens and on top of the filter pack as shown on the Drawings.

3.3.7 Grout Placement

A. A rapid set grout, shall be mechanically mixed in accordance with paragraph CEMENT AND BENTONITE GROUT, and placed in one continuous operation into the annulus between screen intervals in DPEs and MWs and above the bentonite seal or sand bridge to depths specified on the Drawings. Grout injection shall be in accordance with ASTM D 5092. If the casing interval to be grouted is less than 15 feet, the grout can be placed either by pouring or pumping. The tremie pipe shall be thoroughly cleaned with high pressure hot water/steam before use in each well. The bottom of the tremie pipe shall be constructed so as to direct the discharge to the sides rather than downward. The discharge end of the tremie pipe shall be submerged at all times. Additional grout shall be added from the surface to maintain the level of the grout at the land surface as settlement occurs. No work shall be conducted in the well within 24 hours after cement grouting or 4 hours for rapid set grout. The alignment of the well shall be verified by passing a 5 foot long section of rigid PVC 1/4 inch smaller in diameter than the inside diameter of the casing through the entire well. If the pipe does not pass freely, the well will not be accepted. The pipe section shall be thoroughly cleaned with high pressure hot water/steam prior to each test.

3.3.8 Protective Cover Placement

A. MWs shall be enclosed in a well vault as described in Section 2.6. The upper end of each MW shall be fitted with well caps that have quick-connect couplings. DPEs shall be enclosed in well vaults as described in Section 2.6. Holes with pipe sleeves shall be built into concrete vaults. Vaults shall be installed as shown on the Drawings. Vaults shall rest on an aggregate base a minimum of 6 inches thick and extending a minimum of 6 inches beyond the walls. Restored asphalt or concrete shall be sloped at 2 percent to prevent ponding on or around the flush mounted protective utility vaults.

3.3.9 Well Identification

A. An engraved label or a corrosion resistant metal tag shall be affixed to the exterior of each protective cover. The label shall be stamped with the DPE identification number. In addition, each tube/pipe shall be labeled with the site number, monitoring well number, and depth of screen interval. Label shall consist of a metal tag firmly attached to the casing, or shall be directly engraved on the casing or written in waterproof ink. Wells shall be assigned the identification numbers as indicated on the drawings.

3.4 DRILLING WASTE DISPOSAL

A. Drill cuttings, slurry, or other solid material removed from the borehole during drilling, installation and completion, shall be disposed of by placement into D.O.T. approved roll off bins, or 55-gallon drums. The Contractor shall follow, store, sample, profile, and dispose of drill cuttings.

3.5 SURVEYS

A. Coordinates and elevations shall be established for each DPE/test hole. Horizontal coordinates shall be determined to the closest 1.0 foot and referenced to the State Plane Coordinate System in North American Datum 1983, and the values will be reported in feet. A ground elevation to the closest 0.1 foot shall be obtained at each well using the National Geodetic Vertical Datum 1988, and the values will be reported in feet. The highest point on the top of the riser pipe will serve as a measurement point. The elevation of the monitoring well shall reference this point, and shall be surveyed to the nearest 0.01 foot using the National Geodetic Vertical Datum 1988, and the values will be reported in feet. The location identification, coordinates, and elevations of the well and monuments shall be plotted on maps with a scale large enough to show their location with reference to other structures.

3.6 WELL DECOMMISSIONING/ABANDONMENT

A. Any well disapproved by the Engineer, or any well decommissioned/abandoned by the Contractor for any reason shall be decommissioned/abandoned according to the requirements of the State of CA, ASTM D 5299, and the requirements of these specifications. Well decommissioning/abandonment includes the removal of all materials left in the borehole/well, excluding the filter pack, and including backfill materials, casing, screen, and any other material placed into the hole before the decision was made to abandon the borehole/well. Test holes decommissioned/abandoned for any reason shall be grouted from the bottom to within 2 feet of the top of the ground surface according to the protocol for grout/bentonite placement established in paragraph Grout Placement, using the grout mix specified in paragraph CEMENT AND BENTONITE GROUT. The top 2 feet shall be backfilled with material appropriate for the intended land use. The Contractor shall maintain a well decommissioning/abandonment record as specified in paragraph Well Decommissioning/ Abandonment Records. Groundwater levels, if encountered before the decision is made for decommissioning/abandonment, shall be measured in all borings prior to backfilling. These water levels shall be included in the well decommissioning/abandonment records. No well shall be decommissioned/abandoned without the approval of the Engineer.

3.7 WELL ACCEPTANCE

A. It is the responsibility of the Contractor to properly design, construct, install, develop, and test all DPEs according to the requirements of this specification so that they are suitable for the intended purpose. If the Contractor installs wells that are not functional or not in accordance with these specifications, the Engineer will disapprove the well and direct the Contractor to repair or replace it, and to abandon the disapproved well in accordance with this specification.

3.8 SITE CLEANUP

A. After completion of the work, tools, appliances, surplus materials, temporary drainage, rubbish, and debris incidental to work shall be removed. Excavation and vehicular ruts shall be backfilled and dressed to conform with the existing landscape. Utilities, structures, roads, fences, or any other pre-existing item which must be repaired or replaced due to the Contractor's negligence will be the responsibility of the Contractor and repair or replacement shall be accomplished prior to completion of this contract.

3.9 DOCUMENTATION AND QUALITY CONTROL REPORTS

A. The Contractor shall establish and maintain documentation and quality control reports for well construction and development to record the desired information and to assure compliance with contract requirements, including, but not limited to, the following:

3.9.1 Borehole Logs

A. A borehole log shall be completed for each boring drilled. Borehole logs shall be prepared by the geologist present onsite during all well drilling and installation activities. Copies of complete well logs shall be kept current in the field at each well site and shall be available at all times for inspection by the Engineer. Information provided on the logs shall include, but not be limited to, the following:

1. Name of the project and site.
2. Boring/well identification number.
3. Location of boring (coordinates, if available).
4. Make and manufacturer's model designation of drilling equipment and name of drilling firm.
5. Date boring was drilled.
6. Reference data for all depth measurements.
7. Name of driller and name and signature of geologist preparing log.
8. Nominal hole diameter and depth at which hole diameter changes.
9. Total depth of boring.
10. Method of drilling, including sampling methods and sample depths, including those attempted with no recovery. Indication of penetration resistance such as drive hammer blows given in blows per 6 inches of driven sample tubes. Information shall include hammer weight and drop distance. Information such as rod size, bit type, pump type, etc. shall be recorded. Also include a description of any temporary casing used.
11. Depth of each change of stratum. If location of strata change is approximate, it should be so stated.
12. Description of the material of which each stratum is composed, in accordance with ASTM D 2488, and/or standard rock nomenclature, as necessary. Soil parameters for logging shall include, but not be limited to classification, depositional environment and

formation, if known, Unified Soil Classification Symbol, secondary components and estimated percentages, color (using FSUP-01 or \&GEOSA-RCC001&\), plasticity, consistency (cohesive soil), density (noncohesive soil), moisture content, structure and orientation, and grain angularity. Rock core parameters for logging shall include, but not be limited to, rock type, formation, modifier denoting variety (shaly, calcareous, siliceous, etc.), color (using \&GEOSA-RCC001&\), hardness, degree of cementation, texture, crystalline structure and orientation, degree of weathering, solution or void conditions, primary and secondary permeability, and lost core. The results of an organic vapor sample screening shall also be included on the boring log. Classification shall be prepared in the field at the time of sampling. The results of visual observation of the material encountered, and any unusual odor detected shall also be duly noted and recorded.

13. Depth of any observed fractures, weathered zones, or any abnormalities encountered.

14. Box or sample number. Depths and the number of the core boxes and/or samples shall be recorded at the proper interval.

3.9.2 DPE and MW Installation Diagrams

A. The well will not be accepted before the geologic logs and installation diagrams are received. The diagram shall illustrate the as-built condition of the well and include, but not be limited to, the following items:

1. Name of the project and site.

2. Well identification number.

3. Name of driller and name and signature of the geologist preparing diagram.

4. Date of well installation.

5. Description of material from which the well is constructed, including well casing/riser pipe and screen material, centralizer composition, if used, diameter and schedule of casing and screen, gradation of filter pack, lithologic description, brand name (if any), source, and processing method, and method of placement of the filter pack, type of protective cover.

6. Total depth of well.

7. Nominal hole diameter.

8. Depth to top and bottom of screen, and filter pack.

9. Depth to top and bottom of any seals installed in the well boring (grout, sand bridges, or bentonite).

10. Type of cement and/or bentonite used, mix ratios of grout, method of placement and quantities used.

11. Elevations/depths/heights of key features of the well, such as top of well casing/riser pipe, top and bottom of protective casing, ground surface, the depth of maximum frost penetration (frost line), bottom of well screen, top and bottom of filter pack, and top and bottom of seal.

12. Other pertinent construction details, such as slot size and percent open area of screen, type of screen, and manufacturer of screen.

13. Well location by coordinates. A plan sheet shall also be included showing the coordinate system used and the location of each well. A plan sheet is not required for each well installation diagram; multiple wells may be shown on the same sheet.

14. Static water level, if detected, upon completion of the well.

15. Special problems and their resolutions; e.g., grout in wells, lost casing, or screens, bridging, etc.
16. Description of surface completion.

3.9.3 Well Decommissioning/Abandonment Records

A. Decommissioning/abandonment records shall include, as a minimum, the following:

1. Project name.
2. Well or test hole number.
3. Well/boring location, depth and diameter.
4. Date of decommissioning/abandonment.
5. Method of decommissioning/abandonment.
6. All materials used in the decommissioning/abandonment procedure and the interval in which test materials were placed.
7. Casing, and or other items left in hole by depth, description, and composition.
8. Description and total quantity of grout used initially.
9. Description and daily quantities of grout used to compensate for settlement.
10. Water or mud level (specify) prior to grouting and date measured.
11. The reason for decommissioning/abandonment of the DPE/test hole.

3.9.4 Survey Maps, and Notes

A tabulated list of all DPEs and monuments, copies of all field books, maps showing the locations, and elevations of all DPEs, and all computation sheets shall be prepared as a submittal. The tabulation shall consist of the designated number of the well or monument, the X and Y coordinates, and all the required elevations. Data shall be provided in a hardcopy format report that includes the survey data as well as the basis of horizontal coordinates and vertical elevations information. In addition, a tab delimited ASCII file containing the coordinates, and a microstation-compatable electronic file containing the locations and the site features will be provided.

End of Section

SECTION 02831

CHAIN LINK FENCES

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete: Division 3

1.2 QUALITY ASSURANCE

A. Erector shall be a Contractor regularly engaged in installation of similar fencing.

1.3 SUBMITTALS

A. Certification of quality of all fence elements.

B. Shop drawings illustrating locations of all posts, structural details of all fence elements.

C. Submit results of ASTM A90 test for zinc coating weight.

2.0 PRODUCTS

2.1 GENERAL

A. Posts, rails, rods, bars, fittings and hardware shall be hot-dipped, zinc-coated steel per ASTM Specifications A120, A123 and A153, as applicable.

B/ Fence components to be galvanically compatible.

2.2 CHAIN LINK FABRIC

A. Chain link in accordance with ASTM A392, high carbon steel, zinc-coated Class II (2.0 ounces per square foot).

B. No. 9 gauge x 2-inch mesh, hot-dipped after weaving, twisted and barbed at top and bottom selvages.

C. 72-inch height (fabric roll width).

2.3 BARBED WIRE

A. Material shall be either galvanized or aluminized.

B. Shall be four-point pattern consisting of three strands of 12½ gauge line wire with heavy barbs not more than 4 inches apart.

2.4 POSTS

A. Terminal Posts: All end, corner and pull posts, 3 inch O.D. standard pipe, 5.79 pounds per lineal foot (deflection in horizontal fence line of 15 or more requires a terminal post).

B. Intermediate Posts: "H" column, 2-1/4 inch x 2 inch, 4.1 pounds per lineal foot; or 2-1/2-inch O.D. pipe, 3.65 pounds per lineal foot.

C. Gate Hinge Posts

1. Single leaves to 6-foot width: 3 inch O.D. pipe, 5.79 pounds per lineal foot.
2. Single leaves 6 to 13 foot width: 4 inch O.D. pipe, 9.1 pounds per lineal foot.
3. Single leaves 13 to 18 foot width: 6-5/8 inch O.D. pipe, 18.97 pounds per lineal foot.

D. Post Braces: 1-5/8 inch O.D. pipe, 1.17 pounds per lineal foot.

E. All posts shall be provided with tops as required.

2.5 ATTACHMENTS

A. Truss Rods: 3/8- inch diameter round rod.

B. Tension Bars (Stretcher Bar): 1/4 inch x 3/4-inch flat, high carbon steel.

C. Tension Wire (Top and Bottom): No. 7 gauge, galvanized coiled spring wire.

D. Fittings and Hardware: All standard fittings required for the complete fence assembly including gates shall be malleable cast iron or pressed steel. All ferrous material shall be hot-dipped galvanized.

2.6 CONCRETE

A. Per Division 3 with consistency requirement altered to 6-inch maximum slump.

3.0 EXECUTION

3.1 CHAIN LINK FENCE INSTALLATION

A. General:

1. Install as illustrated on approved shop drawings by skilled mechanics experienced in erection of chain link fence and gates.
2. The fence shall be constructed reasonably close to and inside the property line unless shown on the Plans. Deviations in alignment to miss obstacles will be permitted only when approved by the Engineer.

B. Clearing and Grubbing:

1. Clearing of the fence line will be required and shall consist of the removal and disposal of all trees, brush, logs, upturned stumps, roots of down trees, rubbish and debris.
2. Grubbing will not be required except where short and abrupt changes in the ground contour will necessitate removal of stumps in order to properly grade the fence line. All stumps within the clearing limits shall be removed or close cut.
3. Grading of the fence line sufficiently to prevent ground clearance exceeding 6 inches or short and abrupt breaks in the ground contour that will affect the aesthetic appearance of the top of the fencing when installed shall be required. It is expected that in the performance of this work hand work may be required where sufficient width does not exist for machine work.

C. Posts:

1. Posts shall be set vertically and spaced at 10-foot centers measured parallel to slope of ground.
2. Set all posts except line posts in concrete footings to minimum depth of 36 inches.

3. Line posts shall be set in undisturbed earth by driving or drilling. Driving shall not damage post. Any voids around post shall be filled and thoroughly tamped.
4. Diameter of footings: Minimum of 9 inches, except gate hinge posts 3 times diameter of the post.
5. Concrete shall be worked thoroughly to remove voids and crowned to carry water away from the post.
6. Install pull post at 1,000 feet maximum intervals.
7. Install post braces and adjustable truss rods at corners, gates, pull posts or as detailed on approved submittal drawings.
8. Install so posts are plumb when diagonal rod is under tension.
9. Equip posts with tops designed to exclude moisture from posts.

D. Tension Wire:

1. Install top tension wire, top rail not required except at corners and gates.
2. Install bottom tension wire along bottom 2 inches above finish grade.
3. Stretch tension wire prior to fabric stretching and fasten to terminal posts.
4. Secure chain link fabric to tension wire with 11 gauge hog rings spaced 24 inches apart.

E. Chain Link Fabric:

1. Stretch taut and securely fasten to posts.
2. Fasten chain link fabric to all terminal posts by tension bars with heavy one inch by 11 gauge pressed steel bands spaced 14 inches apart.
3. Fasten to line posts with 2 gauge wire clips spaced 14-inches apart.

* * * END OF SECTION * * *

DIVISION 3 CONCRETE

SECTION 03100

CONCRETE FORMWORK

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Reinforcement: Section 03200

B. Anchors and Inserts: Section 03251

C. Expansion and Contraction Joints: Section 03252

D. Waterstops: Section 03253

E. Cast In Place Concrete: Section 03300

1.02 QUALITY ASSURANCE

A. Standards:

1. "Recommended Practice for Concrete Formwork", ACI 347.
2. "Chapter 19", Uniform Building Code.
3. U.S. Product Standard PS 1 for Plywood.
4. Standard Grading and Dressing Rules No. 16 of the West Coast Lumber Inspection Bureau.

1.03 SUBMITTALS

A. A description of the forming system with complete details. Specify panel width (chord lengths) for circular structures. Illustrate the proposed location of all construction joints, method of securing embedded items and blockout procedures (if proposed).

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. On delivery to job site, place materials in area protected from weather.

B. Store materials above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Handle materials to prevent damage.

2.0 PRODUCTS

2.1 MATERIALS

A. Plywood: New or in new condition "B-B Plyform Class 1 Exterior" grade plywood, 5/8 inch minimum thickness.

B. Steel Panels: Flat steel sheet or plate of sufficient thickness, or braced sufficiently, to prevent noticeable deflection from pressure of concrete. Steel forms galvanized and/or coated to prevent rust and staining.

C. Framing, Studding, and Bracing: "Standard" or "Construction" grade West Coast species lumber.

D. Form Ties: Prefabricated rod of the cone-type snap-tie configuration; or approved threaded internal disconnecting type to resist all imposed loads of freshly placed concrete, and permit tightening and spreading of forms. Plastic cone snap-ties shall break back 1 to 1-1/2 inches.

E. Form Coating:

1. Lacquer, plastic or epoxy coating or non-staining form oil that will not impair the bonding quality for final finish of the painting or protective coating.

2. Coatings containing mineral oils or other non-drying ingredients will not be permitted.

F. Shores and Falsework: Standard patented, manufactured shores, or sound commercial construction lumber.

G. Chamfer Strips: Chamfer strips (for all exposed edges) 3/4 inch, 45° bevel wood strips or reusable plastic triangular strips.

3.0 EXECUTION

3.1 DESIGN OF FORMWORK

A. Design formwork to safely support vertical and lateral loads which might be applied until such loads can be supported by the concrete structure. Carry vertical and lateral loads by formwork system to ground or to in-place construction which has attained adequate strength for that purpose.

B. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.

C. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

D. Form facing materials shall be supported by structural members spaced to prevent deflection. Design camber in formwork as required for anticipated deflections.

E. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent material.

F. Keep oil or other agents from getting on reinforcing steel, embedded items, or other surfaces requiring bond with concrete.

3.2 LAYOUT OF FORMWORK

A. Locate and stake out all forms and establish all lines and levels and elevations.

3.3 CONSTRUCTION OF FORMS

A. Formwork - General:

1. Before concrete is placed in any form, verify horizontal and vertical form position and correct all inaccuracies. Complete all wedging and bracing in advance of placing of

concrete.

2. When setting form ties, leave no metal to remain in wall closer than one inch from surface. Ties shall fit tight to prevent mortar leakage at holes in forms. Ties shall be protected from rusting at all times. No wire ties or wood spreaders will be permitted. Cutting ties back from concrete face will not be permitted.

3. At construction joints, anchor forms by using an adequate number of form ties in the new pour a few inches from the construction joints. Do not rely on ties adjacent to the joint used in previous placements. All joints horizontal and vertical.

4. For exposed concrete, forms shall be of new plywood, metal panel, or approved panel materials, smooth, and continuous.

5. For unexposed concrete, forms shall be plywood, metal, boards, or approved material. Boards: nominal one inch minimum thickness, sound and tight, commercial construction lumber, shiplapped or tongue-and-grooved, dressed on at least one side and both edges for tight fit. Plywood, metal, or approved material equal to or better than board surface.

B. Camber: Forms for girders and slabs cambered unless otherwise noted.

C. Chamfered Corners: All corners chamfered 3/4 inch, unless shown otherwise on drawings. Provide 45-degree triangular moldings in forms for all chamfering required.

D. Inspection and Cleanout Openings: Provide inspection and cleanout openings at the bottom of all forms for columns, pilasteres, walls over 8 feet in height, and for forms for irregularly shaped placement where cleaning and inspection from the top would be impractical.

E. Coordination: Coordinate the installation of all items to be inserted or embedded in concrete. Support all items to maintain accurate alignment and prevent distortion during concrete placement.

F. Cleaning: All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms or within the excavated areas before any concrete is deposited therein.

3.4 NOTIFICATION AND INSPECTION

A. Prior to placing of any concrete, and after placement of reinforcing steel in the forms, notify the Engineer at least 24 hours in advance of placing concrete to permit inspection.

3.5 DEFECTIVE WORK

A. Any form movement or deflection during construction or finished surface variations in excess of the tolerances specified will be basis for rejection of cast-in-place product and requirement for replacement of same.

3.6 REMOVAL OF FORMS

A. Do not remove forms and supports until concrete has attained sufficient strength to support anticipated loads.

B. The listing below serves only as a guide in determining the minimum length of time required before removal of forms and is based on the use of Type I Portland Cement. When high early strength Portland Cement is used, the length of time listed below may be reduced to not less than one-third time listed, but not less than 1 day.

1. Walls in mass work - 24 hours

2. Thin walls (12 inches or less) and sides of beams and girders - 48 hours

3. Columns - 7 days

4. Bottom forms and supports of beams, girders and slabs - 14 days

C. Use methods of form removal which will not cause overstressing of the concrete. Remove supports to permit the concrete to uniformly and gradually take the stress due to its own weight. Do not use high impact methods to remove supports.

D. Break back ties after concrete has cured sufficiently to maintain unbroken bond with steel rod.

3.7 REUSE OF FORMS

A. Any reused form for exposed concrete work shall be reconditioned to "like new" condition. Any reused form shall be cleaned, repaired, and recoated before each reuse.

3.8 BLOCKOUTS

A. Where pipes, castings, or conduits pass through the walls, place such pipes or castings in the forms before pouring the concrete, or in special cases, with the express consent of the Engineer or as specified, build accepted boxes in the forms to make cored openings for subsequent insertion of such pipes, castings or conduits. Provide boxes or cores with continuous keyways and waterstop all the way around, and with slight flare to facilitate grouting and the escape of entrained air during grouting.

* * * END OF SECTION * * *

SECTION 03200

CONCRETE REINFORCEMENT

1.0 GENERAL

1. 1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Formwork: Section 03100

1.2 QUALITY ASSURANCE CONTROL

A. Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315.

B. Manual of Standard Practice, Concrete Reinforcing Steel Institute.

1.3 SUBMITTALS

A. Placing drawings, bending and cutsheet schedules.

B. Mill test reports for each shipment of reinforcement shall be submitted to the Engineer for review.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site in bundles marked to coordinate with placement drawings.

B. Handle and store to prevent contamination from dirt, oil and other materials which will affect bond.

C. Store a minimum of 6" above ground and in locations where the materials will not be subject to abuse.

2.0 PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: Unless specified otherwise, deformed bars meeting requirements of ASTM A615, Grade 60. Supplementary Requirements S1 shall apply.

B. Welded Wire Fabric: Wire mesh shall meet requirements ASTM A185, "Welded Steel Wire Fabric for Concrete Reinforcement".

C. Tie Wire: Steel, black annealed, 16-gauge minimum.

D. Reinforcing Bar Supports: Per CRSI Manual Chapter 3, pregalvanized or plastic-coated.

3.0 EXECUTION

3. 1 INSTALLATION

A. Placement and Tolerances: Conform to CRSI "Manual of Standard Practice".

B. Splices:

1. Do not splice bars except at locations shown or noted on the drawings or as otherwise approved.
2. Tie lap slices securely with wire to prevent displacement of splice during placement of concrete.
3. Perform welded splices in accordance with ACI Building Code (ACI 318).
4. Lap wire fabric one full mesh minimum and tie with wire.

C. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that may reduce bond with concrete.

D. Protection During Concreting: Keep reinforcing in proper position during concrete placement.

E. Concrete Cover: Maintain minimum concrete cover over reinforcement as specified in ACI 318 or as noted.

* * * END OF SECTION * * *

SECTION 03251

ANCHORS AND INSERTS

1.0 GENERAL

1. 1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Formwork: Section 03100

B. Waterstops: Section 03253

C. Cast-In-Place Concrete: Section 03300

1.2 QUALITY ASSURANCE

A. Use only materials compatible with embedded concrete environment.

1.3 SUBMITTALS

A. Shop drawings for all anchors, inserts and embedded products (wall castings, pipes with seep rings, and special castings).

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver and store all items to be embedded in a manner to prevent damage or contamination.

2.0 PRODUCTS

2.1 MATERIALS

A. Anchor Bolts: ASTM A307, Steel unless otherwise noted.

B. Threaded or Slotted Inserts: Galvanized malleable iron or stainless steel size and type as specified.

3.0 EXECUTION

3.1 INSTALLATION

A. Coordinate the location and placement of all items to be embedded in concrete.

B. Coat any embedded aluminum with asphalt paint.

3.2 EMBEDDING

A. Set accurately and hold in position all embedded products during placement until the concrete is set.

3.3 DRILLED IN GROUTED ANCHORS

A. In lieu of embedding anchor bolts and when approved, drill holes in hardened concrete and

install the anchor bolts and other items with special mortars. Drill with diamond boring or coring bits. Bonding mortar shall be epoxy grout type, HILTI HY-150 adhesive or approved equal. Blow holes clean and dry before installation of embedded items. Before insertion, coat both hole and the item to be embedded with bonding compound. Studs of equal size and length may be substituted for anchor bolts if nut fasteners are used. Drilled in studs or anchors utilizing mechanical expansion locking in any process areas shall not be used.

* * * END OF SECTION * * *

SECTION 03252

EXPANSION AND CONTRACTION JOINTS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Formwork: Section 03100

B. Waterstops: Section 03253

C. Cast-In-Place Concrete: Section 03300

1.2 QUALITY ASSURANCE CONTROL

A. Prepare and use in strict accordance with manufacturer's instructions. Discard materials after specified "shelf life".

B. Deliver products in manufacturer labeled containers with complete preprinted instructions by manufacturer included.

C. Installers experienced in use of products.

1.3 SUBMITTALS

A. Sealant type and manufacturer.

B. Premolded composition board and backer rod samples.

C. Certification of conformance to Specifications.

2.0 PRODUCTS

2.1 MATERIALS

A. Preformed board shall conform to Federal Specification HH-F-341, Type I, Class B (moderately resilient) unless otherwise noted.

B. Joint Sealant:

1. Polyurethane material designated for bonding to concrete for sewage treatment plant service, which when cured, develops a high bond between surfaces and provides flexible watertight seal, non-sag, resistant to mild alkalis and acids, oils and meets all requirements for Federal Specifications TT-S-00230, Type II, Class A.

2. Prior to ordering the sealant, submit to the Engineer for review, sufficient data to show experience record of sealant and general compliance with the Specification requirements.

3. Joint primer supplied by the same manufacturer supplying the sealant.

C. Backer-Rod: Closed cell polyethylene backer-rod shall be used in sealant joints. The backer-rod shall be resilient and of a diameter at least 1/8 inch larger than the groove and shall be

approved by the sealant manufacturer.

3.0 EXECUTION

3.1 INSTALLATION

A. Joints constructed and located as shown on the drawings.

B. Sealant Surfaces: Clean, free of oil, grease, residue and other foreign materials, prior to application of sealant in accordance with manufacturer's recommendations. Prime all joints with joint primer.

C. Sealant Application:

1. Tape or otherwise protect surfaces adjacent to joints not intended to receive sealants. The backer rod shall be accurately placed in the joint to provide the depth of sealant called for on the drawings.

2. Neatly apply sealants to fill void required to level non-sag surface. Maintain uniform application procedures to continuously apply sealant. Complete joint system without intermediate stops and starts.

3. Sealant shall be applied according to manufacturer's recommendations in a manner so as to avoid entrainment of air in the joint. All sealant shall cure at least 7 days before the structure is filled with water.

4. Secure preformed board to surfaces with fasteners and procedures recommended by manufacturer.

* * * END OF SECTION * * *

SECTION 03253

WATERSTOPS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Formwork: Section 03100

B. Cast-In-Place Concrete: Section 03300

1.2 QUALITY CONTROL ASSURANCE

A. Qualify each PVC welder by demonstrated welding performance on straight and intersection welds. Test samples to 75% of tensile and shear stresses of original product. Testing by independent testing laboratory.

B. Design waterstop intersection fastening methods where normal welding is not appropriate. Design by waterstop manufacturer.

1.3 SUBMITTALS

A. Welder qualifications and certification by testing laboratory.

B. Specification and descriptive literature for welding tools to be used (same as those used to certify welders).

C. Complete shop drawings of all weld locations, intersection details, support and forming details.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver in original container.

B. Store and handle in manner to prevent damage or contamination which would cause leaks or affect bond with concrete.

2.0 PRODUCTS

2.1 MATERIALS

A. Extruded virgin polyvinyl chloride, minimum tensile strength 1,900 psi, ultimate elongation 375% in accordance with ASTM D412.

B. PVC Configurations:

1. Hollow-center bulb waterstops 6-inch overall dimension, 3/16 inch minimum thickness, Water Seals, Inc., "Flex-bulb"; Tecon Products Co., "Multi-seal type 6", or equivalent.

2. Labyrinth waterstops 4-7/16 inch overall dimension, 3/16 inch minimum thickness, Water Seals, Inc., type B-3, 3-rib; Structural Specialties Corp., Type SS-22, or equivalent.

C. 6" - 16 gauge galvanized steel. Use only where and when specifically noted.

3.0 EXECUTION

3.1 AREAS REQUIRED

A. Provide in all joints below grade or liquid level except joints within liquid-containing chambers not intended to be watertight. Waterstops may also be provided in other locations as shown on drawings.

3.2 SPLICES

A. Make splices and intersections in accordance with the manufacturer's instructions and with approved welding unit. Align splices as illustrated on approved detail drawing submittals. Control heat application.

3.3 INSTALLATION

A. Install in accordance with the manufacturer's installation instructions for continuous watertightness. Thoroughly vibrate or compact concrete under and around the waterstop to achieve concrete contact with all waterstop surfaces.

B. Prevent waterstops from being deformed or forced out of place when concrete is placed. Support with reinforcing steel or in conformance with the manufacturer's published recommendations. Hand placement of concrete around waterstops may be required.

C. Clip hog-rings through top of waterstop used in wall to footing joints at maximum of 1'0" spacing and support rings with continuous horizontal reinforcement. Lap galvanized waterstop 12" and fasten laps with four 1/8" galvanized bolts.

* * * END OF SECTION * * *

SECTION 03300

CAST IN PLACE CONCRETE

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Testing Laboratory Services: Section 01410

B. Concrete Formwork: Section 03100

C. Concrete Reinforcement: Section 03200

D. Anchors and Inserts: Section 03251

E. Expansion and Contraction Joints: Section 03252

F. Waterstops: Section 03253

1.2 QUALITY ASSURANCE

A. Delivery: Furnish a certificate with each truckload of concrete product delivered to the site, indicating the composition and quality of the mix. Include size and weight of each aggregate, amount of cement, amount of water and amount and kind of any additives included in the concrete, grout fill, or mortar.

B. Standards: All applicable standards of the following:

1. American Concrete Institute - ACI
2. Concrete Reinforcing Steel Institute - CRSI
3. Uniform Building Code - UBC
4. Other local codes or criteria noted on drawings.

C. Concrete Consistency:

1. Test each truckload of concrete for slump. Calibrate each mixer or haul unit to be used by measuring slump near the beginning and near the end of the discharge cycle. Mix units determined by the Engineer to be deficient in mixing capability shall not be used in subsequent deliveries. Slump testing procedures per ASTM C143.
2. Consistency per values below with tolerance of + 1 inch.
   a. 2-3 inches slump for structural elements 12 inches and greater in thickness.
   b. 2-4 inches slump for structural elements less than 12 inches in thickness and columns.

D. Concrete Test Cylinders:

1. Prepare a minimum of three test cylinders for each location (slab, wall, column, beam, etc.) for each days placement or each 50 cu. yd. whichever is greater.
2. Test set of 3 cylinders as follows:

a. One at 7 days.

b. Two at 28 days.

3. Prepare and test cylinders per ASTM C31 and C39.

E. Prior to placement have available at placement location all tools, cylinder molds, slump cone, rod, curing containers and all other apparatus required for sampling and testing.

F. Air Entrained: One test for each mix design.

1.3 SUBMITTALS

A. Concrete mix design (for each concrete type used) by independent laboratory, including strength tests of 3 cylinders proportioned to mix design formula.

B. Certification of quality of all concrete, mortar, and grout mix design ingredients including admixtures with supporting test data, mill quality control results and all information specified and requested by the Engineer.

C. Qualifications of Quality Assurance Control personnel responsible for concrete consistency, strength, air content and all testing.

D. Curing materials and methods proposed with certification statements of materials quality.

E. Test results, in approved format, at specified intervals for all field sampling and specimens.

F. Certification of quality and type of epoxy bonding materials.

G. Trip tickets for each load of concrete, grout or mortar indicating weights of all materials and additives used in the batch.

H. Location of construction joints not shown on the plans.

1.4 STORAGE OF MATERIALS

A. Maintain in continuously clean environment and in manner required to maintain homogeneity.

B. Cements, grouts, and mortar containerized and kept in dry humidity environment. Engineer shall reject materials which have hardened or show any evidence of initial hydration.

2.0 PRODUCTS

2.1 CONCRETE

A. ASTM C94 and mix design approved by Engineer.

B. Compression strength and water cement ratio: The minimum compressive strength and cement content of concrete shall be not less than that shown in the tabulation that follows. The Engineer may order the cement content for any class of concrete to be increased over the quantity specified in the tabulation if it is determined that such increase is necessary to attain the required strength. Such increased quantities of cement, if so ordered, shall be furnished by the Contractor at no additional cost to the Owner.

Class of Concrete Min. 28-day Compr. Strength(psi)	Type of Work	Max. Size Aggregate (in.)	Min. Cement Pounds Per cu. Yd.	Max. W/C Ratio
4,000	Slabs on grade and footings	1	564	0.46
4,000	Walls and piers	1	564	0.46
3,000	Thrust blocks, encasements and all other uses.	1-1/2	517	0.50

C. Cement ASTM C150:

1. Type II for all wastewater holding or process structures.
2. Type I or II for all other structures.

D. Aggregates:

1. Conform to ASTM C33.
2. Maximum wear 50% at 500 revolutions, AASHTO T96.

E. Water:

1. Clear free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.

F. Admixtures:

1. Use only those specified in approved mix design.
2. Air entrain all concrete unless elsewhere excepted, with agent conforming to ASTM C260. Freshwater concrete air content between 4% and 7% by volume.
3. Apply in strict accordance with manufacturer's printed instructions.
4. No chloride contents permitted.
5. Compatible with coatings specified elsewhere.

2.2 AGGREGATE FOR MORTAR

A. Conform to 2.1 except gradation as follows

Sieve Size Square Opening	Percent Passing By Weight
No. 4	95 - 100
No. 8	80 - 90
No. 16	55-97
No. 30	30 – 60
No. 50	12 – 30
No. 100	0 - 10

2.3 GROUT

A. For equipment and column bases and drilled in anchors use nonshrink, nonstaining, premixed grout, Masterflow 713 by Master Builders; or equivalent. Mix in accordance with the manufacturer's directions.

B. For Fill: Driest consistency practical composed of 1 part Portland Cement 3 parts sand (by volume). Aggregate proportions may be varied slightly to give the most workable mix.

C. For placement at base of walls, one part fine aggregate, one part cement. In a thick cream consistency.

D. Cure in accordance with manufacturer's recommendations.

2.4 CURING MATERIALS

A. Polyethylene Sheeting 0.004 inch thick.

B. Waterproof Paper: Polyethylene-coated, Fed. Spec. UU-B-790 Type I, Grades A, B, C, Style 4. Define lap control lines clearly by printed markings.

C. Masonry Sand: ASTM C144 (Maintained continually moist).

2.5 FLOOR HARDENERS

A. Dusted on type troweled into fresh concrete floor at rate specified by manufacturer.

B. Roll on cure sealer at rate specified by manufacturer.

C. Master Builders Master Cron, or Colortron where color is specified and sealed with Master Seal, or Castle Chemical Corporation Durundum, sealed with Duro-Kure, or equivalent.

2.06 VAPOR BARRIER (UNDER SLABS)

A. Polyethylene sheeting 6 mil (0.006 inch) thickness. Define lap control lines clearly by continuously marking material edges.

B. Glass fiber reinforced waterproof paper coated with polyethylene (both sides). Fed. Sped. UU-B-790 Type I grades A, B, C Style 4. Define lap control lines clearly by printed markings.

3.0 EXECUTION

3.1 MIXING AND TRANSPORTATION

A. Ready-Mixed Concrete: Conform to ASTM C94 Alternate No. 3.

3.2 PLACING

A. Deliver only in sufficient quantities required for specified time interval use and placement. Discard concrete having initial set before placement. No remixing with water or supplementing with other materials will be permitted once initial set has occurred. Initial set as evidenced by typical hydration characteristics to be determined by Engineer and Contractor

quality assurance representative.

B. Place as nearly as possible to final position to avoid segregation of the materials and displacement of reinforcement. Placement shall be completed within 30 minutes after water is first added to the mix. However, at the Engineer's discretion if climatic and temperature conditions are suitable and when the concrete is continually agitated, the time may be extended to 1-1/2 hours.

C. Place no concrete in the absence of the Engineer.

D. Do not change consistency (slump) for a given placement without the Engineer's written permission.

E. Keep open trough and chutes of steel or steel lined, clean and free from coatings of hardened concrete.

F. Do not drop concrete a distance of more than 5 feet unless approved in writing by the Engineer.

G. Do not place concrete in horizontal members or sections until the concrete in the supporting vertical members or sections has been consolidated and a 2-hour period has elapsed since placement in the vertical member to permit shrinkage to occur.

H. In walls containing door and window openings, hold up placements at the top and bottom of the openings. Stop other placements at levels to conform to drawing details.

I. Layout and sequence of placing of concrete in monolithic structures as shown on the drawings or approved by the Engineer.

J. Within a placement, deposit concrete in horizontal layers not to exceed 18 inches in depth. Place at rate such that: (1) no concrete surface shall obtain initial set before additional concrete is placed on it and (2) yielding of forms is not so great as to cause the concrete surfaces to exceed the tolerances specified.

K. Unless specified otherwise, place all slabs and finished floors to finish elevation in one continuous operation, except that the Contractor may place a separate finish topping if prior approval is received from the Engineer. Floor and roof slab sectional thicknesses shown are minimum thicknesses. Slopes on floors or roofs increase, rather than decrease, slab thicknesses.

L. Where a separate finish topping is placed, increase structural slab thickness by the maximum thickness of the finish topping and maintain finished floor elevation as noted on the drawings.

M. Construction Joints:

1. Locate construction joints as shown on the drawings or as approved by the Engineer.
2. Locate construction joints so as not to impair the strength of the structure, and only at locations shown on the drawings or approved by the Engineer.
3. Construct bulkheads to neatly fit reinforcement and waterstops and prevent concrete leakage.
4. Provide waterstops or sealants in construction joints where required.
5. Unless shown otherwise, key all construction joints.

6. Continue reinforcement through construction joint unless otherwise shown or noted.

7. Before placing concrete against previously placed concrete, thoroughly roughen and clean by wet sandblasting or green cutting with an air-water jet.

   a. Use air-water cutting at the proper time after the initial set. Use a high pressure air-water jet to expose clean, sound aggregate without undercutting the edges of the larger aggregate. Protect adjacent subgrade when cutting is used on slab edges.

   b. After cutting or sandblasting, rinse the surface until wash water contains no cloudiness. Dispose of wastes from cutting, washing and rinsing so they do not stain or abrade exposed surfaces.

8. Place concrete continuously to a predetermined construction joint.

N. Care shall be taken in placing concrete through reinforcement so that no segregation of the coarse aggregate occurs. On the bottom of beams and slabs where the congestion of steel near the forms makes placing difficult, a layer of mortar, of the same strength as used in concrete, shall first be deposited in the forms, followed immediately by the concrete. The thickness and use of this mortar layer shall be as approved by the Engineer.

O. Special care shall be taken to prevent splashing forms or reinforcement with concrete. Any hardened concrete or partially hardened concrete on the forms or reinforcements above the level of the concrete already in place shall be removed before proceeding with the work.

P. Cold Weather Placement:

1. Concrete shall be placed only when the temperature is at least 40° F., and rising, unless permission to pour is obtained from the Engineer.

2. Material shall be heated and otherwise prepared so that batching and mixing can proceed in full accord with the provisions of this Specification.

3. Suitable means shall be provided for maintaining the concrete at a temperature of at least 50° F for a period of at least the first five (5) days and at a temperature above freezing for the remainder of the specified curing period, except that where high-early-strength cement is used, this period may be reduced to 72 hours. The methods proposed for heating the materials and protecting the concrete shall be approved by the Engineer.

4. Salt, chemicals, or other materials shall not be mixed with the concrete for the purpose of preventing freezing. Accelerating agents shall not be used.

Q. Hot Weather Placement:

1. The temperature of fresh concrete at the time of placement during hot weather shall be a maximum of 90° F to prevent an accelerated setting of the concrete.

2. A retarding densifier admixture shall be used when the high expected atmospheric temperature for the day is 85° F or above. Admixture shall be used in accordance with the manufacturer's recommendations.

R. Placing Concrete Against Earth:

1. Unless otherwise called for on the drawings, earth cuts shall not be used as forms for vertical surfaces without the prior approval of the Engineer.

2. Concrete placed on or against earth shall be placed only upon or against firm, damp surfaces free from frost, ice and standing or running water. Concrete shall not be placed

upon mud, or upon fills until the required compaction has been obtained.

S. Placing Concrete Slabs:

1. Smooth subgrade surface irregularity with thin film of masonry sand prior to placing vapor barrier.
2. Place vapor barrier on subgrade in maximum widths commercially available. Longitudinal laps 6 inch minimum. End laps 2 feet minimum.
3. Edge and side laps to be in continuous contact. Place materials to maintain tight lap contact.
4. Repair any tears in the material.
5. Place concrete without displacing vapor barrier.

T. Depositing Concrete in Water:

1. Concrete may be deposited in water only when specifically authorized.
2. Methods and equipment used shall be acceptable to the Engineer.
3. When deposited by the tremie method, the tremie shall be watertight and sufficiently large to permit a free flow of concrete. The discharge end shall be kept submerged continuously in the concrete and the shaft kept full of concrete to a point well above the water surface. Placing shall proceed without interruption until the top of the concrete has been brought to the required height.

3.3 COMPACTING

A. Compact all concrete with high frequency internal vibrators immediately after placing.

B. Use external vibrators for compacting concrete where the concrete is inaccessible for adequate compaction by internal vibrators; construct forms sufficiently rigid to resist displacement or damage from external vibration.

C. Penetrate concrete with a sufficient number of vibrations immediately after it is deposited. Move vibrator throughout the mass so as to thoroughly work the concrete around reinforcement and embedded fixtures and into corners and form recesses. Vibrate the minimum time required to compact the concrete in place and not cause separation of the materials. Concrete shall be compacted to maximum density as determined by tests for yield. Select vibrator size to efficiently accommodate reinforcement clearances.

3.4 CURING AND PROTECTION

A. General:

1. Maintain at site ready to install, before actual concrete placing begins, all equipment and materials needed for optimum concrete curing and protection; maintain extra vibrators on standby in case of malfunction of any unit.
2. Protect finished surfaces or edges from stains, abrasions and breakage during the entire construction period.
3. Protect all concrete from accelerated drying and excessive heat at all times. Close all galleries, conduits and other formed openings through the concrete during the entire curing period and as long thereafter as practicable to prevent drying of concrete by air circulation.

4. Install slab curing covers immediately after initial set or as soon as free water has disappeared from the surface of the concrete after finishing or surfacing.

B. Water Curing:

1. Use water curing specified herein for all walls and slabs where watertight construction is required.
2. Keep concrete continuously wet by covering with an approved material or by a system of perforated pipes or mechanical sprinklers or other approved methods. (Periodic wetting acceptable.)
3. Keep forms wet at all times to prevent opening of joints and the drying out of the concrete.
4. Water for curing shall be clean and free from any elements which might cause objectionable staining or discoloration of the concrete.
5. Cover surfaces completely with sheeting. Where a single sheet does not cover the entire surface, lap ends and edges at least 4 inches and continuously seal with tape or other suitable means recommended by the manufacturer.
6. Continue waterproof sheet curing for 7 days. Maintain sheeting and edge and end seals intact for entire period. Repair immediately any breaks in the sheeting envelope.

C. Curing Compounds (Use only when specifically approved and for optimum climatic conditions):

1. Do not use curing compounds unless their use is authorized in writing by the Engineer. Curing compounds unacceptable where concrete is exposed to the direct rays of the sun or accelerated drying conditions.
2. Curing compounds shall not be used unless their use is face membrane type and shall be applied in accordance with the manufacturer's recommendations. They shall be of such composition and characteristics as will spread readily on moist concrete and deposit a hard, tenacious film without permanently coloring the concrete surfaces that will be exposed. The resultant film shall adhere to the concrete surface without chemical reaction therewith, and shall not peel. Maintain coverage for 28 days to prevent detrimental loss of water from the concrete.
3. Prior to applying curing compounds to formed surfaces, the surfaces shall be moistened with a spray of water immediately after forms are removed. Moistening shall be continued until the surfaces will not readily absorb more water. The compound shall be applied as soon as the moisture film has disappeared and while the surface is still damp.
4. On unformed surfaces, the compounds shall be applied immediately after finishing and after bleeding water and "shine" has disappeared.
5. Curing compounds shall not be used on surfaces where future bonding, painting or protective coating is required. In cold weather, curing compounds shall not be used on concrete surfaces that are kept at curing temperature by the use of steam.

D. Saturated Sand Curing:

1. Horizontal construction joints and finished surfaces, cured with sand, shall be kept covered with a minimum thickness of one inch of sand. It shall be kept uniformly distributed and continuously wetted with clean water for a period of 7 days.

3.5 REPAIRING CONCRETE

A. Immediately after removal of forms, break back all form ties and inspect concrete surfaces for defects. Complete repair of defects within 48 hours after removal of forms. No repairs shall be made until the defects have been reviewed and method of repair approved by the Engineer.

B. Remove all defective or damaged concrete, including honeycombed, sand streaked, or fractured material from the area to be repaired. Chip out areas to one inch minimum depth. Edge shall be squared with the surface to eliminate feather edges.

C. Before placing the repair material obtain Engineer inspection. Clean area free of chipping dust, dried mortar, and all other foreign materials.

D. Keep surfaces to be repaired continuously wet for at least three hours prior to placing new concrete or mortar. No free water on the surface when the repair material is placed.

E. Apply a bonding agent to the area to be repaired before placing repair material. Apply the bonding agent per manufacturer's published instructions attached to container.

F. For all repair surfaces permanently exposed to atmosphere use white cement in proportions found by trial to be effective in producing a color that, in the hardened patch, will match the surrounding concrete surface.

G. Make repairs or patch form tie holes by (1) dry-packing, (2) filling with concrete, or (3) plastering with mortar or a combination of all 3 in conformance with the following:

1. Use the dry-pack method for holes at least one inch deep where the depth is equal to, or greater than the smallest surface dimension of the defect, such as cone-bolt or form tie holes, and for narrow slots cut for the repair of cracks. Do not use the dry-pack method where lateral restraint cannot be obtained. Place and pack dry-pack mortar in layers having a compacted thickness of approximately 3/8 inch. Solidly compact each layer over its entire surface by use of a hardwood stick and hammer. Do not use metal tools for compacting. Compact surface just flush with adjacent area. Do not use steel finishing tools or water to facilitate finishing.

2. Use concrete replacement for (1) holes extending entirely through concrete sections; (2) for holes larger than one square foot and deeper than four inches in which no reinforcement is encountered; (3) for holes larger than 1/2 of one square foot where reinforcement is exposed. Concrete used for replacement shall be of the same strength and mixture as used in the structure except for color matching as specified above.

3. Use mortar replacement for holes too wide to dry-pack and too shallow for concrete replacement and when approved by the Engineer for other conditions not covered above.

H. Cure all repairs with the same methods as new concrete.

3.6 CONCRETE FINISHES AND TOLERANCE

A. General Finish:

1. Finish concrete surfaces to conform with the following table unless otherwise noted on the drawings.

2. Formed Surfaces

	System
Exterior - Exposed and One Foot Below Grade	F3
Exterior – Below Grade	F2

Interior	F4

3. Slabs

	System
Tops of exterior footings in contact with soil or backfill	U2
Exterior - Except as Otherwise Noted .	U5
Interior - Walking Surface Except as Otherwise Noted (with hardener) . .	U4
Interior – Tanks and Channels	U4
Exterior and Interior Walks on or over structures including interior clarifier slab to receive swept in grout fill	U1

B. Formed Surfaces: Finishes for formed surfaces shall be as designated below:

1. Finishing for F1 and F2 finishes consists of concrete repairing only, which is to be completed within 48 hours after forms are removed.

2. Finishing for F3 and F4 finishes shall immediately follow concrete repairing and be completed within 96 hours after the forms are removed. Except where forms are left in place for the duration of the curing period, finishing shall be done during the curing period, keeping the interruptions to the curing process as short as possible. Where forms left on prevent finishing during the curing period, finishing shall be completed within 48 hours after forms are removed. All finishes shall receive a minimum of 24 hours of curing after completion of the finish. Curing shall be carefully done so as not to disturb or remove any of the mortar.

3. Finish F1: Rough formed surface with defective concrete repaired and form tie holes and other holes over 1/2 inch deep filled. Forms may be built with a minimum of refinement and form sheathing may be any material that will not leak mortar or yield beyond specified tolerances when the concrete is vibrated.

4. Finish F2: Smooth, formed concrete surface with all fins, projections and loose material removed and defective concrete and form tie holes and other holes over 1/2 inch deep, repaired and filled. Forms in contact with concrete shall be plywood or steel.

5. Finish F3: Smooth, formed concrete surface with all fins, projections and loose material removed, and defective concrete, form tie holes, air bubble holes, surface pits, holes from defective forms, nailhead holes and similar surface defects, repaired and filled. Forms in contact with concrete shall be plywood or steel. Form construction shall be planned so that if any pattern from the forms is left in the concrete surface it will harmonize with the structure or building. All joints shall be horizontal or vertical.

6. Finish F4: Exceptionally smooth, formed concrete surface with all fins, joint marks, bulges, projections and loose material removed. Sandblast to expose air bubble holes, surface pits and similar minor surface defects. Defective concrete, form tie holes, holes from defective forms, and other holes too large to fill by "sack rubbing" shall be repaired and filled. Finish with sack rubbing as follows.

   a. Thoroughly wet the surface and begin treatment while the concrete is still damp. Use 1 part cement, 2 parts (by volume) of sand which will pass a No. 16 screen, and enough water so that mortar consistency will be that of thick cream. Rub mortar thoroughly over the area with clean burlap or a cork or sponge rubber float to fill all

pits, surface holes and air bubble holes. While the mortar in the pits is still plastic, rub the surface with a dry mix of mortar. This dry rub shall remove all excess mortar and place enough dry material in the pits to stiffen and solidify the mortar flush with the surface. No material shall remain on the surface except that within the pits. When the ambient temperature is 85°F or higher, keep the mortar continuously damp by means of a fog spray for 24 hours during the setting period. Take care that the fog spray does not remove any of the mortar. Break finish for any area only at natural breaks in the finished surface.

b. Rub all surfaces that are to be finish painted with a carborundum stone to provide a smooth texture and to remove any latent material on the surface. Pre-blast walls to remove any residual form oils prior to finishing when walls are to be finish painted.

c. Form requirements shall be the same as Finish F-3.

C. Unformed Surfaces:

1. Working on unformed surfaces in various finishing operations shall be held to the minimum required to produce the desired finish. Use of any finishing tool in areas where water has accumulated will not be allowed. Work in these areas shall be delayed until the water has been absorbed, has evaporated, or has been removed by draining, mopping, dragging off with a loop of hose, or by other means. In no case, shall cement or mixture of cement and sand be spread on the surface to absorb excess moisture nor shall such materials or water be added to facilitate troweling. Joints and edges, unless specified otherwise, shall be carefully finished with edging tools.

2. Finishes for unformed surfaces shall be as designated below:

a. Finish U1: Even, uniform finish. Consolidate level and screed concrete to obtain an even, uniform surface. Surplus concrete shall be removed immediately after consolidation by striking it off with a sawing motion of the straight edge or template across wood or metal strips, that have been set as guides. When the surface is curbed use screed strips at approved intervals. For long, narrow stretches of curved surfaces such as on invert paving, a heavy slip form may be used. In the case of extensive flat paving, a paving and finishing machine is preferred.

b. Finish U2: A wood float finish. Follow treatment specified for finish U1 by floating either by hand, or by power driven equipment. Floating to be started after some stiffening has taken place in the surface concrete and the moisture or "shine" has disappeared. Work the concrete no more than necessary to produce a surface known as "wood float finish" which is uniform in texture and free of screed marks. Do any necessary cutting and filling during the floating operations.

c. Finish U3: A steel troweled finish. Follow the treatment specified for the finish U2, except leave a small amount of mortar without excess water at the surface to permit effective troweling. Start steel troweling after the moisture film or "shine" has disappeared from the float surface and after the concrete has hardened enough to prevent an excess of fine material and water from being worked to the surface. Trowel with firm pressure that will flatten the sand surface left by the floating and produce a dense, uniform surface free of blemishes, ripples and trowel marks.

d. Finish U4: A hard, steel troweled finish burnished. Follow the treatment specified for finish U3 with additional steel troweling after the surface has nearly hardened, using firm pressure and troweling until the surface has a burnished appearance.

e. Finish U5: Broom finish. Follow the treatment specified for finish U3 by roughening the surface immediately after troweling with a fiber bristle broom in a direction perpendicular to the direction of traffic. Broom grooves not more than 1/16

inch deep. After brooming, neatly tool all joints and edges to configuration.

f. Finish U6: Anti-slip finish. Follow the treatment specified for finish U3 and immediately after troweling, dust 30 to 40 lbs. or regular non-slip aluminum oxide 14/36 grit abrasive grain uniformly over each 100 sq. ft. of area. Trowel the grit into the surface and after troweling, brush with a fiber bristle broom in a direction perpendicular to the direction of traffic. Broom grooves not more than 1/16" deep. After brooming neatly tool all joints and edges to configuration.

D. Tolerances:

1. Unless otherwise required, allowable tolerances for concrete surfaces shall be in accordance with those shown in the table below. Surface irregularities are classified as either "abrupt" or "gradual". Offsets caused by displaced or misplaced form sheathing, lining, or form section or by defective form lumber shall be considered as abrupt irregularities. All others are classed as gradual irregularities. Gradual irregularities shall be measured with a template consisting of a straight edge for plane surfaces and its equivalent for curved surfaces.

2. The length of the template for testing formed surfaces shall be 5 feet. The length of the template for unformed surfaces shall be 10 feet. Maintain a 5 foot length and 10 foot length steel template on the job site.

3. Maximum allowable irregularities in concrete:

Finish	Irregularity in Inches	
Designation	Gradual	Abrupt
F1	1	1/2
F2	1/2	1/4
F3	1/4	3/16
F4	3/16	3/16
U1 thru U6	1/8	1/8

3.7 TESTING AND REPAIRING CONCRETE STRUCTURES

A. Testing:

1. Separately test each individual chamber that will contain liquid by filling to the overflow with water after the 28-day design strength of the concrete has been obtained. Repair any visible leakage. Damp spots that do not run may be acceptable if below ground or not on walls common with pump rooms or passageways.

2. Allowable leakage not to exceed 0.1% of the volume contained in the chamber in a 24 hour period. Leakage in excess of the allowable amount requires repair to reduce leakage and will be considered to lack watertightness.

B. Repairs:

1. In the event that the structure is not watertight, outline a procedure for repair prior to proceeding with the repair work. Complete any repairs to new work as per specifications at Contractor expense.

2. Approved repairs can include, but not necessarily be limited to one or a combination of the repairs listed below. Use of these techniques is not to be construed as a warranty by the Engineer that the methods outlined will satisfy leakage repair requirements:

a. Replace defective concrete.

b. Grouting of the joint by drilling grout holes to the center of the structural unit and

forcing grout into the joint under pressure.

c. Cutting of a bevel groove on the pressure side of the joint. Groove 1/2 to 3/4 inch in width and depth caulked with epoxy joint sealer in accordance with the manufacturer's instructions.

3.8 UNSATISFACTORY CONCRETE

A. Any concrete placed which fails to meet or exceed the specified strength requirements as determined from molded cylinders or cores, or to meet the density or surface requirements, or which has been frozen during placing or curing, shall be removed and replaced with satisfactory materials at the Contractor's expense.

B. Method of determining unsatisfactory concrete: Visual appearance characteristic of rain or freeze damage to concrete which is apparent to the Engineer.

* * * END OF SECTION * * *

SECTION 03485

PRECAST CONCRETE VAULTS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Shop Drawings, Product Data and Samples

B. Concrete: Division 3

1.2 DESCRIPTION

A. This section covers furnishing and installation of the precast concrete vaults.

1.3 SUBMITTALS

A. Submit complete shop drawings with detailed specifications and data for materials used, parts, devices and other accessories forming part of the vault.

1.4 ADAPTATION OF PRODUCT

A. Furnish product readily adaptable for installation and operation in the manner shown on the drawings.

2.0 PRODUCTS

2.1 GENERAL

A. The vaults shall be precast as manufactured by Utility Vault Co., or equivalent, with tops modified as shown on the plans.

2.2 DESIGN

A. Conform to ASTM C913.

B. Designed for 16000 pound wheel load.

C. Designed for earth load of 130 pounds per cubic foot.

3.0 EXECUTION

3.1 INSTALLATION

A. The bottom of the excavation for the vaults shall be fine graded to a plane surface on firm undisturbed subgrade material.

B. Granular pipe bedding material shall be uniformly spread to a depth of 4 inches over the bottom of the excavated area to provide uniform bearing for the vault.

C. Install vault and accessories in conformance with drawings, specifications and recommendations of vault manufacturer unless otherwise instructed in writing by the Engineer.

D. The vault joints, pipeline, and conduit penetrations through walls as shown on the plans shall be sealed watertight. No leakage will be allowed into the vault.

E. The manhole ring and cover or access doors shall be adjusted to match the finished surface grade.

* * * END OF SECTION * * *

DIVISION 9 FINISHES

SECTION 09900

PAINTING

1.0 GENERAL

1.1 SUMMARY

A. This section includes all materials, equipment, and labor necessary for performing all painting or coating of exposed miscellaneous concrete, metal, pipe, fittings, valves, and equipment required. The following surfaces or items shall not be painted, unless otherwise specified:

1. Factory finished items;
2. Aluminum, brass, bronze, chrome, copper, or stainless steel;
3. Nameplates or serial numbers;
4. Grease fittings;
5. Valve operator stems;
6. Buried or encased piping or conduit; and
7. Glass

1.2 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 design only.

1. ANSI/ASTM D16 - Definitions of Terms Relating to Paint, Tarnish, Lacquer, and Related Products

1.3 SUBMITTALS

A. Manufacturer's product data;

B. Manufacturer's Certification that the paint is in compliance with local Regulatory Requirements; and

C. Manufacturer's application instructions.

2.0 PRODUCTS

2.1 GENERAL

A. Paints shall be suitable for intended use as recommended by their manufacturer. Products of one manufacturer shall be used in any one painting application and all coating materials for that application shall be compatible.

2.2 COATING TYPES

A. The following coatings shall be used:

Description	**Brand**	**Application**	**Color**
Epoxy Primer (54 percent)	Boston Gray Primer	Steel	Beige

Polyamide Epoxy Finish (56 percent)	Expoxoline Series 66	Steel, PVC	Beige
Epoxy Primer (Amine adduct epoxy)	Flakeprime 675	Concrete	Clear
Epoxy Finish (Amine adduct epoxy)	Flakeline 600	Concrete	Clear

Description of coating types includes minimum acceptable percent, by volume, of component solids. For steel and PVC primer and paint, brand identification is keyed to products of Tnemec Co., Inc., Kansas City, MO. For concrete, brand identification is keyed to Ceilcote. These manufacturers are used to establish standard of quality. Other manufacturer's products meeting these physical characteristics and performance criteria shall be acceptable.

2.3 EXCLUSIONS

A. Lead

1. Paints containing lead in excess of 0.06 percent of the total non-volatile content (calculated as lead metal) shall not be used.

B. Chromium

1. Paints containing zinc chromate or strontium chromate pigments shall not be used.

C. Volatile Organic Compound (VOC) Content

1. Paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. All paint to be used shall meet the VOC content limits of South Coast Air Quality Management Distirct.

3.0 EXECUTION

3.1 SURFACE PREPARATION

A. Remove oil, grease, soil, and other contaminants on steel surfaces by use of solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods which involve a solvent or cleaning action, in accordance with Steel Structures Painting Council Surface Protection Specifications (SSPC) SP-1. Remove weld splatter and rough edges and grind rough welds so that all surfaces are smooth and in proper condition to receive the specified coating. All surfaces shall be free of dust or dirt prior to coating application.

3.2 COATING APPLICATION

A. The coating manufacturer shall be responsible, through an authorized representative, to provide technical assistance to the paint contractor, as needed. Workers shall be skilled in structural steel, piping, and mechanical equipment painting.

B. Coat areas with a uniform film, free of sags, runs, or brush marks. Where multiple coats of paint are specified, apply each coat in a different color which complements the following coat and is different than the preceding coat. Each coat must be free of shadows and uniform in appearance. Thin paint only as necessary for workability of coating material in accordance with manufacturer's printed instructions. Use only an appropriate thinner as recommended by the paint manufacturer. Comply with recommendations of the paint manufacturer in regard to drying time for each coat, technique of spray application, ventilation, paint thinning, and

safety precautions. The Contractor must fully inform all members of his field crew of these recommendations.

C. Factory finished items and items not to be painted shall be protected from overspray or splatter during painting. If overspray or splatter does occur, those items shall be cleaned or replaced at the Contractor's expense.

3.3 CLEANING

A. Upon completion of work all staging and scaffolding shall be removed, used containers and rubbish shall be properly disposed, and paint spots, oil, or stains shall be removed from adjacent surfaces.

** End of Section **

DIVISION 11 EQUIPMENT

SECTION 11010

EQUIPMENT GENERAL PROVISIONS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Material and Equipment: Section 01600

B. Operation and Maintenance Data: Section 01730

C. Painting: Section 09900

D. Mechanical: Division 15

E. Electrical: Division 16

1.2 DESCRIPTION

A. The provisions of this section apply to all sections of Division 11 unless specifically revised therein.

B. Furnish each piece of equipment complete with its base, drives, shafting, couplings, controls, guards, and other appurtenances, which are specified or are required for proper and safe operation.

C. All railings, stairs, guards, platforms, etc. shall meet or exceed federal OSHA and state requirements.

D. Fabricate, assemble, erect, place, and test all specified materials and equipment in full conformity with all contract documents and manufacturer's recommendation.

E. Furnish any special tools or equipment required for proper maintenance, testing or adjusting.

1.3 SUBMITTALS

A. If prebid submittals are required by the Bid form, such submittals shall be in accordance with the Bid form, paragraph 16 of the Information for Bidders, Section 01600 and paragraph B below.

B. Drawings and Data: In conformance with procedures set forth, submit complete assembly, foundation, and installation drawings, together with detailed specifications and data covering materials used, parts, devices, and other accessories forming part of the equipment, as well as complete performance data.

1. Include weights and principal dimensions.

2. Provide performance data in U.S. Customary units.

C. Operations and Maintenance Manuals

1. Supply operation and maintenance manuals prepared by equipment suppliers in conformance with Section 01730.

2. Furnish operations and maintenance manuals in addition to any instructions or parts lists

packed with or attached to the equipment when delivered.

1.4 GUARANTEE

A. Unless otherwise excepted herein, contractor shall warranty contractor provided materials and construction for a period of one year from the date of acceptance by the Government. Any required warranty shall be promptly made by the contractor at no cost to the Government. In the event of contractor-supplied equipment failure, the contractor shall respond within 48 hours.

B. Guarantees shall cover:

1. Faulty or inadequate design
2. Improper assembly or erection
3. Leakage, breakage, or other failure
4. Defective workmanship or materials

1.5 PROTECTION

A. Box, crate, or otherwise completely enclose and protect all equipment during shipment, handling and storage.

B. Protect equipment from exposure to elements and keep all items thoroughly dry at all times.

C. Store motors, electrical equipment, and other equipment with moving parts in weather tight warehouses at maintained temperature of 60°F minimum.

D. Painted Surfaces:

1. Protect against impact, abrasion, discoloration and other damage.
2. Repaint to original factory specifications or Section 09900 all painted surfaces which are damaged prior to acceptance of equipment.

E. Protect electrical equipment, controls and insulation against moisture or water damage.

1.6 ADAPTATION OF EQUIPMENT

A. Furnish equipment readily adaptable for installation and operation in the structure shown on the Project Drawings. Equipment furnished shall be compatible with all other equipment furnished.

B. Assume full responsibility for alteration of the planned structure to accommodate other types of equipment. Assume full responsibility for all modifications of mechanical and electrical controls, equipment, wiring, piping, as required to accomplish function contemplated by the contract documents.

C. Equipment which requires alteration of the structure, piping, and/or electrical work will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations.

D. Provide all such alterations free of extra cost to the Owner.

2.0 PRODUCT

2.1 EQUIPMENT

A. In accordance with applicable Section of Division 11.

2.2 ANCHOR BOLTS

A. Adequately sized for equipment loads and in no case less than the size recommended by the equipment manufacturer.

B. Embedded Type: When required by equipment manufacturer or field conditions.

C. Concrete Anchor Type: When allowed by specifications or shown on drawings.

D. Embedded Sleeve Type:

1. Preferred method.
2. When allowed by equipment manufacturer.
3. Anchor bolt assembly shall consist of anchor bolt, surrounding pipe sleeve, bottom plate, leveling nut, nut and washer.
4. Assembly shall permit reasonable lateral movement of the bolts to allow for proper matching of bolts to equipment.

E. Galvanized anchor bolts and anchor bolt assemblies after fabrication unless stainless steel anchor bolts are provided.

2.3 PAINTING

A. Manufactured Equipment:

1. Protect all steel and iron surfaces by suitable coatings applied in shop.
2. Protect for life of equipment surfaces which will be inaccessible after assembly.
3. Finish smooth, thoroughly clean, and fill exposed surfaced, as necessary, to provide smooth uniform base for coating.
4. Coat surfaces to be painted after installation with one or more coats of primer to protect equipment until finish coats are applied.
5. Shop finish electric motors, speed reducers, starters, and other self-contained or enclosed components with oil-resistant enamel.
6. Apply rust preventive compound to all machined, polished and nonferrous surfaces which are not to be painted.
7. Furnish at least one quart of finish coat material with equipment for field touch-up.

B. Shop Fabricated and/or Field Erected: Section 09900 and as specified in applicable Sections.

2.4 LUBRICATION

A. Adequately lubricate equipment by systems requiring attention no more frequently than weekly during continuous operation.

B. Provide lubrication systems that do not require attention during startup or shutdown and that do not waste lubricants.

3.0 EXECUTION

3.1 ERECTION AND INSTALLATION

A. The equipment shall be erected by tradesmen skilled in the erection of the type of equipment and in accordance with the manufacturer's instructions. The erection work shall include furnishing the necessary oil and grease for initial operation and a three months supply. The grades of oil and grease shall be in accordance with the recommendations of the equipment manufacturer.

B. Align and connect each piece of equipment to its piping and subbase then level subbase on shims.

C. Grout in place with nonshrink grout.

D. Provide a concrete base where required by contract drawings.

E. Do not shim between machined surfaces.

F. Support and install piping so that no strain is transmitted to equipment.

3.2 INSTALLATION CHECK

A. Provide services of an experienced, competent, and authorized representative of manufacturer or supplier of equipment to visit site of work and inspect, check, adjust if necessary, and approve equipment installation.

B. Assure that equipment supplier's representative is present when equipment is placed in operation.

C. Verify that equipment supplier's representative revisits jobsite as often as necessary until all trouble is corrected and equipment installation and operation are satisfactory, in opinion of Engineer.

D. Furnish to Owner, through Engineer, a written report prepared by equipment supplier certifying that equipment:

1. Has been properly installed and lubricated.
2. Is in accurate alignment.
3. Is free from any undue stress imposed by connecting piping or anchor bolts.
4. Has been operated under full load conditions and that it operated satisfactorily.

* * * END OF SECTION * * *

SECTION 11210

GROUNDWATER WELL PUMPS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

1.2 SUMMARY

A. This section covers submersible pumps for pumping groundwater. Each pumping unit consists of a vertical pump coupled with an electric motor, and all necessary appurtenances to provide a complete pumping system. Pumping units specified herein shall be supplied by one manufacturer.

B. Operating conditions:

1. Operating conditions as specified describe the range of operating requirements for each pumping system.

2. The rated operating capacity and head is the condition upon which the pumping system has been designed. The pump shall be selected such that the rated condition is to the right of the maximum efficiency point on the head capacity curve. Other specified operating points are estimates defined by the expected operating characteristics of the pumping system. These estimates describe conditions at which the pumping system may operate, such as maximum capacity, maximum head and minimum capacity.

3. The total head is the summation of static head, friction losses, dynamic losses and turbulence losses, and does not include pump inlet, pump discharge or internal pump losses. Pump efficiency is the ratio of the energy output of the pump to the energy input applied to the pump shaft. Maximum nameplate motor horsepower applies to the entire range of specified pump operating conditions.

C. Critical speeds: Each pumping system, comprising pump, driver and all appurtenances, shall have no dangerous critical or resonant frequencies at multiples of the speed range required by the pump to meet the specified operating conditions. In addition, the system shall be free from objectionable or destructive vibration throughout the operating range.

1.3 SUBMITTALS

A. The following shall be submitted in accordance with Section 01300 SUBMITTALS:

1. Data: Manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions.

2. Spare Parts: Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 1 month prior to the date of substantial completion. Data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

3. Drawings, Pump System: Detail drawings consisting of a complete list of equipment and materials. Detail 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, and equipment relationship to other parts of the work including clearances for maintenance and operation.

4. Instructions, Pump System: Proposed diagrams, instructions, and other sheets, prior to posting.

5. Reports, Testing: 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.

6. Operation and Maintenance Manuals, Pump System: Two (2) complete copies of operating manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Two (2) complete copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include simplified wiring, layout, and control diagrams of the system as installed.

1.4 GENERAL REQUIREMENTS

A. Standard Products. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Engineer, reasonably convenient to the site. Pumps of the same type shall be the product of one manufacturer.

B. Nameplates. Each major item of equipment shall have the manufacturer's name, address, type or style, model, serial number, and catalog number on a plate secured to the item of equipment. In addition, the nameplate for each pump shall show the capacity in gallons per minute at rated head in feet and speed in revolutions per minute. Nameplate for each electric motor shall show the horsepower, speed in revolutions per minute, full load current, voltage, frequency, phases, time rating, maximum ambient temperature, insulation class code letter, and service factor.

C. Verification of Dimensions. The Contractor shall become familiar with all details of the work, verify all dimensions in the fields and shall advise the Engineer of any discrepancy before performing the work.

D. The product shall conform to the Hydraulic Institute general configuration for barrel or can pumps

1.5 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

A. The following manufacturers were determined to be acceptable: Grundfos or approved equal.

2.2 DESIGN REQUIREMENTS

A. Pumps shall be capable of discharging quantities of water at maximum pump speed and total pump head with the minimum efficiency indicated. Total pump head in feet shall consist of the pumping level below datum and the static and friction head above datum at design capacity.

B. Unless otherwise stated herein, the pump shall comply with all local and state sanitary and safety regulations.

2.3 OPERATING CONDITIONS

A. Pumps shall be identified by the equipment number and designed for continuous duty under the following operating conditions:

Equipment Number	Flow	TDH
Submersible Well Pump	5 gpm	100 ft.

The pumps provided shall provide the flow listed above. The pump shall be +5% of the listed flows at a minimum of 80% efficiency at the design point. No adjustments to pipe size or valve position may be made by the Contractor to meet the requirements of this Section, unless approved in writing by the Engineer.

2.4 REFERENCES

A. This Section incorporates by reference the latest edition of the following documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and that of the listed document, the requirements of this Section shall prevail.

Reference	Title
AGMA 2001-C	(1995) Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
AGMA 2003-A	(1981; Re-edited June 1998 re6) Rating the Pitting Resistance and Bending Strength of Generated Straight Bevel, ZEROL Bevel, and Spiral Bevel Gear Teeth.
AGMA 6010-E	(1988; Errata Nov 91) Standard for Spur, Helical, Herringbone, and Bevel Enclosed Drives.
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A 153	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
ASTM D 975	(1996a) Diesel Fuel Oils.
ASME B1.1	(1989) Unified Inch Screw Threads (UN and UNR Thread Form).
ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings.
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings NPS ½ thru NPS 24.
ASME B40.1	(1991) Gauges – Pressure Indicating Dial Type – Elastic Element.
AWWA E101	(1988) Vertical Turbine Pumps – Line Shaft and Submersible Types.
ABEMA Std 9	(1990) Load Ratings and Fatigue Life for Ball Bearings.

NEC	National Electric Code (NFPA 70).
UBC	Uniform Building Code
	Hydraulic Institute Standards

2.5 EQUIPMENT FEATURES

A. Pump Design and Materials of Construction

1. There shall be a built-in integral check valve made of 300 Series stainless steel. The check valve seat shall be Teflon® with a 300 Series stainless steel insert.
2. The pump bowls, impellers, guide vanes and filter screen shall be 300 Series stainless steel.
3. Each impeller shall have a Teflon® seal ring around its eye or skirt to reduce hydraulic losses.
4. There shall be a Teflon® shaft bearing located either above or below each impeller.
5. A 300 Series stainless steel filter screen shall be included as part of the suction inlet assembly.
6. A 300 Series stainless steel priming inducer shall be included to provide lubricating flow and to prime the pump should the fluid pumping level fall below the first impeller.
7. The stainless steel nameplates shall be affixed to the pump. The pump model shall be stamped into the nameplate. No inks or dyes shall be used.

B. Motor Design and Materials of Construction

1. The motor shall be a squirrel-cage induction motor designed for submersible operation in conformance with NEMA standards.
2. All materials in contact with the pumped fluids shall be 300 Series stainless steel or Viton®.
3. The motor shall not use any oils or greases for lubrication of bearings.
4. A flexible Viton® diaphragm shall be provided to permit expansion and contraction of the internal motor lubricating and cooling fluid.
5. The motor shaft seal shall be constructed of Viton®.
6. A sand slinger made of Viton® shall be included.

C. Motor Cable Design and Materials of Construction

1. The cable shall be continuous with no splices.
2. The connector boot shall be constructed of Viton®. The connector shall be constructed of 300 Series stainless steel. The motor wire shall be AWG12 with Teflon® insulation.

2.6 EQUIPMENT APPURTENANCES

A. Attachments. All necessary bolts, nuts, washers, and other types of attachments for the installation of the equipment shall be furnished with the equipment. Bolts shall conform to the requirements of ASTM A 307 and nuts shall be hexagonal of the same quality as the bolts used. Threads shall be clean-cut and shall conform to ASME B1.1. Bolts, nuts, and washers specified to be galvanized or not otherwise indicated or specified, shall be zinc coated after being threaded, by the hot-dip process conforming to ASTM A 123 or ASTM A 153 as

appropriate. Bolts, nuts, and washers specified or indicated to be stainless steel shall be Type 316.

B. Equipment Guards. Equipment driven by open shafts, belts, chains, or gears shall be provided with all-metal guards enclosing the drive mechanism. Guards shall be constructed of galvanized sheet steel, galvanized woven wire, expanded metal set in a frame of galvanized steel members or stainless steel. Guards shall be secured in position by galvanized steel braces or stainless steel straps that will permit easy removal for servicing the equipment. The guards shall conform in all respects to all-applicable safety codes and regulations.

C. Special Tools. A complete set of all special tools that may be necessary for the adjustment, operation, maintenance, and disassembly of all equipment shall be furnished. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to the Engineer.

D. Shop Painting. All motors, pump casings, and similar parts of equipment customarily finished in the shop shall be given coats of paint filler and enamel, or other acceptable treatment customary with the manufacturer and suitable for the intended service. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

3.0 EXECUTION

3.1 INSTALLATION

A. General. Each pump shall be installed in accordance with the written instruction of the manufacturer.

3.2 PAINTING AND FINISHING

A. Nameplates shall be cleaned and legible at completion of the work.

3.3 TESTING

A. Factory Pump Test. Factory pump performance test shall be made in conformance with AWWA E101 for the following:

1. Running test.
2. Certified performance test.
3. Sample calculation from test readings.
4. Shop inspection.
5. Hydrostatic test of bowl assembly.
6. Hydrostatic test of discharge head.

B. Field Equipment Test. After installation of the pumping units and appurtenances is complete, operating tests shall be carried out to assure that the pumping installation operates properly. Each pumping unit shall be given a running field test in the presence of the Engineer for a minimum of 2 hours [with each combination of electric motor]. Each pumping unit shall be operated at its rated capacity or such other point on its head-capacity curve selected by the

Engineer. The Contractor shall provide an accurate and acceptable method of measuring the discharge flow.

1. Correct Installation of Appurtenances. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly.

2. Deficiencies. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

3.4 MANUFACTURER'S FIELD SERVICES

A. The Contractor shall obtain the services of a manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installing, adjusting, and testing of the equipment, as neeed.

3.5 FIELD TRAINING

A. Contractor shall conduct a training course for the Owner’s maintenance and operating staff. The training period of 2 hours (minimum) normal working time shall start after the system is functionally complete but before the final acceptance tests. The training shall include all of the items contained in the operating and maintenance instructions as well as demonstrations of routine maintenance operations. At least two weeks advance notice of such training will be provided.

* * * END OF SECTION * * *

SECTION 11500

VAPOR EXTRACTION AND EMISSION CONTROL EQUIPMENT

1.0 GENERAL

1.1 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. AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA) AMCA 99-0401 (1986) Classifications for Spark Resistant Construction

2. AMCA 210 (1985) Laboratory Methods of Testing Fans for Rating

3. AMCA 300 (1994) Reverberant Room Method for Sound Testing of Fans

4. AMCA 801 (1992) Power Plant Fans Specification Guidelines

5. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) ANSI S2.19 (1989) Mechanical Vibration – Balance Quality Requirements of Rigid Rotors, Part 1: Determination of Permissible Residual Unbalance

6. ANSI Z9.3 (1985) Spray Finishing Operations - Safety Code for Design, Construction, and Ventilation

7. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) ASTM A 48 (1994a) Gray Iron Castings

8. ASTM A 53 (1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

9. ASTM A 167 (1993) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

10. ASTM A 240 (1995a) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

11. ASTM A 302 (1993) Pressure Vessel Plates, Alloy Steel, Manganese-Molybdenum and Manganese-Molybdenum-Nickel

12. ASTM A 366 (1991; R 1993) Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

13. ASTM A 527 (1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality

14. ASTM A 528 (1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Drawing Quality

15. ASTM A 569 (1991a; R 1993) Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality

16. ASTM A 642 (1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Drawing Quality, Special Killed

17. ASTM A 653 (1995) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

18. ASTM A 733 (1993) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

19. ASTM B 42 (1993) Seamless Copper Pipe, Standard Sizes

20. ASTM B 68 (1992a) Seamless Copper Tube, Bright Annealed

21. ASTM B 88 (1995a) Seamless Copper Water Tube

22. ASTM B 280 (1993a) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

23. ASTM D 1248 (1984; R 1989) Polyethylene Plastics Molding and Extrusion Materials

24. ASTM D 2854 (1989; R 1993) Apparent Density of Activated Carbon

25. ASTM D 2862 (1992) Particle Size Distribution of Granular Activated Carbon

26. ASTM F 1139 (1988; R 1993) Standard Specification for Steam Traps and Drains

27. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) ASME-18 (1971; Int. Supple 19.5-1972, Errata 1974) Fluid Meters, Their Theory and Application

28. ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)

29. ASME B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings

30. ASME B16.3 (1992) Malleable Iron Threaded Fittings

31. ASME B16.5 (1988; Errata Oct 1988; B16.5a) Pipe Flanges and Flanged Fittings

32. ASME B16.9 (1993) Factory-Made Wrought Steel Buttwelding Fittings

33. ASME B16.11 (1991) Forged Fittings, Socket-Welding and Threaded

34. ASME B16.15 (1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250

35. ASME B16.24 (1991; Errata Jun 1991) Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500, and Flanged fittings, Class150 and 300

36. ASME B16.39 (1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

37. ASME B31.1 (1995) Power Piping

38. ASME B31.3 (1993; B31.3a; B31.3b; B31.3c) Chemical Plant and Petroleum Refinery Piping

39. ASME B31.5 (1992; B31.5a) Refrigeration Piping

40. ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

41. ASME PTC 19.3 (1974; R 1986) Instruments and Apparatus: Part 3 Temperature Measurement

42. ASME PTC 21 (1991) Particulate Matter Collection Equipment

43. ASME PTC 28 (1965; R 1985) Determining the Properties of Fine Particulate Matter

44. ASME PTC 38 (1980; R 1985) Determining the Concentration of Particulate Matter in a Gas Stream

45. AMERICAN WATER WORKS ASSOCIATION (AWWA) AWWA C700 (1990; C700a) Cold-Water Meters - Displacement Type, Bronze Main Case

46. AMERICAN WELDING SOCIETY (AWS) AWS D1.1 (1994) Structural Welding Code - Steel

47. HYDRAULIC INSTITUTE (HI) HI-1.1-1.5 (1994) Centrifugal Pumps

48. HI 3.1-3.5 (1994) Rotary Pumps

49. INSTITUTE OF CLEAN AIR COMPANIES (ICAC) ICAC EP-7 (1987) Gas Flow Model Studies

50. ICAC G-1 (1972) Gaseous Emissions Equipment Product Definitions and Illustrations

51. ICAC M-3 (1970) Gravity, Louver and Dynamic Mechanical Collector Criteria

52. ICAC M-5 (1975) Standardized Method for Particle Size Determination and Collection Efficiency

53. INSTITUTE OF ELECTRONIC AND ELECTRICAL ENGINEERS IEEE C57.12.01-89 General Requirements for Dry-Type Distribution and Power Transformers

54. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS) MSS SP-70 (1990) Cast Iron Gate Valves, Flanged and Threaded Ends

55. MSS SP-80 (1987) Bronze Gate, Globe, Angle and Check Valves

56. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) NEMA MG 1 (1993; Rev 1-1993; Rev 2-1995) Motors and Generators

57. NEMA ST20-86 Dry-Type Transformers for General Application

58. NEMA WD 1-83 General Requirements for Wiring Devices

59. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) NFPA 70 (1996) National Electrical Code

60. NFPA 91 (1995) Exhaust Systems for Conveying of Materials

61. NFPA 496 (1993) Purged and Pressurized Enclosures for Electrical Equipment

62. UNDERWRITERS LABORATORIES (UL) UL 5 (1995) Surface Metal Raceways and Fittings

63. UL 674 (1994; Rev thru Aug 1995) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations UL 698 (1995; Rev thru March 1996) Industrial Control Equipment for Use in Hazardous (Classified) Locations

64. UL 823 (1995) Electric Heaters for Use in Hazardous (Classified) Locations

65. UL 886 (1994; Rev thru Jul 1995) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

66. UL 894 (1993; Rev 1995) Switches for Use in Hazardous (Classified) Locations

67. UL 900 (1994) Test Performance of Air Filter Units

68. UL 1002 (1994; Rev Jul 1995) Electrically Operated Valves For Use in Hazardous (Classified) Locations

69. UL 67-88 Panelboards

70. UL 489-86 Molded-Case Circuit Breakers and Circuit Breaker Enclosures

1.2 SUBMITTALS

A. Approval is required for submittals with a “GA” designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Contract Documents:

1. Data

a. Groundwater and Vapor Extraction and Treatment Equipment and Accessories; GA. A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions. Spare parts data for each different item of material and equipment specified, after approval of detail Drawings and not later than one month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply. The data shall include the trailer data including weight capacity and tow configuration.

2. Drawings

a. Groundwater and Vapor Extraction and Treatment Equipment and Accessories; GA. Detail 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, and equipment relationship to other parts of the work including clearances for maintenance and operation.

3. Instructions

a. Groundwater and Vapor Extraction and Treatment Equipment and Accessories; GA. A copy of the instructions proposed to be framed and posted.

4. Statements

a. Testing and Inspections; GA. A proposed performance test procedure, 30 days prior to the proposed test date, containing a complete description of the proposed tests and sample locations, with calibration curves or test results by an independent testing laboratory of each instrument, meter, and gauge to be used in the tests. The test shall not commence until the procedure has been approved.

5. Reports

a. Testing and Inspections; GA. Test procedures, prior to starting test. Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to provide compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

6. Operation and Maintenance Manuals

a. Groundwater and Vapor Extraction and Treatment Equipment and Accessories; GA. Six complete copies of operation manual outlining the step-by-step procedures required for system startup, operation, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and its basic operating features. Six complete copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repair, and troubleshooting guides. The manuals shall include piping layout, equipment layout, and simplified wiring and control diagrams of the system as installed. Operation and maintenance manuals shall be approved prior to training course.

1.3 WELDING QUALIFICATIONS

A. Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME-18. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Engineer shall be notified 24 hours in advance of tests and the tests shall be furnished at the work site if practicable. The Engineer shall be furnished a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators. The welder or welding operator shall apply his assigned symbol near his welds using a rubber stamp or felt-tipped marker with permanent weatherproof ink or other methods approved by the Engineer that do not deform the metal.

1.4 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

1.5 FIELD MEASUREMENT

A. The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

2.0 PRODUCTS

2.1 MATERIALS

A. Standard Products

1. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening. Equipment shall be supported by in-service organization that is, in the opinion of the Engineer, reasonably convenient to the site.

B. Nameplates

1. Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment.

C. Equipment Guards

1. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto, shall be enclosed or guarded. High-temperature equipment and piping so located as to endanger personnel or to create a fire hazard shall be guarded or covered with insulation of type specified for service.

D. Material Quality

1. Equipment and materials shall be new and free from defects. All equipment of the same or similar type shall be of the same manufacturer throughout the work. Standard production materials shall be used wherever possible.

2.2 PIPE, FITTINGS, AND TUBING

A. Pipe, fittings, and tubing shall conform to the following:

1. Pipe

a. ASTM A 53, Type S, Grade A, standard weight; or copper pipe, ASTM B 42.

2. Nipples

a. ASTM A 733, standard weight to match adjacent piping.

3. Pipe Fittings

a. Steel Pipe Fittings

- ASME B16.9 for butt-welding fittings; ASME B16.11 for socket-welding fittings; and ASME B16.5 for flanged fittings.

4. Brass or Bronze Pipe Fittings

a. ASME B16.15, Class A, 862 kPa (125 pound). (125 pound.)

5. Malleable-Iron Pipe Fittings

a. ASME B16.3, type to match adjacent piping.

6. Unions

a. ASME B16.39, type to match adjacent piping.

7. Flanges, Cast-Iron and Bronze

    a. ASME B16.1 and ASME B16.24.

8. Pipe Threads

    a. ASME B1.20.1.

9. Tube, Copper

    a. Tube for Air, Water, Gas, and Drains, ASTM B 68 or ASTM B 88.

10. Other, Field Installed (Polyvinyl Chloride [PVC]) Pipe and Fittings

    a. See Section 02610 and 15060

2.3. STEEL SHEET

A. Steel sheets shall conform to the following:

1. Zinc Coated (Galvanized).

    a. ASTM A 527, ASTM A 528, or ASTM A 642, with general requirements conforming to ASTM A 653, for dust collector casings, housing, and components. Gauges specified are manufacturers' standard gauge.

2. Low-Carbon.

    a. ASTM A 366 or ASTM A 569, for dust collector casings, housings, and components. Gauges specified refer to manufacturers' standard gauge.

3. Corrosion Resistant.

    a. ASTM A 167, Class 304 or 316. Gauges specified refer to U.S. Standard Gauge.

2.4 THERMOMETERS

A. Thermometers shall conform to ASME PTC 19.3 with wells and temperature range suitable for the use encountered.

2.5 VALVES

A. Valves shall conform to the following:

1. Gate Valves

    a. Gate valves shall be all bronze (ASTM B-62) with wedge disks for sizes 2-inch and less; iron body, bronze mounted as specified in AWWA C500 for sizes 2-½ inch and larger, unless specified otherwise. Valves greater than 12-inch in size shall be provided with handwheel. Gate valves shall be Grinell, Mueller, or approved equal. Plastic gate valves shall be PVC, flanged connection type with Viton seals. Valves shall be Asahi, or approved equal.

2. Ball Valves

a. Stainless Steel Body Ball Valves. Ball valves shall be manufactured with double seals and single piece body construction, equipped with stainless steel body, type 316 stainless steel ball and stem, and TFE seals and seat. Motorized and manual ball valves shall be manufactured by Jamesbury, Worcester, Jenkins or approved equal.

b. Plastic Body Ball Valves. Plastic body ball valves shall have heavy duty PVC body. The valves shall be furnished with wrench type operator handles and shall have true union type end connectors. Valves shall be Chempro, Spears, or approved equal.

3. Butterfly Valves

a. Butterfly valves shall be lug type, cast iron or PVC body, depending on service. Cast iron valves shall have aluminum bronze disk, stainless steel stem, Viton seat, class 150. PVC butterfly valves shall have PVC disc, stainless steel stem, Viton seat, class 150.

4. Air Sample Taps

a. At all points shown on the Drawings, connections for air sample taps shall be made. Taps shall be securely supported and located on straight lengths of pipe that provide a length of 5 to 10 pipe diameters before the tap. The outlets shall be located so that a canister of approximately 1 gallon could be placed adjacent to the tap.

2.6 ELECTRICAL WORK

A. Electrical motor-driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical equipment and wiring shall be in accordance with these requirements, UL requirements for all panel work, and the NEC (as a minimum) requirements for trailer equipment wiring. Electrical characteristics shall be as indicated or specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Each motor shall be sized for temporary excursions, i.e., pump or blower runout. Automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified but not shown, shall be provided. Motors shall conform to NEMA MG 1, with TEFC enclosures.

1. Raceway, Fittings, and Supports

a. General. Conduit shall be provided for power, control, instrumentation, grounding, lighting, receptacles, and signaling systems.

2. Raceway

a. Exposed conduit shall be threaded, galvanized, rigid steel conduit. Minimum size shall be 3/4-inch. Threaded hubs with grounding locknuts and nylon insulating collars, shall be used to connect the conduit to enclosures. Unions shall be galvanized, ferrous alloy type. Threadless fittings are not acceptable. Running threads shall not be used in lieu of conduit nipples.

b. Liquidtight, flexible steel conduit shall be formed from spirally wound, galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight, plastic cover. Minimum size shall be 3/4-inch. Fittings for liquidtight conduit shall have cadmium-plated, malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral and O-ring seals

around the conduit and box connection and insulated throat. Forty-five and 90-degree fittings shall be used where applicable.

3. Boxes

   a. Boxes for use outdoors and in process areas shall be hot-dip, galvanized cast ferrous alloy type FD with integrally cast-threaded hubs for conduit entry. Boxes larger than FD boxes shall be welded steel and hot-dip galvanized after fabrication or fiberglass, rated NEMA 4X. Conduit bodies shall be ferrous alloy type with screw taps for fastening covers. Gaskets shall be made of neoprene.

4. Raceway Supports

   a. Hot-dip galvanized framing channel shall be used to support groups of conduit. Individual conduit supports shall be one-hole galvanized malleable iron pipe straps with galvanized iron clamp backs and nesting backs where required. Ceiling hangers shall be adjustable, galvanized carbon steel rod hangers. Straps or plumbers tape are not acceptable. Hanger rods shall be 1/2-inch all thread rod.

B. Conductors, Wire, and Cable

1. General

   a. Conductors, wires, and cable shall be provided for power, control, lighting, receptacles, instrumentation, grounding and signal circuits. The quantity and size of conductors shall be as specified.

2. Power, Control and Lighting Conductors

   a. Power and control conductors shall be single conductor, stranded, annealed copper with 600-volt THWN/THHN polyvinyl chloride (PVC) insulation, Okonite, Okoseal-N; CABLEC; or approved equal.

3. Lighting and Receptacle Circuit Conductors

   a. Conductors for lighting and receptacle circuits shall be single conductor, annealed copper with 600-volt THWN/THHN PVC insulation. No. 12 AWG shall be solid conductor. Minimum conductor size shall be No. 12 AWG.

4. Grounding Conductors

   a. Grounding conductors shall be concentric stranded, annealed bare copper. Cable size shall be as specified or as required by the NEC.

5. Instrumentation and Signal Cable

   a. Cable for instrumentation and signal circuit shall be twisted shielded pair, No. 16 AWG 7-strand copper with 300-volt PVC insulation, 100 percent aluminum-Mylar tape shield, No. 18 AWG tinned copper drain wire and overall PVC jacket, Dekoron 1852 or approved equal.

6. Splicing and Terminating Materials

   a. Connectors: Connectors for stranded conductors shall be tool applied, tinplated copper, compression type of the correct size and UL approved for the application.

- Connectors for wire sizes No. 10 AWG and smaller shall be nylon self insulated, ring tongue or locking-spade terminals. Connectors for wire sizes No. 8 AWG and larger shall be one-hole lugs up to size No. 3/0

- AWG and two-hole or four-hole for size 4/0 AWG and larger. Mechanical clamp, dimple, or screw-type connectors are not acceptable. 480-volt motor terminations shall be made using bolt connected lugged connectors and factory engineered kits consisting of heat shrinkable, polymeric insulating material with high dielectric strength mastic sealant. Termination of solenoid valves, 120-volt motors, and other devices furnished with pigtail leads shall be made using self-insulating, tubular compression connectors.

b. Terminal blocks: Terminal blocks shall be provided for external control and power wires size 10 AWG and smaller. Terminal blocks shall be 600 volts, heavy-duty, rated 20 amperes for control and 30 amperes for power.

7. Wire Markers

a. Wire markers shall be white shrink tubing, Thermofit Marker System (TMS) by Raychem Co., or approved equal for conductors No. 10 AWG and smaller and locking tab cable markers, W.H. Brady Co., or approved equal, for conductors No. 8 and larger. Letters and numbers identifying each conductor shall be machine printed in permanent black ink.

C. Wiring Devices

1. General

a. Receptacles, plugs, switches, and appurtenances shall be provided as specified on the Drawings. Wiring devices shall be UL approved for the current and voltage specified and shall comply with NEMA WD-1. Receptacles and switches shall be commercial grade.

2. Receptacles

a. All 120V receptacles shall be ground fault circuit-interrupter (GFCI) type, rated 125 volt, 20 ampere. Receptacles shall be housed in a vertical weatherproof "while in use" enclosure. Thomas and Betts WTG100-CV or approved equal.

3. Switches

a. Switches shall be 20 amp, switch type with weatherproof cover and operating handle, Bryant, Leviton or approved equal.

D. Individual Motor Starters

1. General

a. Unless otherwise specified, individual motor starters shall be combination type with molded case motor circuit protector, 3-pole, 600-volt AC contactor, and three overload relays, NEMA Size 1 minimum. Each motor starter shall be individually enclosed, unless otherwise noted.

2. Enclosures

a. The door of the motor starter enclosure shall be interlocked with an externally operated disconnect handle, lockable in the open position. Enclosures shall be NEMA 3R for outdoor and process areas.

3. Motor Branch Circuit Protection

a. Molded case motor circuit protectors shall be magnetic trip only with trip settings adjustable over a range of 700 to 1300 percent of the full load current of the motor served. The motor circuit protector, in conjunction with the starter, shall be rated to interrupt 22,000 amperes (symmetrical) unless otherwise specified.

4. Overload Relay

a. Ambient compensated overload relays shall be bimetallic type with separate heaters for each of the three poles. Reset for individually enclosed starters shall be accomplished with a reset pushbutton located on the unit door exterior. Reset on group mounted starters shall have a reset on the overload relay block. The overload relay shall be a Type A with an adjustable trip rating of plus or minus 15 percent. A normally open, alarm contact shall be provided on the overload relay to actuate when an overload occurs.

5. Control Circuits

a. Control power transformers, fuses, and control devices shall be provided as specified. Two control transformer primary fuses, rated to interrupt 200,000 amperes at 600 volts, shall be provided on all motor starters. Each motor starter shall be provided with one control circuit secondary fuse rated to interrupt 10,000 amperes at 250 volts and sized at 125 percent of the control circuit full load current. Control circuit shall be 120 V with grounded leg.

6. Wiring

a. Conductors shall be switchboard type and rated 90 degrees C above ambient temperature. Conductors shall be identified with tag numbers as specified.

E. Electrical Control Devices

1. Control Devices

a. Pushbuttons: Pushbuttons shall be flush head, heavy-duty, 600 volts, 10 amperes, continuous with NEMA rating to match enclosure types. Pushbutton operators shall be red for stop functions and black for all other functions. Escutcheon plates shall be as specified on the Drawings.

b. Selector Switches: Selector switches shall be heavy-duty, with NEMA rating to match enclosure type, rated 600-volt, 10-ampere, continuous. Switches shall be provided with contact blocks and number of positions as required to perform the specified operations. The escutcheon legend shall be as specified on the Drawings.

c. Indicating Lights: Indicating lights shall be the push-to-test transformer type with 6.3 volt lamps. They shall be NEMA 13, heavy-duty, oiltight. The escutcheon and lens color shall be as specified. DC indicating lights shall be the full voltage type. DC lamps may be tested as a group using a common lamp test button. Unless otherwise specified, indicating lights shall be equipped with colored lenses in accordance with the following schedule:

Color	Function	Example
Red	Alarm	Equipment failed, motor stopped
Amber	Normal	Motor running
Green	Normal	Equipment ready
Blue	Auto Mode	Equipment control in automatic position

d. Control Stations: Unless otherwise specified, control stations shall be NEMA 4X for process areas and outdoor locations, Allen Bradley Bulletin 800H, Crouse-Hinds NCS series, or approved equal.

2. Control Relays

a. Logic Level Switching Control Relays: Control relays used for switching solid-state logic and signal circuits shall be Potter Blumfield series KUP, Schrack Series RA, or approved equal. Relays shall have a minimum of three SPDT, gold-flashed, fine silver contacts rated 3 amps resistive at 120 volts AC or 8 volts DC. Relay shall be plug-in type with heavy-duty, barrier-protected screw terminal sockets and clear polycarbonate dust cover with clip fastener. AC models shall have neon lamp indicator wired in parallel with coil.

b. Timing Relays: Solid state timing relays shall be pulse-count type using a high frequency RC oscillator and integrated circuit counter for timing. Electrolytic capacitors shall not be used in the timing circuits. On-delay, off-delay, and single-shot timing models shall be available. Timer shall reset in 0.03 seconds or less. Timer accuracy shall be plus or minus 2.0 percent under normal conditions. The timing relay shall have two NEMA Form-C timed contacts. Solid state timing relays shall be Agastat, STA series, or approved equal.

3. Elapsed Time Indicators:

a. Elapsed time indicator shall be panel-mounted, nonresettable, six digit, hour indicator, rated 120 volts AC, 60 hertz. Elapsed time indicators shall be provided for all motors 5 HP and above.

4. Fuses

a. Circuits shall be fused. Fuses shall be 1/4 x 1-1/4 inch. Fuses on 120V AC circuits shall be ceramic tube type with 10 amperes interrupting capacity at 125 volts and neon blow fuse indicator lamps. Fuse holders for 120V AC shall be draw-out type and molded from melamine plastic. Fuses for 24V DC circuits shall be fast-acting glass-tube type rated 1/8 amp for 4-20 mA loops and 3 amp for the power supply to individual instruments. Contractor shall provide and install 10 percent additional terminal blocks and fuse holders of each type required.

F. Grounding Material

1. Ground Rods

a. Ground rods shall be copper-covered steel, 3/4-inch diameter, and 10 feet long. Rods shall have threaded type, removable caps so that extension rods of the same diameter and length may be added where necessary.

2. Compression Connectors

a. Compression connectors shall be cast copper as manufactured by Thomas and Betts, or approved equal.

3. Bolted Connectors

a. Bolted connectors shall be Burndy, O.Z. Gedney, or approved equal.

G. Lighting Fixtures

1. Lighting fixtures shall be as specified on the Drawings.

H. Distribution Equipment

1. Panelboards

a. Panelboards shall be circuit breaker, dead front type with bus bar construction. Panelboards shall be composed of individually mounted circuit breakers designed to be removed without disturbing other breakers.

b. Bus shall be copper and shall have a current rating as shown on the panel schedules sized in accordance with UL 67. Panel fault withstand rating shall be equal to the interrupting rating of the smallest circuit breaker in the panel.

c. Panelboards shall be provided with a separate ground bus and a full capacity neutral bus. Neutral bus shall be mounted on insulated standoffs with removable link connector to ground bus. No neutral bus is required for the 480 VAC panel. Panelboards shall be Westinghouse, Square D, or equal.

2. Circuit Breakers

a. Circuit breakers shall be molded-case type provided for the current ratings and pole configurations specified on the panelboard schedule. Circuit breakers rated 120/208 volts and 120/240 volts AC shall have a minimum interrupting current rating of 10,000 amperes (symmetrical) at 240 volts AC. Circuit breakers rated 480 volts AC shall have a minimum interrupting current rating of 25,000 amperes (symmetrical) at 480 volts.

b. Panel mounted circuit breakers shall be bolt-on type.

c. Circuit breakers shall be listed in accordance with UL-489 for the service specified.

d. Load terminals of circuit breakers shall be solderless connectors.

e. Circuit breakers and panelboards shall be products of the same manufacturer.

3. Dry-Type Transformers

a. Transformers shall conform to IEEE-C57.12.01 and UL 506. The voltage, frequency, number of phases, and kVA rating shall be as specified.

b. Transformer coils shall be copper. Transformer coils 15 kVA and below shall be resin encapsulated and shall be isolation type, providing shielding from harmonics.

c. Transformers shall have electrically isolated primary and secondary windings. Primary and secondary winding configurations shall be as specified. Provisions shall be made to permit separate grounding of the neutral conductor and the enclosure. Single-phase transformers shall be the four winding type.

d. Transformers 15 kVA and above shall be provided with two 2 1/2 percent full capacity taps above normal voltage and four 2 1/2 percent full capacity taps below rated voltage on the primary winding.

e. Terminal compartments shall be sized to permit termination of cables specified.

f. Terminal connections shall be made in the bottom third of the enclosure. The terminals shall be copper and sized for the cable specified.

g. Transformers rated 15 kVA and smaller shall be provided with weatherproof, nonventilated enclosures.

I. Nameplates

1. Nameplates shall be made from laminated phenolic plastic. The nominal size of the nameplates shall be 3/4 inch high by 2 inches long. Nameplates shall have black backgrounds with 3/16-inch white letters. If abbreviations are required because of space limitations, abbreviations shall be submitted to the Construction Manager prior to manufacture. Nameplates shall be fastened using self-tapping stainless steel screws. The use of adhesives will not be permitted on the outside of enclosures.

J. Air Flow Indicating Transmitter

1. Air flow indicator shall be thermal dispersion type with single point probe. Probe shall include two RTD's with a heating element to generate a true mass flow reading which includes temperature correction. Unit shall be microprocessor based with 4-20 mA output and local digital display of airflow in scfm. Accuracy shall be +3% of reading with repeatability . Unit shall use 115V AC input power and shall be housed in a NEMA 4 enclosure. Air flow indicator shall be FCI, Model AF88, or approved equal.

K. Process Switches

1. Unless otherwise specified, switches shall comply with the following requirements:

a. Contact outputs used for alarm actuation shall be ordinarily closed and shall open to initiate the alarm, unless otherwise shown on the Drawings.

b. Contact outputs used to control equipment shall be ordinarily open and shall close to start the equipment.

c. Contacts monitored by electro-magnetic devices such as mechanical relays shall be rated NEMA ICS 2, designation B300.

2. Level Switch (Conductance Type)

a. Level switch shall be of the conductance-type with stainless steel rod or wire suspended stainless steel electrodes. Electrode fitting shall be an epoxy-coated and gasketed cast aluminum housing of suitable configuration for the application. Probes shall be Charles F. Warrick Co., or approved equal.

b. Induction relays shall be two winding type. Secondary potential shall not exceed 12 volts

c. AC and short circuit current shall not exceed 25 milliamperes. Level switches shall be Warrick Series 16DM, or approved equal. Probes in potentially explosive areas (all holding tanks) shall use intrinsically safe relays, Warrick Series 17, or approved equal.

3. Flow Switch

a. Contact outputs shall be vane actuated for air flow ON/OFF indication. Snap-action switches shall be housed in a NEMA 4 enclosure SPDT rated 5A at 220V AC minimum.

b. Process connection shall be 1-1/2-inch NPT threaded with 316 S.S. wetted parts.

4. Pressure Switch

a. Pressure switches shall be the diaphragm piston type with wetted materials as recommended by the switch manufacturer. Switch assembly shall be hermetically sealed snap-action switch with fully adjustable setpoint and reset point adjustments. Switch shall be provided with 1/2-inch NPT process connection and one 3/4-inch conduit connection. Switch assembly housing shall be cast-aluminum rated types 3, 4, and 7D per NEMA ICS6. Contractor shall select pressure switch so that setpoint falls between 50 and 75 percent of maximum range. Approximate setpoint and reset point shall be indicated on scales. Repeatability and sensitivity shall be 1.0 percent of operating range or better. Pressure switches shall be SOR Inc., United Electric, Ashcroft, or approved equal.

L. Indicating Gauges

1. Temperature Indicators

a. Temperature indicators shall be industrial quality bi-metal thermometers. Accuracy shall be 1 percent of span. Dial size shall be 3-inch and head shall swivel to facilitate viewing. External adjustment shall be provided for calibration. Dial shall be suitable for mounting outdoors and be fluid-filled. The temperature range shall be 50 to 300 degrees Fahrenheit. Gauge shall be Ashcroft Series EL, Weksler Type AF, or approved equal.

2. Pressure Gauges

a. Pressure gauge scales shall be selected so that the normal operating pressure falls between 50 and 80 percent of full scale. Gauges shall be 3-inch, 270 degree movement, 0.5 percent accuracy full scale, and suitable for bottom mounting. Gauges shall have a 316 S.S. burdon tube. All gauges shall have shatterproof glass and a 1/2-inch NPT bottom connection, and phenolic cases.

M. Multipoint Recorder

a. Recorder shall be six-channel multi-color, microprocessor based, annotating-type printing recorder. Recorder shall accept 4-20 mA or 1-5V DC inputs, and be powered by 120V AC. Recorder shall print, on the strip chart: input description; chart scale data; time; and chart speed. Calibrated chart width shall be 100 mm. Chart drive shall have adjustable speeds of 5 to 120 mm per hour. Recorder shall be Chessell Model 346 with Z-fold cassette, or approved equal with handheld terminal for recorder configuring.

2.7 EXTRACTION AND TREATMENT EQUIPMENT

A. Vapor Extraction and Treatment System

1. Unit shall consist of a moisture separator with discharge pump and level controls, extraction blower, heat exchanger, quench and caustic scrubber, and all associated appurtenances and controls for a complete extraction and treatment unit.

2. Vapor Extraction System Emissions Control Skid

    a. Performance of equipment shall be as indicated. Wet process gas ductwork shall comply with ANSI Z9.3 and NFPA 91. Air and water piping shall comply with ASME B31.1.

    b. Controls, interlocks, instruments, status indication lights, and other devices required for operation and observation of equipment status shall be assembled on an enclosed panel with key locked door. Panel shall be factory assembled, connected to equipment, and mounted on unit. Equipment shall be provided with safety rails and stairs, as required.

3. Specific Skid Mounted Equipment

    a. The following equipment shall be provided for the vapor extraction and treatment system. These requirements indicate the minimum to be provided. To the extent possible, the Contractor shall supply manufacturer's standard, off-the-shelf products. Where alternate products may fulfill the intent of these requirements, the Contractor shall notify the Engineer and submit data for the possible equipment replacement and obtain the Engineer's approval.

    b. All equipment on the trailer shall be wired by the Contractor to a main control and power panel. The entire extraction and treatment unit shall obtain power from the onsite power supply. The plug will be connected to a fixed receptacle near the vapor extraction area pipeline header.

    c. Air/Vacuum Release valves shall be designed to automatically release/ingress large amounts of air during continuous operation. The valve shall consist of a cast iron body and cover and stainless steel float. All valves shall be installed with isolation gate valves the same diameter as the inlet of the air release valve. Valve sizes shall be as shown on the Contract Drawings. Acceptable manufacturers are Apco, Val-Matic, or approved equal.

    d. The moisture separator shall provide for the removal of 99% of all water particles in the incoming air stream which equal or exceed 10 microns in diameter. The separator shall be provided with mounting stand, condensate removal tank, drain valves, level switches, packing supports, packing, internal air flow director piping, and packing removal/replacement access port. The moisture separator shall have a capacity of 10 gallons and a maximum rated flow of 250 scfm, and be a EG&G Rotron MS200D of equivalent.

    e. A condensate pump shall be installed to periodically pump accumulated liquid from the moisture separator to an outside collection tank. The pump shall be a single stage centrifugal pump with an electric motor. The pump housing shall be cast iron and impeller shall be steel. The shaft seals shall be Teflon®. The motor shall be ½ hp, 3-phase, TEFC.

    f. The vacuum blower shall be rotary positive displacement type, two lobe involute design, complete with all accessories as needed. The blower shall deliver a minimum of 250 scfm of free air when operating at nominal rpm, 7.5" Hg (100 in H20)

vacuum inlet, and 2 PSIG outlet pressure. Air vents shall be located between the seals and the impeller chamber to relieve excessive pressure on the seals.

The blower shall be provided complete with motor, inlet and discharge silencers, vacuum relief valve, inlet filter, field adjustable inlet vacuum relief valve, flexible inlet and discharge connectors, and sound enclosure rated to provide not over 75 dBA at 20 feet from the unit. Sound enclosure shall include screened air inlet louvers, cooling fan as required, and high temperature switch.

Blower shall be mounted in the horizontal position. Blower shall be V-belt driven. Blower shall be equipped with internal thrust control to prevent thrust transmitted from the driver to the blower impellers.

Blower motor shall conform to the following requirements, in addition to those specified herein:

Horsepower Not less than 7.5
RPM Approx. 2,365
Voltage 200 or 208
Phase Three
Hertz 60
Insulation Class
Enclosure TEFC
Ambient Temperature 90°F
Nameplate Efficiency 91% (Minimum)

The above information shall be stated on the manufacturer's motor nameplate. The blower shall be a ROOTS model 36 URAI or equivalent.

Motor shall be a TEFC energy efficient, severe duty motor. It shall have Class F insulation with a Class B temperature rise and shall have a service factor of 1.15. The B-1 motor shall be designed to comply with a minimum nameplate efficiency of 91%. Internal surfaces shall be coated with a corrosive-resistant epoxy paint. The efficiency shall be determined by the dynamiter test method, IEEE 112, Method B. Energy efficient, severe duty motors shall be US Motors, Baldor, or an equal approved by the Engineer. A 3-year parts warranty is required by motor manufacturer.

2.8 GROUNDWATER TREATMENT EQUIPMENT

A. The groundwater extraction treatment system consists of the following components

1. Submersible Well Pumps

   a. The pump shall be able to obtain a 5 gpm flow while producing 100ft of head. The pump manufacturer shall be Grudfos, or approved equivalent. The submersible pump shall be controlled with a variable frequency drive to achieve the low flows and prevent the well from running dry.

2. Treatment System

   a. Hydrogen Peroxide and Ozone Treatment System. The system shall combine ozone and hydrogen peroxide to destroy groundwater contaminants in a continuous flow reactor. The system utilizes multiple reagent injection points and mixers to maximize contaminant destruction in a waste-free process. The system shall be skid mounted,

PLC controlled for unattended operation, and equipped with controls for fail-safe operation. The system shall be a Applied Process Technology Inc, HiPOx HCU or Engineer approved equivalent.

b. Liquid Phase Granular Activated Carbon. The vessel shall consist of a system of two canisters containing liquid phase granular activated carbon to cause the processed water to pass through a uniform depth of material in the flow direction. Canisters shall be designed to assure that the adsorbent bed will be uniform, full and free of voids or thin spots and supported and contained to prevent movement, pulverizing, abrasion, or dusting of the adsorbent and easy and full recharging without special facilities or tools. Adsorbent units shall be secured leak-tight in a bulkhead forcing all gas to pass through the adsorbent bed. The adsorbent unit shall provide the equivalent capacity of the following:

- GAC Units (2) – Baker Filtration Kleen.Water 110 or equivalent
- Diameter/Height = 32”/46”
- Carbon/Weight = 500 lbs
- Inlet/Outlet = 2”/2”
- Max Rated Flow = 25 gpm
- Max Operating Pressure = 10 psi

2.9 PAINTING AND FINISHING

A. Equipment and component items shall be factory primed and finish coated with the manufacturer's standard finish. Color on finish coat shall be white. Items shall have weather resistant finish. Damaged finish surfaces shall be refinished with an identical type of finish used at the factory.

3.0 EXECUTION

3.1 INSTALLATION

A. Work shall be installed as indicated and in accordance with manufacturer's diagrams and written instructions. A factory installation specialist shall be at the site for installation and startup of the vapor extraction and treatment equipment.

3.2 OPERATION AND PERFORMANCE REQUIREMENTS

A. Vapor and groundwater extraction control equipment shall process and remove pollutants from the soil and groundwater, respectively, with an effluent that will conform to EPA and other federal, state, and local regulations.

B. The Contractor shall operate and maintain the DPE extraction and treatment system in accordance with Sections 15010 and 15130.

3.3 TESTING AND INSPECTIONS

A. System Operational Test

1. Upon completion and prior to acceptance of the project, the dual phase extraction control equipment and monitoring system shall be tested in accordance with approved procedure to demonstrate indicated performance. A factory startup specialist shall be at the site to direct and monitor startup and testing of the equipment. The Contractor shall notify the Engineer 14 days in advance of the test date. The Contractor shall furnish all instruments and personnel required for the tests. The Contractor shall submit the applicable test procedures and sampling locations to the Government for approval. Electricity and water will be furnished by the Owner/Engineer.

B. Retesting

1. If any deficiencies are revealed during test, such deficiencies shall be corrected and the tests reconducted.

3.4 FRAMED INSTRUCTIONS

A. Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. The instructions shall show wiring and control diagrams and complete layout of the entire system. The instructions shall include, in typed form, 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. The framed instructions shall be posted before acceptance testing of the system.

3.5 MANUFACTURER'S FIELD SERVICE

A. Installation

1. Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the specified equipment shall be provided. The representative shall supervise the installing, adjusting, and testing of the equipment.

B. Training

1. The Contractor shall conduct training course for operating staff as designated by Engineer. The training period, of a total of 16 hours of normal working time, shall start after the system is functionally completed, but prior to final acceptance tests.

2. The field instructions shall cover all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations.

3. The Engineer shall be notified at least 14 days prior to date of proposed conduction of training course.

3.6 ELECTRICAL EXECUTION AND TESTING

A. Raceway, Fittings, and Supports

1. General

a. The Contractor shall limit the number of directional changes of conduit to a total of not more than 270 degrees in any run between pull boxes. Signal conduits which contain signal wires up to 30 volts shall be galvanized rigid steel. Signal conduit shall be separated from AC power and control conduits by a minimum of 12 inches.

B. Exposed Conduits

1. Metallic conduit shall be assembled to provide a continuous ground path. Joints shall be made with standard couplings or threaded unions. Bends and offsets shall be made with a hickey or conduit bending machine or shall be factory performed bends. All metallic conduit terminations to metallic and fiberglass boxes shall use grounding type, threaded hubs. The hubs shall be bonded together.

2. Exposed conduit shall be run on supports spaced not more than 10 feet apart and shall be constructed with runs parallel and perpendicular to walls, structural members, or intersections of vertical planes and ceiling. No conduit shall approach closer than 6 inches to any object operating above 30 degrees C.

3. Liquidtight, flexible steel conduit shall be used for the final connection to equipment, devices, and instruments where flexibility is required. The length of liquidtight flexible steel conduit shall not exceed the lesser of 15 times the trade diameter of the conduit or 36 inches.

C. Conductors, Wire, and Cable

1. General

a. Raceway construction shall be complete, cleaned, and protected from the weather prior to wire and cable being installed. Pulling wire and cable into conduit shall be completed without damaging or putting undue stress on the cable insulation. Soapstone, Talc, or UL listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable. Nylon pull rope shall be pulled through the conduit immediately after concrete pour. Each power, control, signal, and instrumentation conductor shall be identified at each terminal to which it is connected utilizing the wire markers specified above.

2. 600-Volt Conductor and Cable

a. Slack shall be provided in junction and pull boxes. Slack shall be sufficient to allow cable or conductors to be routed along the walls of the box. Conductors crossing hinges shall be bundled in groups not exceeding 12 and shall be so arranged that they will be protected from chaffing when the hinged member is moved.

b. Raceway fill limitations shall be as defined by NEC and the following:

- Lighting and receptacle circuits may be together in the same conduit in accordance with derating requirements of the NEC. However, lighting and receptacle circuits shall not be in conduit with other circuits.

- Solid wire shall not be lugged nor shall electrical spring connectors be used on any except for solid wires in lighting and receptacle circuits. Lugs and connectors shall be installed with a compression tool.

3. Signal and Instrumentation Cables

a. Signal and instrumentation circuits shall be run as individual shield twisted pairs. Terminal blocks shall be provided at cable junction for running signal leads and shield drain wires. Each conductor shall be identified at such junctions. Shields shall be grounded at one end only. Contractor shall trim back the shield and tape or use shrink tubing to isolate the ungrounded end.

D. Wiring Devices

1. Switches and receptacles shall be mounted in "FD" type boxes. Unless otherwise specified, switches shall be mounted 48 inches above the floor. Receptacles shall be mounted 48 inches above the floor in process areas and outdoors unless otherwise specified.

E. Individual Motor Starters

1. Individual motor starters (if required) shall be mounted with the operating mechanism 48 inches above the finished floor unless otherwise specified. The Contractor shall size the overload heater elements to the nameplate full load amperes of the motor served. Motor circuit protectors shall be adjusted to the lowest setting not causing false tripping.

F. Grounding

1. Electrical equipment and enclosures, metal surfaces of equipment, and metal structural members shall be grounded. Grounding system shall be provided in compliance with the NEC and as specified on the Drawings. The dual phase extraction system shall be supplied with grounding connector wire. The wire shall have a permanent lug attached, which will be bolted to permanent ground rods installed by the Contractor at each extraction area.

2. Embedded and buried cable connections shall be made by cast copper compression connectors utilizing diamond or hexagon dies and a hand compression tool for wire sizes 2 AWG and smaller and a hydraulic pump and compression head for wire size 2/0 AWG and larger. Exothermic (Cadweld) connections may also be used. Exposed ground connections shall be made by bolted connectors. Exposed grounding conductors shall be supported by noncorrosive metallic hardware at 4-foot intervals or less.

3. Grounding conductors entering enclosures shall be bonded together to the enclosure if it is metallic and to metallic raceway within terminating at the enclosure. Metal surfaces shall be cleaned prior to making grounding connections and bonds.

4. The ground rod in each vapor extraction pipeline connection box shall be connected to the system electrical system ground wire with the vapor system ground wire. The electrical system ground wire shall bond to all equipment on the trailer.

G. Lighting Fixtures

1. The location and type of fixtures and receptacles are shown on the Drawings. Raceways and wire shall be provided from the fixtures, switches, and receptacles to the lighting panel in accordance with the NEC. Fixtures labeled to require conductors with a temperature rating exceeding 75 degrees C shall be spliced to circuit conductors in a separately mounted junction box. Fixture shall be connected to junction box using flexible conduit with a temperature rating equal to or greater than that of the fixture. Labels and marks, except the UL label, shall be removed from exposed parts of the fixtures. Fixtures shall be cleaned when the project is ready for acceptance.

H. Panelboards

1. The Contractor shall type in the circuit descriptions on the circuit directory as shown on the final record Drawings or panel schedule.

I. Electrical Testing

1. Prior to energizing the electrical circuits, the tests shall be performed as specified. Unless otherwise specified, a 1000-volt megohmmeter shall be used for resistance measurements. The measurements of the tests shall be recorded on the specified forms and provided in accordance with paragraph TESTING FORMS.

    a. Insulation Resistance Measurements - General insulation resistance measurements shall be made on conductors and energized parts of electrical equipment. Minimum acceptable values of insulation resistance shall be in accordance with the applicable ICEA, NEMA, or ANSI standards for the equipment or material being tested, unless otherwise specified. The ambient temperature at which insulation resistance is measured shall be recorded on the test form.

2. Conductor and Cable Tests

    a. The phase-to-ground insulation resistance shall be measured for all circuits 120 volts and above except lighting circuits. Measurements may be made with motors and other equipment connected. Insulation resistance measurements shall be recorded in a format similar to Form 11500-A. Insulation with resistance of less than 10 megohms is not acceptable.

3. Motor Tests

    a. The Installed Motor Test Form, 11500-B, shall be completed for each motor after installation. All motors shall have their insulation resistance measured before they are connected. Motors 50 HP and larger shall have their insulation resistance measured at the time of delivery as well as when they are connected. Insulation resistance values less than 10 megohms are not acceptable.

J. Instrumentation Testing

1. Test Equipment

    a. Test equipment used to simulate inputs and read outputs shall have a rated accuracy at the point of measurement at least three times greater than the component under test. Each test instrument shall be calibrated prior to the commencement of a testing activity and at the completion of a testing activity. Certified calibration reports traceable to the National Bureau of Standards shall be included with the test report.

2. Testing Stages

    a. Each instrument loop shall be tested in the following sequence: wiring and piping; individual components; individual loops; loop commissioning; and system acceptance. Testing of the wiring and individual components shall be completed with certified test reports provided to the Construction Manager prior to commencement of individual loop testing, which shall be completed with certified test reports provided to the Construction Manager prior to commencement of loop commissioning.

        - WIRING AND PIPING TESTING: The following tests shall be performed on each instrumentation and control system cable. Tests shall be end-to-end test of installed cables with the ends supported in free air, not adjacent to any grounded object. Test reports shall be made and provided to the Engineer.

          Continuity tests shall be performed by measuring wire/shield loop resistances of each signal cable as the wires, taken one at a time, are shorted to the channel

shield. No loop resistance measurement shall vary by more than ± 2 ohms from the calculated average loop resistance value. Insulation resistance tests shall be performed by using a 500 volt megohmmeter to measure the insulation resistance between each channel wire, between channel wire and the channel shield, between individual channel shields in a multichannel cable, between each individual channel shield and the overall cable shield in a multichannel cable between each wire and the ground, and between each shield and ground. Values of resistance less than 10 megohms will be unacceptable.

- INDIVIDUAL COMPONENT CALIBRATION AND TEST: Each instrument, except as noted below, shall be calibrated, in accordance with the manufacturer's recommended procedure, on-site by an instrument technician who, by virtue of an acceptable training course or documentable experience, is qualified to calibrate that instrument. Acceptable training shall include successful completion of applicable technical courses in a recognized trade school. Where field calibration is not feasible (e.g., pitot tubes, etc.), certified instrumentation calibration reports may be substituted for field test data subject to prior written approval of the Engineer. A request to submit certified calibration data in lieu of field calibration data shall include the name and address of the laboratory selected to provide off-site calibrations and a detailed description of field test and inspection activities which will be performed to supplement off-site calibration activities in order to ensure proper installation and freedom from damage subsequent to the off-site test. Each analog instrument shall be calibrated at 10 percent, 50 percent, and 90 percent of its specified full scale. Each current trip and pressure switch shall be adjusted to the required setting(s). Data shall be entered on the applicable test form at the time of testing. A report shall be delivered to the Engineer, containing all instruments listed by instrument number, certifying that each instrument has been calibrated and meets contract requirements. For each instrument, the report shall include the test form, with test data entered, together with a statement of defects noted and corrective action taken. Any instrument which fails to meet any contract requirement, or any published manufacturer performance specifications for functional and operational parameters not specified in the contract, shall be repaired or replaced, at the discretion of the Engineer at no cost to the Owner.

  Final element alignment shall be tested and adjusted to verify that each final element operates smoothly over its range in response to instrumentation control signals. Unless otherwise indicated, final elements shall be arranged to close or go to minimum speed when control signal is at its minimum calibrated value. A written report shall be submitted showing: each final element by equipment number and title; status at 10 percent, 50 percent, and 90 percent control signals; and comments noting any behavior such as hysteresis or nonlinearity that might adversely affect closed-loop control.

- LOOP TEST: Each instrument loop shall be treated as an integrated system. This test shall be designed to verify that indicators operate correctly, function modules provide proper signal, conditioning alarms operate correctly, final elements move in the correct direction, and control trips cause proper action in interlocking or control circuits. This test shall also check calibration from transmitter to readout components within RSS (root-sum-squares) derived tolerances. Signals shall be injected at the signal connection to primary measuring elements. If any output device fails to indicate within required tolerance, corrections to the loop circuitry shall be made as necessary and the test repeated until all outputs are within tolerance. If any final element moves in the wrong direction or fails to move over the required range, corrections shall be made as necessary and the test repeated until final element action is correct.

All circuit modifications required to pass the Loop Tests shall be incorporated into the required record Drawings. A completed legible set of elementary, loop, connection, and interconnection diagrams shall be included in the certified test report for the Loop Test.

- CLOSED-LOOP COMMISSIONING TEST: Commissioning test shall be performed as part of the system test and shall demonstrate stable operation of the loop under actual operating conditions. This test shall include adjustment of closed-loop tuning parameters. Tuning parameters, proportional gain, integral time constant, and derivative time constant for each control loop shall be adjusted to provide 1/4-amplitude damping (subsidence ratio of 4).

- SYSTEM ACCEPTANCE TEST: The system test shall be executed after all component and subsystem tests have been completed, and shall be designed to place the completed system in full operation and demonstrate that all functional requirements of this specification have been met. The system test shall, as a minimum demonstrate the following: 1) That each component of the system operates correctly with all other components of the system; 2) That analog control loops operate in a stable manner; 3) That all interlocks perform correctly; 4) That all control sequences perform correctly; 5) That the complete system is reliable and consistent under all conditions of plant operation.

K. Record Drawings

1. Record Drawings shall include all of those documents maintained and annotated by the Contractor during construction, including manufacturer Drawings and design Drawings.

L. Testing Forms

The following forms shall be used to record the test results specified in 3.6.8.2.

11500-A. WIRE AND CABLE RESISTANCE TEST DATA FORM:

Wire or Cable No.: _____ Temperature, ^{o}F

Location of Test	Insulation Resistance, megohms
1.	
2.	
3.	
4.	
5.	
6.	
7.	

CERTIFIED _____Date
Contractor's Representative

WITNESSED _____Date
Owner's Representative

11500-B. INSTALLED MOTOR TEST FORM:

Motor Equipment Number_____ Date of test

Equipment Driven

MCC Location

Ambient temp_____ ^{o}F

Resistance:
Insulation resistance phase-to-ground megohms:

Phase A , Phase B , Phase C

Current at Full Load:

Phase Current, _____ amps

Phase Current, _____ amps

Phase Current, _____amps

Thermal Overload Device: Manufacturer/catalog # _____ Amperes

Circuit breaker (MCP) setting:

Motor Nameplate Markings:

Mfr _____Mfr type _____Frame _____ HP

Volts _____ Phase_____ RPM_____ **Service factor

Amps _____ Freq_____ Ambient temp rating _____ ^{o}C

Time rating _____ **Design letter
(NEMA 1-10.35) (NEMA MG-1.16)

Code letter _____ Insulation class

**Required for 3-phase squirrel cage induction motors only.

CERTIFIED _____ Date
Contractor's Representative

WITNESSED _____ Date
Owner's Representative

** End of Section **

DIVISION 15 MECHANICAL

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. SVE and Groundwater Conveyance Piping and Fittings: Section 15060

B. Valves: Section 15100

1.2 WORK INCLUDED

A. Provisions of this section shall apply to all sections in Division 15.

B. Work covered by Division 15 is limited to aboveground pipe work, special fittings, valves, and work within vaults.

C. Refer to Division 2 for typical civil work including all below ground pipework.

D. Manholes, catch basins, air/vacuum relief vaults, blowoffs, and other similar items as specified in Division 2.

1.3 QUALITY ASSURANCE

A. Meet requirements of local and state codes.

B. In case of conflict between contract documents and governing codes, the most stringent shall take precedence.

C. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

1.4 SUBMITTALS

A. Certificates: Submit manufacturer's certificates of conformance.

B. Test Reports: Submit certified copies of test reports.

C. Fabricated Pipe: Submit fabrication drawings.

D. Shop drawings: Valves and operators.

E. Descriptive literature or shop drawings: All equipment, plumbing fixtures, floor drains, heater, etc.

F. Hangers and Supports: Submit layout showing type, spacing, maximum loads and materials.

G. Provide complete manufacturer's installation and maintenance instructions including parts tests and recommended spare parts.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Exercise care in transporting and handling to avoid damage to materials.

B. Store materials on the site so as to prevent damage or theft.

C. Keep materials clean, dry, and free from deleterious conditions.

D. Do not store materials directly on the ground.

E. Repair or replace damaged materials or equipment to satisfaction of Engineer.

F. The Contractor shall be responsible for the equipment included in this Contract until it has been finally inspected, tested and accepted in accordance with the requirements of these Specifications.

2.0 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. In accordance with applicable section of Division 15.

B. All equipment and materials shall be designed for the service intended; shall be of rugged construction; of ample strength for all stresses which may occur during fabrication, transportation, erection and during continuous or intermittent operation; shall be adequately stayed, braced and anchored; and shall be installed in a neat and workmanlike manner.

C. Appearance and safety, as well as utility, shall be given consideration in the design of details.

D. Materials of construction shall be cathodically compatible.

E. Design, fabricate and assemble equipment and systems with new materials and in accordance with acceptable modern engineering and shop practices.

F. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field. Make like parts of duplicate units interchangeable.

2.2 GUARDS

A. All exposed moving parts shall be provided with guards in accordance with the requirements of OSHA.

B. Guards shall be fabricated of flattened expanded metal screen, 3/4-inch No. 10, to provide visual inspection of moving parts without removal of the guard.

C. Guards shall be galvanized after fabrication and shall be designed to be readily removable to facilitate maintenance of moving parts.

D. Windows shall be provided in the guard of access to the lubricating fittings.

2.3 NAMEPLATES

A. Equipment nameplates shall be engraved or stamped on stainless steel and fastened to the equipment in an accessible location with oval head stainless steel screws or drive pins.

2.4 EQUIPMENT MOUNTS, GROUTING, AND VIBRATION ISOLATION

A. Equipment mountings shall be as shown.

B. Where a steel or cast base is shown between the equipment and a concrete pedestal, it shall be painted after fabrication in conformance with applicable provisions of Sections 09900.

C. Drain pans and drain connections, where applicable.

D. Where specified or noted in the Drawings, the equipment, including the base, shall be mounted on or suspended from vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the supporting structure.

E. Vibration isolation available internally in the equipment unit is not equivalent and shall not be provided when vibration isolation as specified herein is required. Normally provided internal vibration isolators need to be replaced with rigid supports in such cases.

2.5 ANCHOR BOLTS

A. Adequately sized for equipment loads and in no case less than the size recommended by the equipment manufacturer.

B. Use embedded type when required by equipment manufacturer or field conditions.

C. Use concrete anchor type when allowed by specifications or shown on drawings.

D. Embedded Sleeve Type:

1. Preferred method.
2. When allowed by equipment manufacturer.
3. Anchor bolt assembly shall consist of anchor bolt, surrounding pipe sleeve, bottom plate, leveling nut, nut and washer.
4. Assembly shall permit reasonable lateral movement of the bolts to allow for proper matching of bolts to equipment.

E. Galvanized anchor bolts and anchor bolt assemblies after fabrication unless stainless steel anchor bolts and assemblies are provided.

2.6 HANGERS AND SUPPORTS

A. Design by Contractor in accordance with MSS SP-58 "Pipe Hangers and Supports - Materials, Design and Manufacture" and MSS SP-59 "Pipe Hanger and Supports - Solution and Application".

B. Submit shop drawings showing type, spacing, support conditions and manufacturer.

C. Manufactured materials:

1. Hanger Rods: Carbon Steel, ASTM A575.
2. Continuous Concrete Inserts: Unistrut P-3200 series, hot-dipped galvanized to ASTM A123 or A153, 2-oz./sq. ft. coating weight.
3. Individual Inserts: Unistrut M26 or equivalent, swivel-type concrete insert, hot-dipped galvanized to ASTM A123 or A153, 2 oz./sq. ft. coating weight.
4. Metal Framing: Unistrut 1-5/8 inch channel width series or equivalent, continuous slot channel, hot-dipped galvanized to ASTM A123 or A153.

5. End Closures, Joint Covers, Closure Strips, Parts, Screws and Nuts: Electro-galvanized, FS QQ-Z-325 or cadmium plated.

D. Concrete and Fabricated Hangers and Supports:

1. Field erected cast-in-place concrete.

2. Shop fabricated steel.

2.7 WALL SLEEVES

A. Material: Standard weight steel.

B. Seep Collar: Steel, 1/4-inch thick extending at least 3 inches from the outside pipewall surface and welded to pipe with continuous watertight weld for all structures to be watertight.

2.8 FLOOR SLEEVES

A. Material: Standard weight steel.

B. Extend 1" above floor level in areas except finished areas.

C. Extend 1/4" above floor level in finished areas, but allow placement of escutcheons.

2.9 SEISMIC CONSIDERATIONS

A. Contractor shall submit detailed calculations for review by the Engineer, which demonstrates that the anchor bolting for all equipment with an operating weight of 1,000 pounds or more (250 pounds in the case of vibration isolated equipment having seismic restraints) will not fail in shear or in tension.

B. Calculations shall be performed by an Engineer registered in California.

C. Calculations shall include the following steps as a minimum:

1. Operating weight and centroid of the equipment. Operating weight and centroid for liquid-containing tanks shall be determined with the tank full to the high water level (HWL) indicated on the Drawings and fluid specific gravity of fluid contained in the tank.

2. Shear and overturning forces at each anchorage due to a force equal to 0.5 times the operating weight of the equipment being applied at the centroid in each direction along the three principal orthogonal axes (use the values obtained in the dynamic analysis in the case of seismically restrained vibration isolated equipment).

3. Shear and tension forces which must be developed by the anchor bolts at each support to resist the forces calculated in the previous step.

4. Select anchor bolting details based on the maximum shear and tension forces calculated.

5. Details shall include, but not be limited to, number of bolts, material, diameter, total length and embedded length.

D. Vibration-isolated equipment shall be provided with snubbers capable of retaining the equipment in its designated locations without any material failure or deformation of the snubbers when exposed to a vertical or horizontal force at the contact surface equal to 100 percent of the operating weight of the equipment. Air gaps between retainer and equipment base shall not exceed 1/4-inch.

E. Types of anchorage shall be coordinated with the Contractor so that anchorage may be installed at time

of pouring of concrete. If calculations and anchorage details are not submitted prior to pouring of concrete, the Contractor will become responsible for any strengthening of concrete elements because of superimposed seismic loading.

F. All piping, raceways, ductworks, accessories, appurtenances, etc., furnished with equipment shall be anchored to resist a lateral seismic force of 40 percent of its operating weight without excessive deflection. This force shall be considered acting at the center of gravity of the piece under consideration.

G. Piping with flexible connection and/or expansion joints shall be anchored such that the intended uses of these joints are maintained in the piping system.

2.10 TOOLS AND SPARE PARTS

A. All special tools required for the exclusive operation and maintenance of respective items of equipment shall be furnished with those items of equipment by the manufacturer.

B. This requirement includes special tools, instruments, accessories required for proper "in-plant" adjustment, maintenance, overhaul, and operations.

C. Tools shall be high-grade, smooth, forged, alloy tool steel.

D. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment, whether identified in the manufacturer's standard manual or not.

E. Tools and spare parts shall be carefully packed in cartons, labeled with indelible markings, and shall be adequately treated for a long period of storage.

F. Complete ordering information including manufacturer's name and address, part ordering information including manufacturer, part number, part name, and equipment name and number(s) for which the part is to be used shall be supplied with the required spare parts.

G. The tools and spare parts shall be delivered and stored in a location directed by the Engineer.

H. Spare parts to be provided for certain equipment have been specified elsewhere in these Specifications. The Contractor shall collect and store all spare parts so required in an area to be designated by the Engineer.

I. The Contractor shall furnish the Engineer with an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item.

2.11 LUBRICANTS

A. The Contractor shall provide all mechanical equipment with a sufficient supply of correct lubricant for starting, testing, and initial 30-day operation period.

B. All lubricants shall be of types recommended by the applicable equipment manufacturer. The Contractor, subject to the approval of the equipment manufacturer, shall limit lubricants to the least number or types required for normal maintenance of all equipment.

C. Not less than 90 days before the date scheduled for field testing of the equipment, the Contractor shall provide the Engineer with 3 copies of a listing indicating all lubricants required for each item of mechanical equipment.

D. Unless otherwise noted, all grease lubrication fittings shall be of an approved standard hydraulic type.

2.12 LIFTING LUGS

A. Lifting lugs shall be provided for all equipment weighing 50 pounds or more.

2.13 VIBRATION

A. Except as subsequently modified for particular cases by these Specifications, all rotating, mechanical equipment shall not exhibit unfiltered readings in excess of the following amplitudes:

Speed Range	Bearings[(a)]	Sleeve Bearings[(b)]
900 rpm and below	3.0 mils	3.5 mils
901-1800 rpm	2.2 mils	3.0 mils
1801-3000 rpm	1.3 mils	2.5 mils
3001-4500 rpm	1.0 mils	2.0 mils
4501 and above	0.5 mils	1.6 mils

(a) Measured on bearing housing in vertical axial and horizontal direction.

(b) Relative shaft-to-casting motions for both rigid mounted and isolator mounted equipment.

B. Axial shaft vibration displacements (relative to casing) shall not exceed 50 percent of the maximum lateral shaft vibration displacements (relative to casing existing at any point along the shaft).

C. The above vibration responses are to include the range from 5.0 Hz to 5000 Hz and shall therefore encompass both low and high frequency responses of the subject equipment. The measurements shall be obtained with the equipment installed and operating at any capacity within the specified operating range. In addition to these maximum unfiltered readings, it is also stipulated that no narrow band spectral acceleration component, whether subrotational, higher harmonic or asynchronous multiple of running speed, shall exceed 40 percent of the synchronous displacement amplitude component without manufacturer's detailed verification of the origin and ultimate effect of said excitation.

2.14 NOISE REQUIREMENTS

A. The maximum permissible "free field" noise level for a complete piece of mechanical equipment which is to be located within a structure shall not exceed 87 dBA at a distance of 3 feet from the equipment.

B. For the purposes of this Subsection, "free field" shall be the noise level measured when the equipment shall include the driver, driven equipment and any intermediate couplings, gears and auxiliaries.

C. For a complete piece of mechanical equipment located outside of a structure, the maximum permissible noise level shall comply with the requirements of the OSHA Standard Specifications.

D. Maximum permissible noise levels are in decibels as read on the "A" weighting network of a standard sound level meter (dBA); all measurements are made in relation to a reference pressure of 0.0002 microbar. Measurements of emitted noise levels shall be made on a sound level meter meeting at least the Type II requirements as set forth in ANSI S1.4 Specification for General Purpose Sound Level Meters, or any later revision thereof. The sound level meter shall be set on the "A" scale and to slow response.

E. Point of measurement of sound level shall be at the specified distance from any major surface along the entire perimeter and at mid-height of the piece of equipment. If midheight is not easily determinable, then line of measurement shall be at a height level with the apparent noise source. To assure accuracy, the sound level meter shall be acoustically calibrated with an appropriate instrument, prior to test

measurement.

F. The Contractor shall furnish for each piece of equipment, prior to shipment to the job site, a certified factory noise test reports on the actual equipment to be provided or an unconditional guarantee that the equipment when operating under design conditions will not produce noise exceeding the permissible levels specified.

G. Noise measurements shall be accomplished at the factory or at such other location approved by the Engineer prior to shipment of any equipment to the job site. The measurements shall take place in a reverberant or semi-reverberant condition, with equipment sitting on a hard reflecting surface or conditions which duplicate the circumstances under which the equipment will operate in this project.

H. Noise level measurements shall be taken or observed by an independent acoustical laboratory or consultant retained and paid for by the Contractor. Such independent acoustical laboratory or consultant shall be qualified by experience in the acoustical field to take such measurement and shall be responsible for conducting them in accordance with accepted procedures for the measurement of sound. The selection of the laboratory or consultant shall be approved by the Engineer.

I. If the Contractor provides an unconditional guarantee, the Engineer may reset field tests for noise generation which shall be conducted at the Contractor's expense by an independent acoustical laboratory or consultant approved by the Engineer. In the event that the noise level is in excess of the allowable limits, appropriate field noise reduction measures shall be undertaken to reduce the noise to the allowable limits. If the noise level is within the allowable limits the Owner will pay the Contractor for all expenses incurred in conducting the test.

J. All field noise reduction measures shall be at the Contractor's expense and shall be approved by the Engineer prior to installation. Rated capacities, operation and normal maintenance procedures of the equipment shall not be affected by the noise reduction measures.

2.15 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis.

B. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other materials approved by the Engineer.

2.16 PAINTING

A. Manufactured Equipment:

1. Protect all steel and iron surfaces by suitable coatings applied in shop.
2. Protect for life of equipment surfaces which will be inaccessible after assembly.
3. Finish smooth, thoroughly clean, and fill exposed surfaces, as necessary, to provide smooth uniform base for coating.
4. Coat surfaces to be painted after installation with one or more coats of primer to protect equipment until finish coats are applied.
5. Shop finish electric motors, speed reducers, starters, and other self-contained or enclosed components with oil-resistant enamel.
6. Apply rust preventive compound to all machined, polished and nonferrous surfaces which are not to be painted.

7. Furnish at least one quart of finish coat material with equipment for field touch-up.

B. Shop Fabricated and/or Field Erected: Section 09900 and as specified in applicable Sections.

3.0 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Pipe, fittings, wiring and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations.

B. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

C. Equipment and materials shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair.

D. In accordance with applicable section of Division 15.

E. Cooperate with all trades in furnishing materials and information for correct location, in proper sequence, of all sleeves, bucks, inserts, foundations, wiring, etc.

F. Piping connections to equipment shall be made with unions or flanges to permit dismantling. Flanges and unions shall also be installed in the piping systems to permit disassembly consistent with good installation practice and as required for removal of connected equipment from place of installation.

G. Belt drives, flexible couplings and other exposed rotating or reciprocating parts shall be covered with approved safety covers. Covers shall be permanent type and easily removable.

H. Motors and bearings shall be covered with watertight and dustproof covers during construction period.

I. Sleeves:

1. Sleeves through outside walls above grade shall be caulked with approved caulking;
2. Below grade shall be caulked with oakum and lead wool.
3. Pipe through walls and floors where exposed to view shall have floor or ceiling plate of size required, and shall be chromium plated, except where special escutcheons are required under plumbing fixtures.
4. Special sleeves through walls shall be installed as detailed.

3.2 COORDINATION OF WORK

A. Plan all work so that it proceeds with a minimum of interference with other trades.

B. Openings required in the construction for the installation of the work under this division, of these specifications shall be coordinated with work of all other trades.

C. Contractor shall pay for all extra cutting and patching made necessary by his failure to properly direct such work at the correct time.

3.3 INTERFERENCE

A. Contractor shall arrange the routing of the piping, ducting and wiring in such a manner that it does not interfere with grills, light outlets, light fixtures or other equipment.

B. Routing shall normally be parallel to walls, ceiling or floor.

3.4 INSULATING COUPLING

A. Furnish and install at all inter-connections between piping systems of dissimilar materials and at all connections of piping systems to equipment where piping and equipment are of dissimilar materials.

B. Couplings shall be specifically designed for the purpose of electrically isolating pipe lines from other piping systems or equipment.

3.5 WELDED INSTALLATION

A. Shop fabricated to maximum extent possible.

B. Use welders certified in accordance with the latest requirements of the American Welding Society "Standard Qualifications Procedures".

C. Repair protective coating and linings to a condition equivalent to the factory applied coating or lining.

D. Install coupling at ends of pipe to be welded to provide access for replacing protective lining.

3.6 PIPE OPENINGS

A. Openings in pipes and equipment shall be kept closed during the progress of the work.

3.7 VALVES AND VALVE DESIGNATION

A. Provide valves at each piece of equipment to provide for isolation of the equipment from its connected system.

B. Valves shall not be placed with stems below horizontal.

3.8 EQUIPMENT BASES

A. Provide concrete equipment base extending 4 inches above the floor unless otherwise required.

B. Base plan dimension shall be at least 2 inches larger in each dimension than the steel or cast iron equipment base to be installed.

C. The Contractor shall furnish the necessary materials and construct concrete foundations for all equipment installed by him, even though such foundations may not be indicated on the Drawings.

D. The Contractor shall make an allowance of at least one inch for grout under the equipment bases. All shims shall be removed. Unless otherwise approved, all grout shall be an approved nonshrinking grout.

E. Grout shall be mixed and placed in accordance with Section 03300. Where practicable, the grout shall be placed through the grout holes in the base and work outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamber around the top edge of the finished foundation.

3.9 ACCESS TO EQUIPMENT

A. All motors, valves, control devices, specialties, etc., shall be so located as to provide for easy access for operation, repair and maintenance.

3.10 LUBRICATION

A. Provide lubrication for the operation of all equipment until acceptance.

B. Provide with a chart listing each piece of equipment, the proper type of oil or grease required and recommended frequency of lubrication.

C. Contractor shall be required to run in all bearings and, after they are run in, shall drain and flush bearings and refill with a new oil charge.

D. Oil and lubrication fittings shall be located within reach from the operating surface. In order to meet these requirements with equipment as furnished, minor deviations from the Drawings may be made as favorably reviewed by the Owner.

* * * END OF SECTION * * *

SECTION 15060

PIPE AND FITTINGS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. General Mechanical Requirements: Section 15010

B. Valves: Section 15100

2.0 PRODUCTS

2.1 STEEL PIPE AND FITTINGS (3 INCH AND LARGER PIPE)

A. Pipe: AWWA C200 (ASTM A53), Seamless, Type E or S, Grade B, Black, Standard Weight, cement mortar lined where specified.

B. Joints: Exposed; Forged Steel slip-on flanges conforming to ANSI B16.5 or weld neck flanges conforming to AWWA C207 or field butt welded as shown on the drawings; Buried; Field Butt Welded unless otherwise noted.

C. Fittings: Forged Steel, AWWA C200, or ASTM A234/A234M, Grade WPA unless otherwise noted, lining to match adjoining pipe.

D. Bolts: ASTM A307 bolts and nuts threaded in accordance with ANSIB1.1, dimensions in accordance with ANSIB18.2, heavy hexagonal, semi finished pattern.

E. Gaskets: ASTM D1330, Grade 1, Red Rubber, ring type, 1/8 inch thick (or compressed gasketing material consisting of organic fibers (Kevlar) and neoprene binder).

2.2 STEEL PIPE AND FITTINGS (2-1/2 INCH AND SMALLER PIPE)

A. Pipe: ASTM A53, Seamless, Grade B, Black or Galvanized where specified, Extra Strong, cement mortar lined where specified.

B. Joints: Threaded; ANSI B16.3, straight taped, plain end beveled.

C. Fittings: Threaded Malleable Iron; ANSI B16.3, Class 150, Type 1 for Black Pipe, Type II for Galvanized pipe, lining to match adjoining pipe.

2.3 CAST AND DUCTILE IRON PIPE AND FITTINGS

A. Refer to Section 02610.

B. Fittings shall be flanged for above grade.

C. Buried fittings to be mechanical joint unless otherwise noted.

2.4 SOIL PIPE AND FITTINGS

A. Refer to Section 02610.

2.5 COPPER PIPE AND FITTINGS

A. Pipe:

1. Seamless Copper Water Tube: ASTM B88 Type K, hard drawn for underground and Type L, hard drawn for above ground.
2. Copper Drainage Tube (DWV): ASTM B306.

B. Fittings:

1. Wrought Copper and Bronze Solder-Joint Pressure Fittings: ANSI B16.22.
2. Cast Bronze Threaded Fittings: ANSI B16.15, 250 pounds class.
3. Cast Bronze Solder Joint Pressure Fittings: ANSI B16.18 and B16.18a.
4. Cast Bronze Solder-Joint Drainage Fittings (DWV): ANSI B16.23.
5. Bronze Flanges and Flange Fittings: ANSI B16.24, 150 pounds class.
6. Cast Bronze Fittings for Flared Copper Tubes: ANSI B16.26.

C. Brazing Filler Material: AWS 5.8.

D. Solder Metal: ASTM B32.

E. Brazing Flux: FS O-F-499, Type B.

F. Soldering Flux: FS O-F-506, Type 1.

2.6 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Pipe:

1. For Chemical Service.
2. ASTM D1785.
3. Solvent Welded: Schedule 40.
4. Threaded: Schedule 80.

B. Fittings: ASTM D2466 for Schedule 40 or D2467 for Schedule 80, PVC I; by pipe manufacturer or by Celanese, Chemtrol, or equal.

C. Material: PVC 1120, PVC 1220 or PVC 2120.

D. Solvent Cement: ASTM D2564.

E. Expansion joints: Belmont ”Style 3915,” Resistoflex “Style R6905” molded expansion joint, or equal.

2.7 FLEXIBLE COUPLINGS

A. Cast Iron Flanged Coupling Adaptor:

1. Use for ductile iron pipe 12-inches and under to connect plain end pipe to flanged pipe or

equipment.

2. Body: Gray iron ASTM A126 Class B or malleable iron ASTM A47. Bolt circle, bolt size and spacing conform to ANSI 150 pound flange drilling.
3. Follower: Malleable iron ASTM A47 Grade 32510 or ductile iron ASTM A536.
4. Gasket: Grade 30 specially compounded rubber of all new materials.
5. O-Ring: Grade 60.
6. Cross and tee bolts: Ductile iron ASTM A536, malleable iron ASTM A47 or high strength low alloy steel to AWWA C111 (ANSI-A21.11) standards.

B. Steel Flanged Coupling Adaptor:

1. Use for steel pipe of all sizes and ductile iron pipe over 12-inches to connect plain end pipe to flanged pipe or equipment.
2. Body Sleeve: Steel ASTM A53, ASTM A512 or carbon steel having a minimum yield of 30,000 psi.
3. Flange: 3-inch through 5-inch sizes - ANSI 150 pound flat face. 6-inch and above - AWWA C207 Class D, ANSI 150 pound drilling.
4. Follower: 3-inch through 12-inch sizes - malleable iron ASTM A47 Grade 32510 or ductile iron ASTM A536. 14-inch and above heavy rolled steel AISI C1018.
5. Gasket: Grade 30 specially compounded rubber of all new materials.
6. Bolts and Nuts: High strength low alloy steel with heavy semi-finished hexagon nuts to AWWA C111 (ANSI-A21.11) standards.

C. Grooved Coupling:

1. Use for steel pipe where indicated on drawings.
2. Victaulic coupling Style 77, Standard Flexible Coupling.

D. Cast Coupling:

1. Use for ductile pipe 16 inches and under to connect two plain ends.
2. Sleeve: Gray iron ASTM A126 Class B or ductile iron ASTM A536. Ends have a smooth inside taper for uniform gasket seating.
3. Followers: Malleable iron ASTM A45 Grade 32510 or ductile iron ASTM A536.
4. Gaskets: Grade 30 specially compounded rubber of all new materials.
5. Bolts and Nuts: High strength low alloy steel with heavy semi-finished hexagon nuts to AWWA C111 (ANSI-A21.11) standards.

E. Steel Coupling:

1. Use for steel pipe of all sizes and ductile iron pipe over 16-inches to connect two plain ends.
2. Sleeve: ASTM A53, ASTM A512 or carbon steel having a minimum yield of 30,000 psi. Fusion bonded epoxy coating with an average 12-mil protective coating that is suitable for potable water systems.
3. Followers: Malleable iron ASTM A47 Grade 32510 or ductile iron ASTM A536 or steel AISI C1018.

4. Gaskets: Grade 30 specially compounded rubber of all new materials.
5. Bolts and nuts: High strength low alloy steel with heavy semi-finished hexagon nuts to AWWA C111 (ANSI-A21.11) standards.

F. Insulating Coupling

1. Use for joining steel pipe of all sites to ductile iron pipe or other dissimilar metals.
2. Dresser Insulating Coupling, Style 39 or approved equal.

2.8 WALL SPOOLS (CAST-IN-PLACE)

A. Material: Cast or ductile iron.

B. Seep Collar:

1. Integral Cast.
2. Steel 1/4-inch thick extending at least 3 inches from the outside and brazed to pipe with continuous watertight weld.

2.9 SHOP FABRICATION

A. Butt Welded Steel Pipe:

1. Fabricate: To field dimensions taken at site, not from drawings.
2. Weld-Neck or Slip-on Flanges: Use adjacent to forged fittings and insert type valves.
3. Forged Fittings: Use for all line sized laterals and tees.
4. Grooved Ends: Cut-grooved to manufacturer's specifications for flexible joints unless rigid joints are necessary to meet field conditions.
5. Lining and Coating: After fabrication.

B. Cast and Ductile Iron Pipe:

1. Fabricate: To field dimensions taken at site, not from drawings.
2. Flanged Ends: Screwed type.
3. Grooved Ends: Cut-grooved to manufacturer's specifications for flexible joints unless rigid joints are necessary to meet field conditions.

3.0 EXECUTION

3.1 INSTALLATION OF BURIED PIPE

A. Excavating, Trenching and Backfilling for SVE piping: Section 02222.

B. Lines and Grades:

1. In position and to accurate lines, elevations and grades as shown on plans.
2. Slope to drain where possible.
3. Lay pipe to grade between control elevations shown on plans when slope is not indicated.

C. Securing In Place: By blocking, brackets, anchors, clamps or other approved methods to secure pipe in place to withstand test pressure and thermal operating forces without

movement.

3.2 INSTALLATION OF INTERIOR (ABOVEGROUND) PIPE

A. Complete installation to present neat orderly appearance.

B. Do not block openings or passageways with piping.

C. Run piping parallel to walls, floors or ceilings of building.

D. Keep piping free from contact with structure or installed items.

E. Allow clearances for expansion and contraction of pipe.

F. Anchor horizontal runs over 50 feet at midpoint to force expansion equally toward ends.

G. Placement of Vertical Piping:

1. Secure at sufficiently close intervals to keep pipe in alignment and to support weight of pipe and contents.
2. Install supports at each floor or vertically at intervals of not more than 10 feet
3. If piping is to stand free of support, or if no structural element is available for support during construction, secure in position with wooden stakes or braces fastened to pipe.

H. Placement of Horizontal Piping:

1. Support at sufficiently close intervals to maintain alignment and prevent sagging.
2. Install hangers or supports at ends of runs or branches and at each change of direction or alignment.
3. Hanger or support spacing shall meet the requirements of the drawings. If not specified on the drawings, the support spacing shall not exceed the manufacturer's recommendations nor as listed below:

Pipe	**Maximum Support Spacing (Feet)**
Steel	
Under 1-1/2"	6
1-1/2" to 3"	8
3" and over	16
Cast or Ductile Iron	
Under 4"	8
4" and Over	16
Stainless Steel and Copper	
Under 1-1/2"	5
1-1/2" to 4"	8
Over 4"	16
PVC	
Under 2-1/2"	4
2-1/2" and Over	6

I. Support at Equipment: Install to not induce strain on equipment during or subsequent to the installation of pipework.

J. Provide flexible connection or union at all connections to equipment to facilitate removal for maintenance.

3.3 INSTALLATION AT CONCRETE WALLS AND FOOTINGS

A. Install wall sleeves and wall spools in advance of pouring concrete.

B. Wall Spools: Use cast iron wall spools for steel pipe 3 inches and over.

C. Wall Sleeves: Use special cast iron wall spool or steel wall sleeves for all pipe 2-1/2 inches and smaller and for all nonferrous pipe except concrete.

D. Flexible Connections: At each exterior wall penetration and at excavation lines.

3.4 BELL AND SPIGOT, PUSH-ON, AND MECHANICAL JOINT PIPE INSTALLATION

A. Lead Joint Installation:

1. Tightly pack joint with jute placed in annular spaces.
2. Allow at least 1 inch for lead on soil pipe and 2-1/4 inches for cast or ductile iron pipe.
3. Do not permit packing to enter bore of finished joint.
4. Clean joint after packing.
5. Fill remaining space with one pouring of lead.
6. After lead has cooled, caulk joint tightly by use of hammer and caulking iron.

B. Push on Joint Installation: Per manufacturer's instructions.

C. Mechanical Joint Installation: Per manufacturer's instructions.

D. Set grade to meet requirements of piping system and applicable code prior to installing joint.

3.5 FLANGED PIPE INSTALLATION

A. Tighten flange bolts so that gasket is uniformly compressed and sealed.

B. Do not distort flanges.

C. Flange bolts to project 1/8 to 3/8-inches beyond the face of nut after tightening.

3.6 THREADED JOINT INSTALLATION

A. Threads: ANSI B1.201, NPT.

B. Cut threads full and clean with sharp dies.

C. Ream ends of pipe after threading and before assembly to remove burrs.

D. Leave not more than three pipe threads exposed at each connection.

E. Joint Sealer - Teflon thread tape.

3.7 COPPER PIPE INSTALLATION

A. Bending Pipe:

1. Bend pipe by any method and to any radius within manufacturer's recommendation.
2. Surface shall be free of cracks and buckles after bending.

B. Solder joints:

1. Ream or file pipe to remove burrs.
2. Clean and polish contact surfaces of joint.
3. Apply flux to both male and female ends.
4. Insert end of tube into fittings full depth of socket.
5. Bring joint to soldering temperature, in as short a time as possible.
6. Apply continuous solder bead around entire circumference of joint.
7. Let cool without disturbing.

C. Brazed Joints:

1. Ream or file pipe to remove burrs.
2. Clean and polish contact surfaces of joint.
3. Apply flux to both male and female ends.
4. Insert end of tube into fittings full depth of socket.
5. Bring joint to brazing temperature, in as short a time as possible.
6. Apply continuous bead of filler material around entire circumference of joint.
7. Let cool without disturbing.

D. Flared Joints:

1. Ream or file pipe to remove burrs.
2. Slip fitting over tube end to be flared.
3. Expand end of tube using flaring tool.
4. Tighten joint fitting.

E. Unions: Use dielectric unions for all connections between copper and ferrous materials.

3.8 PVC PIPE INSTALLATION

A. Cutting:

1. Cut pipe with a knife or hand saw.
2. Make cuts square with pipe.
3. Remove burrs by smoothing edges with a knife, file, or sandpaper.

B. Solvent Joints:

1. PVC pipe 3 inches diameter and smaller shall be joined by means of socket fittings and solvent welding in conformance with ASTM F402.
2. Clean joint surfaces.
3. Coat with solvent cement and join.

4. Hold joint together until cement takes hold.
5. Use sufficient cement so that a bead of cement is formed between pipe and fitting at socket entrance.

C. Threaded Joints: Tighten by strap wrench to not more than one full turn beyond hand tight.

3.9 TESTING

A. General:

1. All pipe and fittings shall be pressure-tested as specified herein.
2. The Contractor shall furnish all materials, equipment, and labor for testing and retesting the piping system.
3. Each system may be tested as a unit or in sections, but each complete system shall successfully meet the requirements specified herein before acceptance by the Engineer.
4. Should any defects appear in the pipe or fittings, the necessary repair shall be made, and the line retested until it shall meet the requirements.
5. The Contractor shall take all necessary precautions to prevent any joints from drawing while the pipelines and their appurtenances are being tested and he shall at his own expense repair any damage to the pipes and their appurtenances or to any other structures or equipment resulting from or caused by these tests.
6. The Contractor shall inform the Engineer at least two days in advance of the time set for testing the piping system.

B. Sewage, Sludge and Water:

1. Pneumatic testing shall be conducted on all water piping. Test pressure for water piping shall be 100 psig. The test shall be made by closing valves or providing bulkheads or plugs and filling the pipeline with air. The test pressure must be maintained a minimum of one hour or sufficiently long to permit URS to make an inspection of the system and verify the adequacy of the test. During the test, pipe, fittings, and joints shall be completely tight.
2. The test shall be made by closing valves or providing bulkheads or plugs and filling the pipeline with water. Provisions shall be made for release of all air in the lines. Lines may be filled with water sometime before testing to allow for absorption of water by pipe or joint material. The test pressure must be maintained a minimum of one hour or sufficiently longer to permit the Engineer to make an inspection of the system. During the test, pipe, fittings and joints shall be completely tight.

C. Gas, Air Piping and Fittings:

1. All Air piping, interior and exterior shall be air tested at a pressure of 150 percent of the maximum working pressure of the system.
2. The test shall be made by closing valves or providing bulkheads or plugs as required. The test pressure must be maintained a minimum of one hour or sufficiently long to permit the Engineer to make an inspection of the system. The Contractor shall test all joints in the system with a soapy solution while the line is under test pressure and all joints shall be completely tight.

* * * END OF SECTION * * *

SECTION 15100

VALVES

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Mechanical Requirements: Section 15010

B. Pipe and Fittings: Section 15060

1. 2 QUALITY ASSURANCE

A. Where specified, valves and operators shall conform to all applicable AWWA and ANSI standards.

B. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

C. All valves of the same type shall be by a single manufacturer.

2.0 PRODUCTS

2.1 PLUG VALVES

A. General:

1. Type: Nonlubricated eccentric.
2. Rating: 150 psi.
3. Ends: Screwed, flanged, grooved, bell, or mechanical joint. Flanged valves are faced and drilled to ANSI B 16.1, 125 lbs.
4. Laying Length: Through 12-inch, flange face-to-face dimension equal to standard gate valves.
5. Body: Semi-steel with raised seats.
6. Seats: 3-inch and larger valves welded-in overlay of high nickel content on all surfaces contacting the plug face.
7. Plugs:
   a. Standard and 3-way valves: Resilient faced plugs.
   b. Facings: Neoprene suitable for use with sewage, sludge or scum.
   c. Port areas 4 - 20-inch valves: At least 80 percent of full pipe area.
   d. Port areas 24-inch and larger valves: At least 70 percent of full pipe area.
8. Bearings: Valves through 20-inch permanently lubricated stainless steel bearings in the upper and lower plug stem journals.
9. Bonnet: Bolted.

10. Packing 4-inch and Larger Valves:
    a. Repacked without removing the bonnet.
    b. Adjustable.
11. Zinc Plating: All exposed nuts, bolts, springs and washers.

B. V-Port Plug Valves: Same, except Ni-resist body, and Ni-resist metal plug.

C. Buried Valves: Same except:
1. 2-inch square operating nut.
2. Exposed nuts, bolts, springs and washers shall be stainless steel.

D. Three-Way Plug Valves:
1. Combinations: As shown on the plans.
2. Stops: Required for open/closed positions in accordance with flow pattern combination. Valves with 360 degrees plug rotation without stops to limit plug travel are not acceptable.

E. Manual Operators:
1. Type: Nut, lever or gear.
    a. Lever.
    b. Handwheel.
    c. Chain wheel.
    d. Tee wrench.
2. Gear Housing:
    a. Gearing enclosed in a semi-steel housing.
    b. Suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water.
    c. Actuator shaft and the quadrant supported on permanently lubricated bronze bearings.
3. Stops and position indicators:
    a. Valve position clearly indicated.
    b. Adjustable stop provided to set closing torque.
4. Buried valves:
    a. Seals on all shafts and gaskets to prevent the entry of dirt and water.
    b. Totally enclosed mounting brackets with gasket seals.
    c. Exposed nuts, bolts, springs and washers are stainless steel.
    d. Two tee wrenches shall be furnished which must fit all buried valves with valve boxes.

2.2 BUTTERFLY VALVES

A. Service: Throttling and/or frequent shut-off operation and for applications involving valve operation after long periods of inactivity. For use on liquids and dilute sludges, 4-inch and larger. Not for chemical use.

B. Type: Tight-closing with rubber seats which are securely bonded to the valve body.

C. Rating: 175 psi driptight, with flow in either direction.

D. Ends: Flanged; drilling and facing ANSI B16.1, Class 125.

E. Operators:

1. Valves shall open counterclockwise.
2. Provide handwheel with each valve above grade.
3. Provide square nut and valve box for below grade valves.

G. Approved Manufacturers: Mueller or approved equal.

2.3 GATE VALVES

A. Bronze Body and Trim:

1. Size: 2-1/2-inch and smaller.
2. Type:
   a. Solid Wedge: For vertical pipe runs.
   b. Double disc: For horizontal pipe runs.
3. Rating: 200 psi
4. Federal Specification WW-V-54.
5. Ends: Screwed or flanged.
6. Stem: Rising.
7. Stem Seals: Graphite impregnated asbestos packing.
8. Body-Bonnet Connection: Union.
9. Manual Operator: Handwheel, counterclockwise opening.

B. Iron Body and Bronze Trim:

1. Size: 3-inch and over.
2. Type:
   a. Solid Wedge: For vertical pipe runs.
   b. Double disc, parallel seat: For horizontal pipe runs.
3. Rating: 200 psi W.O.G.
4. Ends: Flanged, grooved, push-on, bell, mechanical joint.
5. Stem: Nonrising unless otherwise specified.
6. Stem Seals: Neoprene "O"-Ring.
7. Buried Service: Provide 2-inch square operating wrench nut.

8. Manual Operators:

   a. Direction of Rotation to Open: Counterclockwise, with operator marked to show direction to open.

   b. Types: Handwheel; chainwheel with chain; extension stem, valve box and tee wrench; gear case with removable handwheel, etc.

   c. Buried Valves: Use tee wrenches supplied with plug valves or furnish two which must fit all valves with valve boxes. If gearing is used, they must be totally enclosed.

   d. Gear cases: Must be used for valves larger than 16 inches.

2.4 GLOBE AND ANGLE VALVES

A. Size: 2-1/2-inch and smaller.

B. Rating: 200 psi.

C. Fed. Spec. WW-V-51.

D. Body and Trim: Bronze.

E. Ends: Screwed.

F. Stem: Rising.

G. Stem Seals: Graphite impregnated asbestos packing.

H. Body-Bonnet Connection: Screwed.

I. Disc: Renewable composition disc for hot or cold water depending on service.

2.5 BALL VALVES

A. Size: 3-inch and smaller.

B. Rating: 300 psi

C. Type: Full port, same as line size.

D. Body and Trim: Bronze.

E. Ends: Screwed.

F. Stem Seals: TFE or Viton "O"-Ring, "in-line" seal replacement and adjustment.

G. Seats: Replaceable TFE seats suitable for water and air service.

H. Operator: Lever with indicator stop.

2.6 PVC VALVES

A. Service: Use PVC valves for liquid chemical service.

B. PVC Ball Valves:

1. Rating: 150 psi.
2. Body and Trim: PVC.
3. Ends: Screwed union type at both ends. Valve can be removed from the line without installing additional unions.
4. Seats: TFE.
5. Seals: Viton "O"-Ring.
6. Operator: Lever handle with open/closed stops.

C. PVC Ball Check Valves:

1. Rating: 150 psi.
2. Body and Trim: PVC.
3. Ends: Screwed union type at both ends. Valve can be removed from the line without installing additional unions.
4. Ball Seal: Viton "O"-Ring.
5. Body Seals: Viton "O"-Ring.

D. PVC Angle Valves:

1. Rating: 150 psi.
2. Body and Trim: PVC.
3. Ends: Screwed.
4. Body-Bonnet Connection: Screwed.
5. Sealing Disc: TFE.
6. Stem Seals: Viton or TFE.
7. Operator: PVC handwheel.

E. PVC "Y" Pattern Valves:

1. Rating: 150 psi.
2. Body and Trim: PVC.
3. Ends: Screwed.
4. Body-Bonnet Connection: Screwed.
5. Sealing Disc: TFE glass filled.
6. Stem Seals: Viton or TFE.
7. Operator: PVC handwheel.

2.7 SOLENOID VALVES

A. Type: Two way globe pattern energize to open.

B. Principle of Operation:

1. 3/8-inch and smaller: Direct acting valve.

2. 1/2-inch and larger: Internal pilot operated valve.

C. Rating: 200 psi W.O.G.

D. Service: Suitable for sediment carrying water.

E. Body and Trim: Forged brass/bronze.

F. Ends: Screwed or flanged. If ends are screwed, a union must be installed upstream adjacent to the valve.

G. Seat: TFE or as required for specific application.

H. Solenoid Construction: Internal parts in contact with fluid are stainless steel.

I. Solenoid Enclosures: NEMA Type 4, watertight and dust tight, indoor and outdoor.

J. Coil: Rated for continuous duty at 40°C ambient temperature.

K. Electrical: 120 Volts, 60 Hertz, single-phase AC

L. Fluid Temperature: Check specific application.

2.8 CHECK VALVES

A. Disc Check Valves:

1. Type:

a. Horizontal Lift Check: For horizontal line installation.

b. Vertical Lift Check: For vertical line installation.

2. Size: 2-1/2-inch and smaller.

3. Rating: 300 psi, W.O.G.

4. Service: Must be suitable for sediment carrying water.

5. Body and Trim: Bronze.

6. Ends: Screwed.

7. Disc: Renewable composition disc as required for specific application.

B. Swing Check Valves:

1. Type: Full opening, with outside lever with adjustable weights.

2. Size: 3-inch and larger.

3. Body and Trim: Iron body, bronze mounted.

4. Ends: Flanged.

5. Disc Facing: Bronze.

6. Hinge Pins: Stainless Steel.

7. Outside lever position: Right hand side when facing the valve inlet.
8. Lever Seal:
    a. 3-inch through 12-inch valves: hinge pin extended through outside lubricated bronze bushing and O-ring seals.
    b. 14-inch and larger: same, except outside packed glands instead of O-rings.
9. Lubrication: Grease fittings for outside lubrication of lever seals.
10. Valve Position: In all but potable water lines, check valves must be installed in horizontal runs only.

2.9 BACKFLOW PREVENTER

A. Type: Reduced pressure principle, automatic operation.

B. Design: Two independently acting spring-loaded toggle lever check valves together with an automatically operating pressure differential relief valve located between the two check valves.

C. Accessories: Non-rising stem isolation gate valves located at each end of the backflow preventer as shown on the plans. Properly located test cocks.

D. Head Loss: 10 psi maximum at rated flow through the complete backflow assembly.

E. Working Pressure Rating: 175 psi maximum.

F. Hydrostatic Test Pressure: 350 psi.

G. Approval: Must be approved by state and local authorities.

H. Body: Galvanized cast iron.

I. Working Parts: Bronze.

J. Ends: Flanged, class 125.

K. Servicing: All parts must be removable or replaceable without removal of the unit from the line.

3.0 EXECUTION

3.1 INSTALLATION

A. General: All valves and accessories shall be installed in a manner and location as shown on the plans or as required for the application and in accordance with manufacturer's instructions. Size of valve is equal to line piping in which valve is installed unless otherwise noted on the plans. Support all valves where necessary. In case of conflict between these specifications and a governing code, the higher standard shall prevail.

B. Accessories:
    1. Provide all accessories necessary for proper valve operation as specified or required for the application. Buried valves shall be installed with 2-inch square operating nuts and

adjustable cast iron valve box with cover. Provide sufficient number of T-wrenches for buried valve operation for all sizes of operating nuts and for placement at convenient locations. Buried valves shall be provided with extension stems if the operating nut would be 36 inches or more below the ground surface.

2. Provide extension stems for submerged valve service where indicated on the plans or required for convenient operation. Provide sufficient number of adjustable cast iron stem guides such that the ratio of unsupported length of stem to radius of stem does not exceed 200. Provide suitable floor stands with operators at approximately 30-inch height where indicated on plans or required for proper valve operation. Small lever or handwheel operated valves may utilize handrails or other suitable structure for support of extension stems.

C. Valve Operators: Valves shall be installed with the operator in a position for convenient operation. Particular care shall be taken to assure that space is available for operation of lever or handwheel operated valves without interference from walls, piping or equipment. Any valve which is installed, in the opinion of the Engineer, in a manner that operation is inconvenient shall be modified or removed and reinstalled in a manner acceptable to the Engineer. Operators for manual valves shall be lever or handwheel as is standard with the manufacturer unless another type of operator is recommended by the manufacturer.

D. Valve Identification:

1. Provide with numbered brass discs attached to valve by brass chain.
2. Provide valve chart indicating valve tag number, location of valve, service, and normal position of valve.
3. Provide valve tag list to Engineer for approval prior to tagging.
4. All globe, angle and check valves shall have their composition discs selected in accordance with the line service, either for cold water or hot water. Valves shall be tagged with a permanent label under handwheel indicating type of disc installed.
5. Valves must be fully identified by the manufacturer including size, manufacturer's name, and pressure rating.

3.2 ADJUSTMENTS

A. Check and adjust valves and accessories for smooth operation. Lubricate in accordance with manufacturer's recommendations. All globe, angle and gate valves shall have their stuffing boxes packed with an excess of 30 percent of packing (for future adjustment).

3.3 TESTING

A. Test with piping as per Section 15060.

* * * END OF SECTION * * *

SECTION 15121

FLOW METERS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Mechanical Requirements: Section 15010

B. Pipe and Fittings: Section 15060

1.2 QUALITY ASSURANCE

A. Conform to applicable AWWA and ANSI standards.

1.3 DESIGN REQUIREMENTS

A. The nominal size of the meter shall be the same size as the pipe shown on the Drawings.

B. Corrosion-resistant materials shall be used throughout the mechanical enclosure.

C. Flow meter system accuracy shall be +/-2% of true flow rate within the range specified.

2.0 PRODUCTS

2.1 FLOW METERS

A. The flow meters and appurtenances shall be provided by a single manufacturer, shall be sized to match adjoining pipe and provided with flanged end connections, where possible. The flow meters shall be manufactured with fabricated steel flow tubes and meter heads and shall be supplied with straightening vanes per the manufacturer's recommendations. Indicator units displayed shall be gallons per minute (G.P.M.). Totalizer units displayed shall be hundreds of cubic feet (X100ft3). Flow meters shall be Water Specialties Corporation Model ML-04D, or an equivalent approved by URS. Solid-state digital indicator-totalizer transmitters shall be Water Specialties Corporation Model TR-28-2 or an equivalent approved by URS. Flow meter and digital display shall have easily assessable calibration hardware.

B. Impeller shall be factory tested and adjusted to maintain an accuracy of +/-2% over the normal flow range and remain accurate without the use of change gears.

3.0 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer’s written instructions and approved submittals.

B. Locate meter as recommended by manufacturer with respect to other piping components to ensure flow meter will meet specific accuracy.

* * * END OF SECTION * * *

SECTION 15130

PRESSURE GAUGES

1.0 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Mechanical Requirements: Section 15010

B. Pipe and Fittings: Section 15060

1.02 QUALITY ASSURANCE

A. Conform to applicable ANSI standards.

2.0 PRODUCTS

2.1 PRESSURE GAUGES

A. Gauges shall be premium grade industrial type with bourdon tube element, 270 degree milled stainless steel movement, phenolic case and shatter-proof acrylic plastic window.

B. Unless otherwise specified or shown, gauges shall be 4-1/2 inch dial, 1/2 inch ANPT.

C. All exposed parts shall be stainless steel.

D. Gauges shall be calibrated to read in applicable engineering units, with an accuracy of ± 1% of span or better.

E. Span, unless otherwise specified, shall be 0 to 150% of working pressure of pipe or vessel to which they are connected.

F. Gauges shall be as manufactured by Ashcroft Duragauge, Ametek Solfrunt, or equivalent.

3.0 EXECUTION

3.1 INSTALLATION

A. Pressure gauges shall be provided on suction and discharge side of pumps, on each side of pressure reducing valves, and where shown.

B. Each gauge shall be protected by a suitable snubber and stopcock.

* * * END OF SECTION * * *

DIVISION 16 ELECTRICAL

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Materials and Methods: Section 16050

B. Grounding: Section 16450

C. Dry Type Transformers: Section 16455

D. Feeder and Branch Circuits: Section 16460

E. Equipment Connections: Section 16470

F. Lighting: Section 16500

G. Instrumentation and Control: Section 16900

1.2 WORK INCLUDED

A. The requirements of this section apply to all the sections within Division 16. Applicable requirements of all of these Specifications shall apply to electrical work.

1.3 SYSTEM DESCRIPTION

A. General:

1. Complete Functional and Operable Systems:

a. All specified parts, materials and functions.

b. All detailed systems, equipment, power and controls.

c. Ready for use.

d. Final sizing is dependent on equipment selected by the Contractor.

e. Ratings indicated on the electrical drawings are for guidance only and do not limit the equipment size.

2. Electrical Systems to be Installed:

a. 120/208 volt, 3-phase, 4-wire, 60 Hz, distribution.

b. 9 - 120/208 volt, 3-phase, 60 Hz, DPE well control panels.

c. 120/208 volt, 3-phase, 50 amp, 60 Hz HiPOx HCU control panel

d. 120/208 volt, 3-phase, 50 amp, 60 Hz SVE control panel

e. 120 volt receptacle system

f. Grounding system.

g. Contractor to provide and install the SCADA controller system with hardware and

software.

h. Contractor supplied communications equipment.

i. Temporary lighting and power facilities during construction.

B. Labor, Services and Skilled Supervision:

1. Complete Electrical Construction, Erection, Installation and Connection:

a. Materials and equipment specified in this section.

b. Related materials and equipment necessary to complete a system.

c. Wiring equipment specified in other divisions.

2. Adjustment and Testing:

a. Simulate system operation.

b. Proper system operation.

c. Proper control settings for limit switches, flow and pressure devices, and valve actuators.

d. System electrical integrity.

- Continuity
- Insulation resistance
- Ground

C. Materials and Equipment

1. Specified in this Division.

2. Necessary to complete the Systems.

3. For equipment specified in other Divisions.

D. Costs Billed by Private or Public Utilities as Service Charges included in Contract price.

1. To extend or connect, the electric or communication supply system.

2. Temporary power used during construction.

3. Metering installation.

E. Permits and Inspection Certificates:

1. State electrical.

2. Municipal electrical.

3. Southern California Edison Company Standards and Requirements.

1.4 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Shop Drawings and Data: In accordance with procedures set forth in Section 01300, submit complete assembly, foundation, and installation drawings together with detailed specifications and data covering materials used, parts, devices, and other accessories forming part of equipment, including, but not limited to:

1. Motor control centers (soft start motor controllers).
2. PLC controllers, control devices and power supplies.
3. Remote control system.
4. Ground conductors, rods.
5. Conductors, 600 volt.
6. Junction boxes, one cubic foot and larger.
7. Lighting Fixtures and Poles.
8. Dry-Type Transformers.

1.5 WARRANTY

A. Except lamps.

B. Free of defects.

C. Function properly.

D. Manufacturer's warranty time and coverage shall be included with bid.

2.0 PRODUCTS

2.1 CODES, ORDINANCES, STANDARDS AND PERMITS

A. Comply With All Codes Applicable to the Work:

1. Bidders inform themselves of all local and state codes and regulations.
2. In case of conflict between Contract documents and governing codes, the most stringent shall take precedence.
3. Where Contract documents exceed minimum code requirements, Contract documents take precedence.
4. No extra payment will be allowed for work or changes required by local code enforcement authorities.

B. Apply for, Obtain and Pay for All Required Permits and Inspection Certificates.

1. Arrange for all inspection by permit enforcing agencies.
2. Deliver all permit compliance documents to Engineer.

C. Underwriters Laboratories Labels Shall Apply To:

1. All materials and devices, etc.
2. Except specified items not covered by existing UL standards.

D. Conflicts With Applicable Regulations

1. Resolve at Contractor's expense.

2. Prepare and submit details of alternate construction:
    a. Acceptable solution of conflict.
    b. List of substitute materials:
        - For approval of inspecting authorities.
        - For approval of Engineer.

2.2 IDENTIFICATION

A. Conductors:

1. Color code:
    a. Continuous jacket color.
    b. Colored tape wrap at each end and each intermediate junction box.
    c. Plastic adhesive tape at each end and each intermediate junction box.
2. Conductor numbers or letters and numbers:
    a. Laminated composition or plastic disc (floater) with string loops. Hot stamped sleeves. Identify same at each end in the control panel and the device, and each intermediate junction box.
    b. Correspond to design drawing. Prepare as-built record drawing identifying conductor numbers as installed.
3. Phase color code:
    a. NEC as applicable.
    b. Each phase separate color or color taped.
    c. Each circuit voltage separate color.

B. Terminal Strips:

1. Identify each conductor:
    a. Conductor number, or,
    b. Function, or,
    c. Serial number.
2. Provide terminal strips in all junction boxes terminating four or more conduits with #10 and smaller wire.

C. Equipment Without Terminal Strips:

1. Identify each connection point:
    a. Tape on equipment body beside terminal screw.
    b. Tape or tag on conductor.
    c. Correspondence with conductor number.
    d. Do not cover manufacturer's contact numbers on equipment.

D. Panelboards and Control Centers, Disconnects and Circuit Breakers:

1. Phenolic Name Plates:
   a. Black lettering scribed on white background.
   b. Identify purpose, use, pertinent characteristic (volts, phase, etc.)
   c. Motor or equipment being controlled.
2. Breaker Panel Circuit Schedule:
   a. Remove or furnish directory card.
   b. Type neatly assigned circuit use.
   c. Replace in panel.
3. Auxiliary Relays and Components:
   a. Identify corresponding to drawings.
   b. Typed data adhesive tape.
4. Control and Visual Indicating Devices:
   a. Identify corresponding to drawings.
   b. Use standard nameplate or engraved legend as required.

E. Equipment Identification:

1. Name and number if more than one similar unit:
   a. Phenolic engraved nameplate or etched or engraved anodized aluminum.

3.0 EXECUTION

3.1 INSPECTION OF SITE

A. Each bidder shall thoroughly inspect the site and existing conditions affecting the work prior to bidding.

3.2 CONTRACT DRAWINGS ESSENTIALLY DIAGRAMMATIC FOR CLEARNESS AND LEGIBILITY

A. Equipment shown in desired location.

B. Size and location shown to scale wherever possible, but is approximate unless dimensioned.

C. Contractor compare all available data to refine location.

D. Verify information and dimensions at building site.

E. Install all work to conform to structure and equipment.

F. Avoid obstructions.

G. Preserve headroom and working clearances.

H. Keep openings and passageways clear.

J. Make accessible all equipment requiring inspection and maintenance.

3.3 PROTECTION, CARE AND CLEANING

A. Protect materials before and after installation against moisture, dirt and damage.

B. At all times, keep the premises clear of undue accumulation of rubbish.

C. On completion of the work, remove all rubbish and debris resulting from this Contract and dispose of same.

D. Equipment and fixtures shall be thoroughly cleaned and left in a satisfactory condition for use.

E. Provide temporary heat in motors and electrical panels, control centers and enclosures to eliminate condensation until installations are placed in normal service.

F. All electrical equipment and fixtures shall be installed in a manner to meet the requirements of a Seismic Zone 4 area.

3.4 DEMONSTRATION OF COMPLETE ELECTRICAL SYSTEM

A. Contractor to provide assistance for inspection:

1. To Engineer.
2. To state or local permit inspectors.
3. To utility company inspections.
   a. At all times as requested:
      - Remove covers.
      - Operate machinery.
      - Continuity tests.
      - As necessary to demonstrate quality and adequacy.
   b. Operate each:
      - Branch feeders.
      - Panelboard circuits.
      - Motor controls and motors.
      - Control systems.
      - Electric controls on installed mechanical equipment.
      - Remote and local control and alarm systems.

3.5 TESTS

A. General:

1. Perform all tests as outlined.
2. Additional tests as may be necessary to establish:
   a. Adequacy to perform function.

b. Quality of workmanship.

c. Safety.

d. Completeness.

e. Suitability.

3. Provide test labor materials and tools.

4. Advance timely notification of test schedules.

5. Correct promptly any failure or defects revealed by test.

6. Retest or transient conditions test may be required in critical cases as required by Engineer.

B. Driven Ground Rod Resistance Test:

1. Immediately after installation.

a. Each rod individually.

b. Combined resistance when 2 or more in-group.

2. Maximum 25 ohms at point of system connection.

3. Report contain:

a. Date of test.

b. Soil conditions.

c. Measured resistance.

d. Submit at once.

C. Wiring Tests:

1. Continuity.

2. Proper wire size:

a. Insulation resistance measured by DC 2000 volt megger:

- All circuits including services.

b. Circuits 600 volts or less:

- 1,000,000 ohms to ground minimum.
- Except circuits over 50 amperes with:
  - All served devices except fluorescent fixtures connected,
  - All incandescent lamps removed, motor terminals disconnected,
  - Panelboards and switchboards with switches closed,
  - 300,000 ohm to ground minimum.

c. Insulation between ungrounded conductors not less than 1.5 time's minimum insulation to ground.

D. Equipment Tests:

1. Operating amperes:

a. Each motor:

- Measure and record each phase.
- Equal or less than nameplate rated current at 1.0 service factor.

b. Each panel and load center:

- Measure and record input each phase.
- Balance phases by reconnection.
- Maximum variation ±10 percent between phase current and average.

c. Dry type lighting and supply transformers:

- Measure and record each phase.

E. System Tests:

1. Service voltage: Measure voltage at the service entrance. Voltage shall be within service range A as defined by ANSI/IEEE C84.1.
2. Utilization Voltage: Measure voltage at each load of 5 kVA or greater. Other voltage measurements shall be taken as required by the Engineer. Voltage shall be within utilization range A as defined by ANSI/IEEE C84.1.
3. Voltage balance:
   a. Maximum 1 percent unbalance at full load.
   b. Cooperate with utility to achieve balance within limits.
   c. Rearrange single-phase loads.
   d. Unbalance definition for 1 percent:
      - 100 times the sum of the deviation of the three voltages from the average voltage divided by the average voltage.

F. Electrical System Test Reports:

1. Indicate all tests performed.
2. Demonstrate conformance with performance criteria.
3. Note corrections made to meet performance.
4. Consult Engineer on report format.

G. Motor Test Reports:

1. Consult Engineer on report format.
2. Provide information on each motor 1/3 horsepower and larger:
   a. Motor use.
   b. Location.
   c. Duplicate of motor nameplate, or tabulation of complete nameplate data.
   d. Measured full load current phase A, B, C.
   e. No-load voltage phase AB-BC-CA.
   f. Full-load voltage phase AB-BC-CA.
   g. Feeder conductor insulation resistance phase-to-phase and phase-ground.

h. Control circuit function.

i. Rotation direction from drive end.

3.6 RECORD DRAWINGS

A. One Complete Set Blue Line Prints Provided:

1. Keep separate and clean.
2. Reserve for complete picture of work actually installed.
3. Serve as work progress report sheets.
4. Notations made neat and legible.
5. Available all times at job site.
   a. Record Layout Actual Routing
   b. Completion of Work and Record:
      - Signed by Contractor.
      - Dated.
      - Delivered to Engineer.

* *.* END OF SECTION * * *

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Requirements: Section 16010

B. Grounding: Section 16450

C. Lighting: Section 16500

D. Instrumentation and Control: Section 16900

1.2 QUALITY ASSURANCE

A. General Requirements:

1. New, free from defects, quality as specified.

2. Standard product of known manufacturer.

3. Same manufacturer:

a. Material of the same type or classification.

b. Used for the same purpose.

4. Labeled or listed by approved testing laboratories.

5. Suitable for the intended application.

6. Approved by inspection authorities.

B. Applicable Codes and Standards: Shall be the latest revisions, supplements and amendments to the following:

1. ANSI/NFPA 70: National Electrical Code (NEC).

2. NEMA Standard ICS-2: Industrial Control Devices, Controllers and Assemblies.

3. NEMA Standard KS-1: Enclosed and Miscellaneous Distribution Equipment Switches.

4. NEMA Standard MG-1: Motors and Generators.

5. NENA Standard PB-1: Panelboards.

6. NEMA Standard WD-1: General Requirements for Wiring Devices.

7. UL Standard 98: Enclosed and Dead-Front Switches.

8. UL Standard 845: Motor Control Centers.

9. UL Standard 1004: Electric Motors.

10. IEEE 519: Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

11. Southern California Edison Company Electrical Service Requirements Latest Edition.

1.3 SUBMITTALS

A. Shop Drawings and Data: In accordance with procedures set forth in Section 01340, submit pictorial, assembly and installation drawings together with detailed specifications and data for the following material and equipment listed in Section 16010, Paragraph1.04

B. In addition to the requirements above, submit two copies of Operation and Maintenance manuals for the following:

1. Motor and water treatment controls
2. Motor control centers
3. Motors
4. Remote control interface equipment
5. Panelboard circuit breakers

C. Operation and maintenance manuals shall be in addition to any instructions or parts lists shipped with the equipment.

D. Wiring and Connection Diagrams: Submit wiring and connection diagrams for motor controllers and motor control centers. Extent and detail of wiring diagrams shall comply with NEMA standards for the equipment.

2.0 PRODUCTS

2.1 RACEWAYS

A. Rigid steel threaded galvanized or sheradized. (EMT acceptable for lighting and receptacle branch circuits routed within building structures).

B. PVC Schedule 40 for all underground runs.

C. Long radius bends for underground runs shall be rigid steel.

D. Locknuts and insulating bushing on terminations.

E. Flexible metallic conduit shall be used in short runs for ease of installation and to prevent vibration from equipment.

1. Liquidtight flexible conduit.

2. Zinc-coated steel core.

3. Extruded gray PVC cover.

4. Sealtite Type “UA”.

F. Minimum size conduit shall be 3/4-inch.

2.2 CONDUCTORS

A. Copper Conductor:

1. 600 volt minimum insulation.
2. Type THHW or higher temperature rating. (All wire shall be sized per 75°C rating)
3. Minimum Wire Size:
   a. Power carrying conductors, No. 10 AWG.
   b. Control wiring, No. 14 AWG stranded.
   c. Fixture wire, No. 16 AWG stranded.
4. Insulation colors consistent each phase.
5. Stranded power conductors No. 8 AWG and larger sizes.
6. Terminal lugs and connectors for power and lighting circuits shall be copper alloy pressure type.

B. Instrument wire and cables

1. 300 Volt Minimum Insulation Rating

2. Instrumentation signal and telemetry cables

3. Insulation thickness shall be 32 mils of polyethylene, insulated with 2.3 mils 100 percent aluminum foil/polyester shield and No. 18 stranded tinned copper drain wire, all under a 32 mil PVC jacket. The shield shall be continuous and shall be grounded only at the receiving end, or as indicated.

4. Multi-individual shielded pair or triad instrumentation cable shall consist of individual shielded and twisted pair copper conductors with an ethylene-propylene insulation, and No. 18 AWG tinned stranded copper drain wire, an overall aluminum Mylar shield and an overall chloro-sulfonated polyethylene compound jacket. The cables shall be suitable for conduit raceway installation and shall be flame retardant.

5. Wire color code shall be per Insulated Cable association (ICEA) standards.

All cables shall be rated for installation in dry or wet locations. All cable shall be rated for pulling through conduit raceways without damage to the individual conductors.

2.3 CONDUIT FITTINGS

A. Cast malleable iron condulets or unilets.

B. Threaded with watertight gasket.

C. Watertight seals on conduit entering underground structures, Type EYS, located inside structure wall.

D. Non-metallic, compatible with PVC Schedule 40 raceway.

2.4 JUNCTION BOXES

A. Size as required by code or as shown on the plans. Allow extra space when splicing.

B. Full access screwed covers mounted with corrosion resistant machine screws.

C. Fabricated from code gauge galvanized sheet steel:

1. Paint with rust-inhibiting primer.

D. Cast metal with threaded hubs FS or FD or type RS with cast plates with threaded hubs:

1. Exterior, damp or underground locations unless otherwise shown on the drawing.
2. Fully gasketed.
3. Size for outlets including gang requirements.
4. Size for conduits, conductors and volume fill by Code.
5. Stainless machine screws for covers and side plates.

2.5 WIRING DEVICES

A. General

1. Specification grade, NEMA standard.

B. Switches:

1. 20 ampere, 125 volts.
2. Totally enclosed in a molded phenolic case.
3. Flush tumbler type.
4. Group under a gang plate where two or more switches in same location.
5. Motor horsepower rated trip-free with overload device for use with fractional HP or more motor loads.

C. Receptacles:

1. 20 amperes, 125 volts, 2 pole, 3 wire NEMA 5-20R unless otherwise noted:

a. Totally enclosed GFI protected, grounding type.

D. Cover Plates:

1. Appropriate size and type.

2. Gasketed weatherproof type of corrosion resistant or galvanized steel or galvanized malleable iron for exterior or damp locations.

3. Gang plates for multiple switches or multiple outlets at one location.

4. Fastening screws corrosion resistant or stainless.

2.6 MOTOR CONTROLS

A. NEMA Standard:

1. Individual wall mounted units.

2. Control center group mounted units.

B. Combination circuit breaker and magnetic starter unless otherwise specified.

C. Switch and fuse units:

1. Heavy duty loadbreak with quick make, quick break operation.

2. Common operator for 3 phases.

3. High pressure switch contacts.

4. Current limiting fuses rated as shown on the drawings.

D. Circuit breaker units.

1. Thermal magnetic circuit breakers.

2. Interchangeable trip type.

3. Adjustable magnetic trip elements.

a. Magnetic-only (MCP) type acceptable only if shown on the drawings and if part of an UL listed assembly.

E. Type, size and functions as indicated on the drawings.

1. Across-the-line start.

2. Contacts self-cleaning type designed for easy inspection and replacement.

3. Manual toggle switches, quick make, quick break trip-free type.

a. Single phase less than one horsepower.

F. Modular construction suitable for motor control center installations unless otherwise indicated on the plans.

G. Pilot devices on controller door unless otherwise indicated on the Plans.

1. Start-stop buttons or selector switch (see schematic diagrams).

a. Reset buttons.

b. Running time meter, hours and tenths, non resettable.

H. Pilot lights shall be transformer push-to-test type with color and functions shown below unless otherwise noted on the drawings.

1. Motor running - green light.
2. Motor stopped - red light.
3. Circuit energized – white light.

I. Overload trips in each phase.

1. Sized for actual motor running current.

J. All disconnect or circuit breaker operators shall have padlocking provisions in open portion with field knockout or drill position for closed position.

K. 120 volts control power through an integral control transformer with 125 VA spare capacity unless otherwise indicated on the drawings.

L. Protective fuse for each control circuit.

M. Terminal strip for all external connections.

2.7 MOTOR CONTROL CENTERS

A. NEMA, AIEE and ANSI Standards. NEMA enclosure type 12.

1. Sections 20-inches, 24-inches, or 35-inches wide by 20-inches and 90-inches high.

2. Short circuit bracing to 65,000 RMS amperes or as otherwise shown on the drawings.

3. Back access prohibited.

B. Completely wired NEMA Class I, Type B wiring.

C. 480 volts, three phase, 60-hertz alternating current, ampere ratings as indicated on the plan drawings.

D. Motor controllers as described in Paragraph. 2.07 of this section and soft start motor controllers in Section 16480.

E. Comprised of individual vertical units of same depth and height.

F. Common power bus arranged for easy section additions.

G. Six size 1 starters per vertical section.

H. Main horizontal bus (800 amp) with vertical busses (400 amp) to feed each section.

I. Busses shall be tin plated aluminum or copper.

J. Ground bus across the bottom or manufacturer's standard.

K. Top and bottom wiring space for each vertical section wiring.

L. Vertical wiring space for unit wiring.

M. All wiring neatly grouped, tied and supported to hold in place.

N. All units to be modular construction of interchangeable type, front accessible held by machine screws.

O. Each unit completely isolated and barriered from other units.

P. Unit door hinged on the left side when facing the panel.

1. Three hinges for doors over 1/3 height.

2. Four hinges for full height doors.

Q. Spare sections to be complete with all facilities except interior unit.

R. Hinged door for spare sections to be furnished with covered cutouts.

S. Blank area shall be covered.

T. Zinc phosphate treated inside and out or rust preventive treatment.

U. Tough epoxy resin primer, durable baked enamel, light grey finish.

V. Auxiliary controls mounted in MCC:

1. Auxiliary panel for equipment mounting.

2. Relays, timers, meters, metering transformers, auxiliary power transformers mounted in separate compartments from starter.

3. Limit two auxiliary relays in starter compartment:

a. Locking provision in extended position.

b. Roller or ball bearing slide.

W. Acceptable Manufacturers

1. Allen-Bradley 2100 Centerline

2. Square-D

3. Cutler-Hammer

4. Siemens

2.8 PANELBOARD

A. Type, size and functions as indicated on the drawings.

B. Dead front, flush, surface or motor control center mounting.

C. Tin-plated aluminum busses, or copper busses, full panel height, rigidly supported with bus supports.

D. Minimum bus rating not to be smaller than feeder protective device setting.

E. Complete with main breaker or main lugs and sub-breakers as shown on the drawings.

F. Circuit breakers:

1. Molded case thermal magnetic trip units.
2. Common trip bar for two or three pole breakers.
3. Trip-free and trip-indicating plug-in type.
4. Quick-make, quick-break contacts.
5. Single, two or three pole breaker interchangeability.
6. Ground fault circuit interrupter (GFCI) where indicated.

G. Zinc-coated sheet steel cabinets, Underwriters' Laboratories, Inc. label. Heavy gauge for embedded installation.

H. NEMA Type 1 enclosures for indoor locations unless otherwise noted.

I. NEMA Type 3R enclosures for outdoor locations.

J. Typewritten directory properly identifying each circuit under the clear plastic cover.

K. Panel bus arrangement:

1. Single phase, 3 wire, 120/240 volts with solid neutral and ground bars with lugs.

L. Gutter space:

1. 5-inch minimum at top and bottom in addition to ground and bus space.
2. 4-inch minimum on sides.
3. Meet NEC requirements.

M. Transient-voltage surge suppressor shall be sized for each panelboard voltage rating and connected per manufacturer's requirements.

N. Breaker interrupting rating not less than the following unless shown otherwise on the Drawings:

	Interrupting Capacity	**RMS Symmetrical Amperes**
Breaker (Ampere Rating)	208 V AC	480 V AC
20 - 60	10,000	14,000
70 - 125	10,000	14,000
150 - 400	40,000	30,000

2.9 OVERLOAD PROTECTION

A. Size to fit motors.

B. Verify from motor nameplate and measure amp load.

B. Special consideration for submersible motors. Check manufacturer’s recommendations.

2.9 MOTORS

A. All motors shall be of the horsepower and speed appropriate for the equipment drive, of squirrel cage design, 40°C ambient, and shall be of nationally known manufacturer, and shall conform to the applicable standards of the National Electrical Manufacturer's Association.

B. Motors 1 horsepower and over shall be 3-phase. Fractional horsepower motors may be single phase.

C. Insulation shall be not less than Class B and an epoxy dip coating for protection against accidental submergence. Ambient temperature will be approximately 32°C and under these conditions the service factor shall be 1.0 minimum.

D. The totally enclosed fan cooled (TEFC) motor frame shall be suitably protected against corrosion inside and out considering operation in an outdoor or moist corrosive atmosphere. Open drip proof (ODP) motors operating in a clean, dry indoor environment shall be provided with bug screens on all ventilation openings. Grease fittings with grease relief drain plugs shall be provided on all thrust and radial ball bearings if required by the manufacturer.

E. Motors in corrosive locations shall be approved for such areas as indicated on the drawings.

F. All motors shall be the highest-grade premium efficiency.

G. Motor heaters are required for all motors ten horsepower and larger. Heaters wired to energize when motor is off.

H. Motor overheat switches are required for all motors ten horsepower and larger. Motor overheat switches not required for fire pumps.

2.10 POWER MONITORING

A. Three Phase Power monitoring shall be provided

B. Power monitoring shall, at a minimum, detect:

1. Phase Loss
2. Phase Unbalance
3. Phase Reverse
4. Low Voltage

C. Monitor, in alarm, shall provide visual indication at station and provide dry contacts for Owners use to connect to SCADA system.

D. Monitor shall provide an analog signal to SCADA system to allow monitoring power consumption. Four analog loops shall be provided to SCADA interface.

E. Acceptable Manufacturers:

1. General Electric (Multilin PWM-T20-C or equal)

2.11 COMBINATION POWER PANEL/TRANSFORMER

A. The combination power panel/transformer package shall include , but shall not be limited to the following:

1. A transformer with a maximum full load temperature rise of 115°C using a 180°C insulation system. The core and coil is encapsulated in an epoxy resin-sand combination.

2. A circuit breaker section enclosed in a weather-resistant, steel enclosure.

3. Enclosures use an electrostatically applied, ANSI 49 color, powder coating for the transformer and panel board section. This construction provides a unit for use in wet, dirty, or dusty applications.

4. Two-part construction uses removable transformers that can be replaced without disturbing external panelboard wiring. All are furnished, complete with the transformer main primary and main secondary circuit breakers sized in accordance with National Electrical Code requirements.

B. Product: Square D Mini Power-Zone Power Supply or equivalent approved by URS.

3.0 EXECUTION

3.1 ERECTION

A. The Contractor shall install the wiring and materials by tradesmen skilled in the installation of this type of work and in accordance with the manufacturer's instructions. All electrical work shall be in accordance with applicable electrical codes.

3.2 RACEWAYS AND CONDUIT

A. Rigid conduit support intervals not greater than:

1. 1-1/2-inches and smaller - 6 foot intervals

2. 2-inch to 6-inch - 10-foot intervals

B. Flexible conduit support intervals not greater than 4-1/2 foot intervals.

C. Conduit runs on the interior walls and ceilings:

1. Support on U-channel.
2. Attach to concrete walls.
3. If not practical to attach to concrete walls, attach to a structural member through the covering materials.
   a. Seal covering to prevent sound transmission.

3.3 CONDUCTORS

A. Pulling lubricant soapstone or NEC approved materials.

B. No splices between outlet boxes or fittings.

C. Color identify or tag as specified in Section 16010.

D. Conductor ends stripped of insulation without nicking metal.

E. Assure high conductive permanent connections.

3.4 JUNCTION BOXES

A. Mount and support per good standard practice using brackets, rod hangers, bolts, and expansion bolts.

B. Support independent of attached conduit.

C. Replace covers and screws when wiring is complete.

3.5 WIRING DEVICES

A. Wall switch outlet 4 feet 0 inches above finish floor.

B. Receptacle outlet 4 feet 0 inches above finish floor in pump room, 1 foot 6 inches in all other areas.

C. Height as noted on drawings.

D. Lighting switches on lock side of entrance door.

3.6 LOCAL CONTROL STATIONS

A. Secure to adjacent wall.

B. Secure to controlled equipment in convenient location.

3.7 MOTOR CONTROLS

A. Separately enclosed starter units:

1. Fasten securely to supporting structure:

a. Wood screws or lag screws to wood boards or timbers.

b. Machine bolts to metal framing or plates.

c. Expansion anchors to concrete walls.

d. Expansion toggle wing bolts or sleeves anchors to hollow block.

f. Provide 1-inch spaces to set panel out from concrete or block wall.

2. Arrange for driven equipment use or function.

a. Similar units adjacent.

b. Multiple units:

- In horizontal line uniform to top height.
- In groups symmetrical arrangement. Top of highest enclosure not exceeding 6-feet-9-inches above floor and bottom lowest enclosure not less than 1-foot-3-inch above floor.

B. Motor control centers:

1. Provide 3-inch mounting curb under cabinet.

2. Fasten brace from adjacent wall or support structure to enclosure frame.

a. Support enclosure as required for Seismic Zone 4.

3. Fasten securely at base.

a. Anchor bolts in concrete.

b. Lag bolts or through bolts in timber.

4. Assemble units and make-up field connections.

a. Follow manufacturer's instructions.

b. Special care for joints in electrical busses.

5. Connect all wiring to power source, loads and controls.

3.8 PANELBOARDS AND CABINETS

A. Fasten securely to wall:

1. Wood screws or lag screws to wood boards or timbers.

2. Machine bolts to metal framing or plates.

3. Expansion anchors to concrete walls.

4. Expansion toggle wing bolts or sleeves anchors to hollow block.

5. Provide 1-inch space to set panel out from concrete or block wall.

B. Outdoor post mounted:

1. Provide wood or galvanized angle brackets.

a. Galvanized 1/2 inch lag screw or through bolt fastening to pole.

b. Galvanized lag screw or through bolt fastening box to bracket.

2. Brackets top and bottom if enclosure more than 15 inches high.

3. Support post not less than 6-inch x 6-inch treated timber; 4-inch Schedule 40 galvanized pipe or u-channel (as shown on drawings) set in concrete.

C. Mounting height:

1. Single unit - 5 feet centerline above floor or ground.

2. Multiple units - uniform top height.

D. Mounting Supports

1. Fasten brace from adjacent wall or support structure to enclosure frame.

a. Support enclosure as required for Seismic Zone 4.

* * * END OF SECTION * * *

SECTION 16450

GROUNDING

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Requirements: Section 16010

B. Basic Electrical Materials and Methods: Section 16050

1.2 DESCRIPTION

A. Furnish all labor, material, equipment, instruments, supervision, and accessories as required to install the grounding system required. Equipment grounds, including conduits, shall have separate grounding conductors above grade. Grounds at various equipment locations may be combined into single conductors connecting to below grade grids.

B. Provide grounding of all electrical equipment per code rules and established safety practices.

C. Provide grounding system as indicated on the Drawings. Coordinate with the Engineer, the grounding system components that will be furnished by the Engineer.

1.3 QUALITY ASSURANCE

A. Applicable Standards:

1. ANSI C2: National Electrical Safety Code (NESC).
2. ANSI/NFPA 70: National Electrical Code (NEC).
3. UL Standard 467: Grounding and Bonding Equipment.

B. Acceptable Manufacturers:

1. Ground Rods:
   a. A.B. Chance Co.
   b. Copperweld Corporation
   c. Porcelain Products
   d. Willard Industries
   e. American Electric
2. Cable-to-Equipment Ground Lugs:
   a. Burndy Corporation (Burndy)
   b. Erico Products
   c. O.Z. Gedney Company
3. Coatings:
   a. Kop-Coat, Carboline Company

1.4 SUBMITTALS

A. Submittals: In accord with Section 01340.

B. Includes, but not limited to, catalog cuts for the following:

1. Ground Rods
2. Connectors

2.0 PRODUCTS

2.1 MATERIALS

A. All materials shall be in accordance with the requirements as specified on the drawings and the referenced specification details.

B. Wire and Cable:

1. In general, ground cables shall be bare, or insulated soft or medium hard drawn, Class A or Class B stranded copper, of sizes shown on the drawings.
2. Ground cables that are direct buried and part of an electrode system shall be bare.
3. Conductor Sizes:
   a. As indicated for specific connections or as required by NEC.
   b. For required connections not indicated, use conductor size not less than No. 2/0 AWG if buried in earth or cast in concrete, or No. 6 AWG at other locations.

C. Ground Rods:

1. Copper-clad steel or copper-alloy sectional-type rods. Copperweld 9400 Series or equivalent.
2. One end pointed to facilitate driving.
3. 3/4-inch diameter and 10-feet long with diameter and length stamped near top of rod.

D. Connection Materials:

1. Below Ground
   a. Cable-to-cable, cable-to-rod, and cable-to-connector connections of exothermic-welding-type process.
2. Above Ground
   a. Compression type unless otherwise indicated on the drawings.
   b. Bolted to equipment housing with silicon bronze bolts and lock washers.
3. Cable to building column connections by exothermic-welding type process.
4. Ground Rod Clamps: One piece cast bronze with safety set screw. Copperweld 6500 Series or equivalent.

E. Coatings

1. Kop-Coat Bitumastic No. 50 asphaltic coating.

3.0 EXECUTION

3.1 INSPECTION

A. Do not cover connections before they are inspected by Engineer.

3.2 INSTALLATION

A. General

1. Copper ground wire shall be used on interior and exterior installations and in conduit runs for equipment grounding.

2. All electrical equipment and conduit installed under this contract shall be grounded as required by NEC, indicated on the contract drawings and as specified herein.

B. Wire and Cable

1. Install using as few joints as possible.
2. Suitably protect cable against damage during construction.
3. Replace or suitably repair cable if damaged by anyone before final acceptance.
4. Route runs as indicated or required by NEC.
5. Route where possible for maximum physical protection.

C. Ground Rods

1. Install rods as indicated by driving and not by drilling or jetting.
2. Drive rods into unexcavated portion of the earth where possible.
3. Where rods must be installed in excavated areas, drive rods into earth after compaction of backfill is completed.
4. Drive to a depth such that top of rods will be approximately 24 inches below final grade, or subgrade, and connect main grid ground cable thereto.

D. Connections

1. Conform to manufacturer's instructions.
2. Chemically degrease and dry completely before welding connections.
3. Apply one coat of asphaltic coating to all exothermic-welded connections to be buried.
4. Make connections to equipment as follows:

   a. Make up clean and tight to assure a low-resistance connection with resistance drop not exceeding 1 ohm.

   E. Install so as not to be susceptible to mechanical damage during operation or maintenance of equipment.

E. Metallic Conduit Ground

1. Adequately and properly ground at all terminal points and wherever isolated from equipment or grounded steel.
2. Where extending into floor-mounted equipment from below, connect to equipment ground bus or frame.
3. All conduit shall be grounded directly or through equipment frames and ground busses to the ground system conductor which shall be minimum of No. 6 bare copper.

F. Box Grounds

1. Unless grounded by conduit system, ground all boxes by direct copper connection.

3.3 FIELD TESTING

A. Measure resistance of ground system to each ground riser.

B. Record results and notify Engineer if any reading exceeds 25 ohms. If the resistance exceeds 25 ohms, then ground rod(s) shall be added. Additional rods shall be driven at least 6 feet away from any existing rods and shall be tied to the existing ground system.

C. Test at least three of each type of ground connections and not less than 25 percent of all ground connections.

D. Test by one of the following methods for resistance measurement:

1. Three-point method, using an ammeter and voltmeter and a-c- or d-c power supply.

2. Commercial instrument method approved for such type testing.

* * * END OF SECTION * * *

SECTION 16455

DRY-TYPE TRANSFORMERS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Requirements: Section 16010

1.2 DESCRIPTION

A. Furnish all labor, material, equipment, instruments, supervision, and accessories as required to install the dry-type transformers.

B. All transformers shall be properly grounded as indicated on the drawings or as required by the NEC and established safety practices.

1.3 QUALITY ASSURANCE

A. Applicable Codes and Standards: Shall be the latest revisions, supplements and amendments to the following:

1. ANSI C2: National Electrical Safety Code (NESC).
2. ANSI/NFPA 70: National Electrical Code (NEC).
3. ANSI Standard C57.12.50: Ventilated Dry-Type Distribution Transformers.
4. NEMA Standard ST20: Dry-Type Transformers for General Applications.
5. UL Standard 1561: Dry-Type General Purpose and Power Transformers.

B. Acceptable Manufacturers:

1. General Electric
2. Westinghouse
3. Square D
4. I-T-E (Siemens)

1.4 SUBMITTALS

A. Submittals: In accord with Section 01340.

B. Includes, but not limited to, catalog cuts for the following:

1. Transformer, single-phase, 480 volts primary, 120/240 volts secondary, 60 hertz.

2.0 PRODUCTS

2.1 MATERIALS

A. Design Requirements:

1. Transformer sizes shall be as indicated.
2. Transformer construction and testing shall meet or surpass all applicable requirements of "Applicable Standards".
3. All transformers shall bear the UL label and shall be acceptable for installation in the locations indicated.
4. All transformers shall be supplied from the same manufacturer.

2.2 DRY-TYPE TRANSFORMERS

A. Three-phase transformers shall be 480 volt primary. Transformers shall have a minimum of 4-2 1/2% full capacity primary taps.

B. Transformers shall be 150°C-temperature rise above 40°C ambient. All insulating materials to be in accordance with NEMA ST20 Standard for a 220°C UL component recognized insulation system.

C. Transformer coils shall be of the continuous wound construction and shall be impregnated with nonhygroscopic, thermosetting varnish.

D. All cores to be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The completed core and coil shall then be bolted to the base of the enclosure but isolated therefrom by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. The vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating systems requiring the complete removal of all fastening devices will not be acceptable.

E. Transformers shall be in a heavy gauge, sheet steel, ventilated enclosure. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and National Electrical Code standards for ventilated enclosures. Transformers through 100 kVA shall be designed so they can be either floor or wall mounted. Above 100 kVA they shall be floor mounted design.

F. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed, and finished with a grey, baked enamel.

G. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.

H. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible-grounding conductor sized in accordance with applicable NEMA, IEEE, and ANSI standards.

I. Sound levels shall be guaranteed by the manufacturer not to exceed 50 dB.

3.0 EXECUTION

3.1 INSPECTION

A. Verify location and mounting requirements for each transformer.

B. Verify voltage rating and connections for each transformer prior to installation.

C. Examine transformers for damage and replace prior to installation.

3.2 INSTALLATION

A. Install transformers in accordance with manufacturer's instructions, the drawings, and NEC.

B. Properly ground transformers to ground system.

C. Properly support and align transformers and provide all necessary accessories and steel shapes for support of the transformers.

D. Coordinate complete transformer installation with the facility construction.

3.3 TESTING

A. Refer to Section 16010, this Division, for general testing criteria.

B. Test all transformers for proper operation and correct phasing.

C. Perform all tests as recommend by the transformer manufacturer and requested by the Engineer.

* * * END OF SECTION * * *

SECTION 16460

FEEDER AND BRANCH CIRCUITS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Requirements: Section 16010

1.2 DESCRIPTION

A. Provide all feeders shown on the Drawings.

B. Provide branch circuits to all outlets, devices, motors, appliances and electrical equipment unless otherwise noted.

2.0 PRODUCTS (Not Applicable)

3.0 EXECUTION

3.1 INSTALLATION

A. All feeder conductors to be continuous from origin to panel or equipment without splice in intermediate pull or splice box. Unless otherwise indicated each feeder raceway to contain only those conductors constituting a single feeder.

B. Feeder raceways to enter directly opposite terminal lugs where possible.

C. Provide feeder conductor identification in accordance with Section 16010: Basic Electrical Requirements.

D. Install branch circuit wiring in raceways throughout project unless otherwise indicated.

E. Verify roughing-in requirements prior to installation of branch circuits. See equipment schedules, architectural, mechanical and structural Drawings for equipment locations.

F. See Section 16050; Basic Electrical Materials and Methods, for general installation requirements.

* * * END OF SECTION * * *

SECTION 16470

EQUIPMENT CONNECTIONS

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Requirements: Section 16010

1.2 DESCRIPTION

A. Connect to all equipment noted or as scheduled on the Drawings, and provide all cords, cord caps, circuit protection, disconnect switches and necessary devices required for proper connection of equipment.

B. All control devices furnished by subcontractor are to be set in place by him unless otherwise noted. Control wiring between starters, hydraulic or pneumatic electric switches, electrically operated control components, etc. provided by electrical contractor unless indicated otherwise.

2.0 PRODUCTS

2.1 MATERIALS

A. Disconnect switches: Heavy duty unfused unless otherwise noted. Disconnect switches for fractional horsepower, single phase motors may be motor rated toggle switches. Enclosures for disconnect switches as shown or required for conditions encountered.

3.0 EXECUTION

3.1 INSPECTION

A. Verify exact location and method of connection to each piece of equipment prior to roughing-in. Where roughing-in requirements are different from that shown on the Drawings, verify with Engineer before proceeding.

B. Determine voltage and phase of each item before connecting, and if characteristics are not proper for energy available immediately notify Engineer.

C. Verify location of all control devices with subcontractor.

D. Examine location of all equipment to assure adequate clearance for operation and connection.

E. Obtain drawings from subcontractor and equipment suppliers to insure proper connections.

3.2 INSTALLATION

A. Connect motors to provide proper direction of rotation.

B. Make connections to equipment in accordance with manufacturer's instructions and NEC requirements.

C. Install raceway entrances to roof mounted equipment inside equipment bases wherever possible to eliminate penetrating roofs.

D. Test all circuits for fusing, continuity and control.

E. Coordinate work with other subcontractors.

* *.* END OF SECTION * * *

SECTION 16500

LIGHTING

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Requirements: Section 16010

B. Basic Electrical Materials and Methods: Section 16050

1.2 ADAPTATION OF EQUIPMENT

A. Furnish equipment readily adaptable for installation and operation in the structure in the manner shown on the drawings.

B. Assume full responsibility for alterations of planned structure to accommodate actual equipment furnished.

C. Make and coordinate all required changes, including structural redesign if required to accommodate actual equipment furnished.

D. Provide all such alterations free of extra cost to the Owner or his representatives.

E. Provide fixtures complete with lamps, ballasts, reflectors, diffuser, lenses, louvers, shielding, hangers, accessories and fittings.

1.3 SUBMITTALS

A. Shop Drawings and Data: In accordance with procedures set forth in Section 01340, submit picture, complete assembly, and installation drawings together with detailed specifications and data covering materials used, parts, devices, and other accessories forming part of the lighting equipment, including, but not limited to:

1. Foot candle distribution pattern, each axis if unsymmetrical.
2. Maintenance factors.
3. Coefficient of utilization.
4. Lamp rated lumens and wattage.

B. Ballast type and protection.

B. Consideration of fixtures submitted will be based on:

1. Comparison with the catalogue data for the fixtures specified.
2. Must be UL listed and approved for locations indicated.
3. All fixtures submitted at one time.
4. Sample fixture when specifically requested by Engineer.

C. Operation and Maintenance Manuals:

1. Supply operation and maintenance manuals prepared by the equipment supplier and covering:
    a. Assembly, installation, adjustment and checking instructions.
    b. Parts list.
    c. Outline, cross sections, and assembly drawings, illuminating engineering data; and wiring diagrams.
2. Operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

1.4 PROTECTION

A. Box, crate, or otherwise completely enclose and protect all equipment during shipment, handling, and storage.

B. Protect equipment from exposure to elements and keep thoroughly dry at all times.

C. Painted Surfaces:
    1. Protect against impact, abrasion, discoloration, and other damage.
    2. Repaint, to satisfaction of Engineer, all painted surfaces that are damaged prior to final acceptance.
    3. Protect electrical equipment, controls, insulation, etc. against moisture and water damage.

1.5 EQUIPMENT GUARANTEE

A. Guarantee all equipment against:
    1. Faulty or inadequate design.
    2. Improper assembly, erection, or handling.
    3. Defective workmanship or materials.
    4. Leakage, breakage, or other failure.

B. Provide guarantee as specified in General Conditions.

1.6 QUALITY ASSURANCE

A. Applicable Standards: Shall be the latest revisions, supplements and amendments to the following:
    1. Certified Ballast Manufacturers (CBM) - Ballasts
    2. Illuminating Engineering Society (IES)
    3. Reflector and Lamp Manufacturers (RLM) Standards Institute
    4. Underwriters' Laboratories, Inc. (UL)
        a. UL Standard 1029: High Intensity Discharge Lamp Ballasts
        b. UL Standard 1571: Incandescent Lighting Fixtures
        c. UL Standard 1572: High Intensity Discharge Lighting Fixtures

5. American National Standards Institute (ANSI):
    a. Applicable codes under C78 (Electric Lamps) for:
        - High Intensity Discharge
        - Incandescent
    b. Applicable codes under C81: Electric Lamp Bases and Holders
    c. Applicable codes under C82: Lamp Ballasts and Transformers
6. ANSI/NFPA 70: National Electrical Code (NEC)
7. ASTM D523: Standard Test Method for Specular Gloss
8. Federal Specification W-L-101: Incandescent Lamps
9. Federal Specification W-L-00116: Fluorescent Lamps

B. Acceptable Manufacturers:
1. Lighting Fixtures: As listed on the Lighting Schedule or approved equivalent.
2. High Intensity Discharge
    a. Jefferson Electric
    b. Advance Transformer
    c. Magnetek Lighting Products
3. High Intensity Discharge :
    a. General Electric Co.
    b. Philips Lighting
    c. Sylvania (GTE Products)

2.0 PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Furnish and install a complete and operable lighting system.

B. Provide exterior lighting systems as indicated:

1. 120 volt, 1-phase, 60 hertz.

2. 480-volt, 1-phase 60 hertz

C. The fixture catalog numbers listed on the "luminaire schedule" indicate manufacturer, fixture design, appearance, etc., desired. These fixtures shall be modified if necessary to comply with the corresponding ceiling systems and application.

D. All lighting fixtures shall bear the Underwriter's Laboratories, Inc., label and shall be acceptable for installation in the locations indicated.

E. All fixture component parts shall be manufactured and/or assembled at the manufacturing plant for shipment in one or more packages. The shipment from the fixture manufacturer shall include integrally-mounted ballasts where ballasts are required for the proper operation of the fixture lamps.

F. If fixtures specified herein are discontinued at the time the work is executed, provide suitable substitute fixtures, without additional cost, as directed by the Engineer.

G. Provide accessories such as wire guards, fusing, stem, canopies, cords, toggle bolts, etc., necessary to mount fixtures in a proper and approved method.

H. Voltage: Provide ballast for operation of fixtures at voltage shown by circuiting on Drawings, or otherwise indicated.

2.2 PERIMETER POLE LIGHTING

A. As listed on the drawings

B. Construction:

1. Rust-protected highest quality steel
2. Die-cast low copper aluminum alloy

C. Finish on entire Fixture:

1. Gray polyester powder paint finish for lighting fixture..
2. Brushed aluminum for pole.
3. Satin Aluminum for 8-ft mouting arm.

D. Optical systems:

1. Flat tempered glass lens, full cutoff

E. Poles:

1. Lengths shall not exceed 30-ft..
2. Round tapered aluminum with on mounting arm
3. Pole width shall match fixture mounting requirements.
4. Handhole for access to electrical connections shall have a raintight cover plate with attachment hardware provided.
5. Provisions for grounding shall be located immediately inside the handhole.
6. Anchor base and bolts shall be per manufacturer's requirement for the size and amount of fixtures on each pole and the wind conditions for the sites
7. All mounting hardware shall be made of AISA 300 series stainless steel.

2.3 INCANDENSCENT FIXTURES

A. Maximum temperature 90°C (194°F) at point of contact with ceiling or wall.

B. Light pattern similar to specified unit.

2.4 HIGH INTENSITY DISCHARGE (HID) FIXTURES

A. As listed or indicated on the drawings.

B. High Intensity Discharge Lamp Ballast shall conform to UL-1-29 and bear the CBM and UL labels

2.5 AREA POLE LIGHTING

A. As listed on the drawings..

B. Post Mount Luminarires

1. Construction:

a. Rust-Protected highest quality steel.

b. Die-cast aluminum ballast housing.

c. UL1572 listed suitable for wet locations.

d. HPF reactor or Lag ballast type.

C. Finish on entire fixture:

1. Gray for lighting fixture

2. Satin ground for pole.

a. Optical systems

- LEXAN® polycarbonate refractor.

3. Post mount luminaire poles:

a. Length shall not exceed 18-ft.

b. Round tapered aluminum shaft.

c. Anchor base.

D. Twin Mounting Arms Luminaires

1. Construction

a. Rust-protected highest qualtiy steel.

b. Die-cast low copper aluminum alloy.

c. Satin aluminum for mounting arm.

2. Finish on entire fixture:

a. Gray polyester powder paint finish for the lighting fixture.

b. Brushed aluminum for pole.

c. Satin aluminum for mounting arm.

3. Optical systems

a. Ovate refractor, drop lens glass.

2.6 LAMPS

A. Provide lamps manufactured by General Electric, Philips, or Sylvania unless otherwise indicated.

2.7 24-HOUR TIMERS

A. Timekeeping Capabilities

1. The control shall be utilized as a traditional 24-hour general-purpose time control.

B. Programming Attributes and Capabilities

1. The control provide for 16 events.
2. All controls shall provide a manual toggle override that will change the position of the switch until either override or the next time event.

C. Hardware Attributes

1. The control shall provide 7 days power without a battery.
2. The clock format shall be selectable 12-hour (civilian) or 24-hour (military)clock format with LCD display of time of day and day of the week.
3. Control shall be housed in a NEMA 1 steel enclosure.

2.8 SPECIAL ACCESSORIES

A. Provide as necessary to mount fixture:

1. Suspended ceiling frames
2. Stems
3. Canopies
4. Toggle bolts
5. Cords, etc.

3.0 EXECUTION

3.1 INSPECTION

A. Verify location and mounting requirements for each fixture.

B. Verify voltage at each fixture outlet prior to installation.

C. Examine fixtures for damage or broken parts and replace prior to installation.

3.2 INSTALLATION

A. General:

1. Install lighting fixtures at locations indicated on contract drawings.

2. Coordinate installation of fixtures with other subcontractors, and verify methods of hanging and supporting required.

3. Install after pipe, duct, conduit, etc., that will be installed above light fixtures have been installed unless otherwise directed by the Engineer.

4. Fixtures to be coordinated with ductwork, piping and structural members. Adjust stems as required for proper illumination of the area.

5. Properly support and align fixtures and provide all necessary accessories and steel shapes for support of the fixtures. Coordinate complete fixture installation with the facility construction.

6. All fixtures to be illuminated at time of acceptance.

7. All fixtures to be supported in a manner to meet the requirements in a Seismic Zone 4 area.

3.3 SUPPORTS AND ALIGNMENT

A. Provide proper supports for all fixtures:

1. Rods, hangers, swivel plates to suit conditions and slopes.
2. Steel angles and shapes, unistrut, spacers as required by conditions.
3. Fixture supports independent from conduit.

B. Alignment:

1. Parallel to building lines.
2. Uniform and symmetrical spacing within rooms.
3. Uniform level when suspended from sloping surfaces.

3.4 CLEANING AND TOUCH-UP

A. All lighting fixtures shall be cleaned prior to final inspection.

B. Touch-up scratched or marred surfaces to match original finish.

3.5 TESTING

A. Refer to Section 16010, this Division, for general testing criteria.

B. Test all systems for proper operation and correct wiring connections.

C. Test all lighting circuits and systems upon completion of installation to assure that the lighting loads operate satisfactorily and conform to Contract Documents.

D. Perform all tests as recommended by the system manufacturers or requested by the Engineer.

* * * END OF SECTION * * *

SECTION 16900

INSTRUMENTATION AND CONTROL

1.0 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Requirements: Section 16010

B. Basic Electrical Materials and Methods: Section 16050

1.2 DESCRIPTION

A. Refer to Drawings and Specifications for control descriptions, equipment specifications, and installation instructions.

B. The Contractor shall furnish all equipment and appurtenances which are specified or required for continuous, proper and safe operation.

C. Instrumentation subcontractor shall be responsible for installing the SCADA controller hardware for a complete system, including terminations of circuits and cables. Furnishing and installation of conduits, cables, terminals, and power supplies shall be the responsibility of the electrical subcontractor. Final hookup, checkout and acceptance testing of subsystems hardware shall be the responsibility of the instrumentation subcontractor.

D. The Contractor shall provide the communication system for the site and be responsible for final checkout and acceptance testing of the communication system software.

1. The Contractors integrator shall do the software programming. The electrical contractor shall provide assistance to the integrator during start-up and commissioning to make required hardware changes so the system operates as intended.

1.3 SUBMITTALS

A. Drawings and Data:

1. Name of manufacturer.
2. Type and model.
3. Materials of construction.
4. Configuration drawings.
5. Connections required.
6. Electrical classification and power requirements.
7. Enclosure classification.
8. Unit weight.
9. Accessories provided.
10. Environmental and operational limits.

11. Operational ranges.
12. Performance characteristics (signals, accuracy, repeatability, temperature effects, elevation effects).
13. Installation instructions.

1.4 QUALITY ASSURANCE

A. Applicable Standards: Shall be the latest revisions, supplements and amendments to the following:

1. ANSI/NFPA 70: National Electrical Code (NEC).
2. ANSI/ISA S5.1: Instrumentation Symbols and Identification.
3. ANSI/ISA S82.01: Electric and Electronic Test, Measuring, Controlling and Related Equipment
4. NEMA-ICS 1: General Standards for Industrial Control and Systems
5. NEMA-ICS 2: Industrial Control Devices, Controllers and Assemblies

2.0 PRODUCTS

2.1 ALARM MONITORING

A. The alarm monitoring system shall detect alarm conditions for discrete and analog variables. The alarm priority for each point can be set to either CRITICAL or NON-CRITICAL. Up to five (5) separate alarm conditions may be specified for each analog point: rate of change alarm, low low alarm, low alarm, high alarm, and high high alarm. An alarm deadband shall be defined to prevent a signal from oscillating in and out of alarm condition.

2. User selectable alarms will activate the local existing system and be addressed per the Engineer's requirements.

2.2 INSTRUMENTS AND CONTROLS

A. Refer to the drawings and these specifications for power, control and instrumentation requirements.

2.3 SUPERVISOR CONTROL AND DATA ACTUATION (SCADA)

A. The SCADA system shall be provided by ATSI or equivalent. The SCADA system shall allow for remote access to fully operate the system.

3.0 EXECUTION

3.1 INSTALLATION

A. Supervision and Installation:

1. Contractor shall be responsible for furnishing all equipment as indicated and wiring connections so their programming can functionally satisfy intended system requirements as described herein.

2. Contractor shall be responsible for coordination and supervision of the entire instrumentation, connections and control system.

3. Contractor shall furnish at least one factory trained and fully qualified control specialist to supervise the installing, testing, calibrating field equipment, and commissioning of the process control system.

4. Control specialists' credentials must be approved by the engineer prior to employment by the Contractor.

5. All equipment necessary for testing, calibrating and commissioning of the system shall be provided by the Contractor.

6. All equipment used for testing, calibrating and commissioning the system shall be rated to an accuracy of at least five times greater than specified accuracy of instrument involved. Evidence must be shown that test equipment accuracy’s have been certified by the National Bureau of Standards within the previous six months of use.

7. Work performed by the Contractor and supervised by manufacturer's specialists must conform to applicable codes and standards listed herein.

B. Testing:

1. Check and test all instrument wiring for identification, continuity, polarity, correct origin and termination, proper securement of terminal connectors, proper grounding and for absence of undesirable grounds.

2. Inspect each lead wire for polarity at point of origin and terminal, and demonstrate an infinite resistance between wire and ground.

3. Impose a milliamp signal at point of origin of wire and demonstrate read-outs in two milliamp increments at proper instrument or alarm device. Note discrepancies, corrections made and reimpose signal until certification is accomplished.

C. Calibration:

1. Calibrate each instrument and meter at 0%, 25%, 50%, 75% and 100% of span with test instruments simulating inputs and read outputs.

2. Provide a written calibration sheet for each instrument, which certifies its calibration to its published specified accuracy. Calibration sheet information shall include but not necessarily be limited to date, instrument tag numbers, calibration data, name of individual performing calibration, name of person supervising calibration, listing of published accuracy, permissible tolerance at each point of calibration, final calibration reading, defects encountered, action required and corrections made.

D. Commissioning:

1. Commission each instrumentation and metering loop to perform its intended function within system tolerance.

2. System tolerance is defined as root-mean-square of individual component accuracy’s included in the loop.

3. Commission each loop by simulated process inputs at process sensors of 25%, 50%, 75% and 100% of span and verifying each component responds as required within system tolerance.

4. Demonstrate the following functions:

   a. An increasing process signal does cause a change in proper direction of final control.

   b. Process controllers are set for proper action and mode. If adjustment is required, determine process dynamics in actual simulated loop operation and adjust system accordingly to demonstrate proper action and mode.

   c. Alarms operate at required settings and are activated at these settings.

   d. Critical alarms signals are audible acknowledge and test functions where required.

   e. Interlock devices operate at required settings and operate or prevent operation as intended at proper settings.

   f. Systems perform as required in both automatic and manual modes.

E. Acceptance:

1. Materials and installation are subject to inspection and approval during any phase of fabrication, erection, and testing. No exceptions to specifications shall be taken without prior approval of the Engineer.

2. Field instruments shall be identified by tag number. The identification shall be by embossed stainless steel or plastic tags which shall be mechanically fastened with wire ties. If any instrument tag is lost or missing, the Contractor shall identify and tag the instrument.

3. Labor and equipment necessary for conducting acceptance tests on all systems and components shall be provided by the instrument manufacturer. Details of the test procedure shall be submitted for approval prior to testing. Tests shall be conducted to demonstrate that the installations are correct and complete, and will provide satisfactory operation. Test data, instances of inferior workmanship and materials, improper installation, and mal-operation shall be recorded. Work failing to pass inspection shall be corrected, reinspected and retested. Final acceptance of the work shall be contingent upon the work being complete, correct, and performing in accordance with the specification requirements.

4. Representatives of Contractor and Engineer shall be present during acceptance tests, which may be scheduled with final commissioning. Concurrence of representatives is necessary before instrument system or loop and all of the associated instruments will be accepted. Signing of an acceptance form by all representatives shall constitute acceptance.

5. The Acceptance Form shall be provided by the Contractor and shall include, but not be limited to, date, tag numbers of all instruments, test data, and remarks. Space shall be provided for the representatives' signatures, with their names type in full beneath.

6. The Contractor shall provide a report certifying completion of commissioning of each instrument system. This report shall indicate calculated system tolerances or the Engineer’s operating tolerances for each output, verification that the system meets these

tolerances, and any provisional settings made to the devices. The Engineer shall countersign this report which shall constitute final acceptance of each system.

7. During the course of the work, the Contractor shall maintain a complete set of record drawings annotating changes made in the field and panel installation and wiring. This set of drawings shall be used to provide the Engineer a complete set of verified "Completed Construction Document" reproducible drawings after all installation is complete and accepted by the Engineer.

3.2 SPARE PARTS

A. The following spare parts shall be provided with the instrumentation and control system:

1. Spare fuses and lamps (ten each of each type and rating used in the systems).

2. Spare relays, if required (three of each type used in the systems).

B. Recommended spare parts lists of items Owner should have on hand.

3.3 TRAINING

A. Training of the engineer’s personnel on the proper use, maintenance, calibration, and repair of all instruments shall be provided under this contract. All testing and calibration equipment shall be provided for training. Two (2) test and calibration instruments of each type shall be provided to the Engineer for permanent use.

B. The training shall be performed by qualified representatives of the equipment manufacturer, as required.

C. Each training class day shall be a minimum of 8 hours and shall cover operation, maintenance, calibration, troubleshooting and repair of the instrument.

* * * END OF SECTION * * *

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COOPER DRUM COMPANY
OPERABLE UNIT 2
CONSTRUCTION QUALITY CONTROL PLAN

Prepared For:
Contract No. 68-W-98-225/WA No. 047-RDRD-091N
U.S. Environmental Protection Agency
Region IX
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ACRONYMS AND ABBREVIATIONS

CQC	construction quality control
CQCP	construction quality control plan
DPE	dual-phase extraction
EPA	United States Environmental Protection Agency
OU	operable unit
PVC	polyvinyl chloride
QC	quality control
RFI	Request for Information

1.0 INTRODUCTION

This is the construction quality control plan (CQCP) to be implemented during installation of the Operable Unit (OU) 2 remedial action remedy, which includes dual phase extraction (DPE) of contaminated soil vapor and any contaminated groundwater from the perched aquifer, the excavation of near-surface soils (less than 5 feet below ground surface), and implementation of institutional controls at the Cooper Drum Company Superfund Site (Cooper Drum) located in Southgate, California. This CQCP deals only with the construction aspects of the installation of the DPE system.

2.0 GENERAL REQUIREMENTS

The CQCP provides the quality control (QC) objectives, the construction quality control (CQC) manager responsibilities, the CQC phases, the types and frequencies of inspections and tests to be performed, and the required CQC reporting and documentation required for successful completion of the construction activities.

2.1 CQCP Objectives

The objective of this CQCP is to provide guidelines ensuring that required levels of quality are achieved during construction activities performed by the contractor at Cooper Drum. The method, process, and standards to perform the work are detailed in the project specifications and design drawings.

2.2 CQC Manager

The CQC manager is responsible for overall management of the CQC system and has the authority to act independently in all QC matters. Some of the individual responsibilities of the CQC manager include:

- Managing all on-site and off-site inspections and testing;
- Evaluating the results of the inspections and testing;
- Inspecting and accepting/rejecting materials delivered to the site;
- Notifying the site construction manager of acceptance or rejection of the work;
- Documenting all inspections, testing, and notifications using daily CQC reports; and
- Reviewing all submittals (Requests for Information [RFIs], As-Builts, etc.) related to QC with the engineer.

2.3 CQC Phases

To ensure that activities comply with the requirements of the specifications, the CQC oversight will be conducted in four phases: preparatory, initial, follow-up, and final. The elements of the first three phases are described below and presented in detail in Tables 2.1 through 2.3, respectively. These tables highlight some, but not all, of the CQC elements, required verification points, related specification sections, and reporting requirements. The contractor must be familiar with the work, method, and QC requirements of the work as detailed on the design drawings and specifications. Any discrepancies and uncertainties must be brought to the attention of the United States Environmental Protection Agency (EPA) and the engineer for clarification and is the responsibility of the contractor.

2.3.1 Preparatory Phase

A preparatory CQC phase will be performed prior to the start of construction. As part of this phase, the CQC manager will:

- Review and QC design drawings;
- Ensure that the client and site engineers/site manager have reviewed the design drawings and are aware of all aspects of the planned construction activities;
- Confirm that all required materials and/or equipment have been purchased and delivered to the site;
- Inspect the material and equipment and ensure that they meet all required specifications and conform to the design drawings (see Table 2.1);
- Inspect the work area and ensure that all required preliminary work has been completed, surface obstacles have been removed, underground utilities and obstructions have been identified, and all permits (if applicable) and clearances have been acquired; and
- Formally record and report the results of the preparatory phase inspection utilizing the CQCP reporting and acceptance documentation.

2.3.2 Initial Phase

The initial CQC phase will be performed after the first segments of the site remedy are constructed. During this phase, the CQC manager will:

- Inspect and verify the quality of workmanship, including the quality of the excavation, trenching, pipe layout, soil compacting, and backfilling;
- Verify that preliminary work is in compliance with specifications, design drawings and dimensions, and contract requirements;
- Review and verify construction methods;
- Review and verify the results of QC tests (see Table 2.2); and
- Formally record and report the results of the initial phase inspection utilizing the CQCP reporting and acceptance documentation.

2.3.3 Follow-Up Phase

Follow-up inspections will be performed periodically to ensure continuing compliance with contract requirements. The CQC manager will:

- Review and verify construction methods, including treatment compound construction and system installation;
- Review and verify the results of QC tests (see Table 2.3);
- Oversee completion of each definable feature of work;

- Prepare a "punch list" of items that do not conform to the approved specifications and indicate the estimated date that deficiencies will be corrected; and
- Formally record and report the results of the follow-up inspection utilizing the CQCP reporting and acceptance documentation.

TABLE 2.1

Preparatory Phase CQC Elements and Required Testing

CQC Element	Required Verification/Testing	Specifications Reference/Tests	Required Reporting
Mobilization/Site Preparation	• Coordinate with EPA representative for site access. • Review and verify design drawings and maps. • Verify location of temporary utilities. • Verify allowable staging areas.	Specifications Section: 01000 Site Description and Project Background 01010 Summary of Work 01039 Project Coordination and Meetings 01045 Cutting and Patching 01210 Preconstruction Conference 01501 Site Specific Requirements 01545 Protection of Work and Property 01600 Material and Equipment	Daily CQC Report
Utilities Survey	• Prepare and submit dig permit applications. • Verify that all utilities, including fiber optic lines, have been identified and clearly painted along the entire length of the proposed excavation.	Specifications Section: 01010 Summary of Work 01545 Protection of Work and Property	Daily CQC Report
Conveyance and Utility Piping Construction	• Verify that all location, elevation, and installation requirements are established and dig permits are acquired as needed. • Verify that field engineering sketches are developed depicting the locations of any key items not shown on the drawings. • Verify that all design drawings have been reviewed and approved. • Verify compliance in pipe and size, quantity, and materials. • Verify that pipe bedding and backfill materials are available and compliant.	Specifications Section: 02222 Excavation, Trenching, and Backfilling for SVE Piping 02234 Base Course 02551 Bituminous Paving for Roads, Streets, and Open Storage Areas 02558 Bituminous Tack Coat 02576 Fence and Concrete Removal 02579 Restoration of Rigid Pavements 02610 Pipe and Fittings •	• Daily CQC Report • Acceptance Certificates

TABLE 2.1 (Continued)

CQC Element	Required Verification/Testing	Specifications Reference/Tests	Required Reporting
Conveyance and Utility Piping Construction (Cont'd)	• Verify that stockpile or disposal sites are approved for excavated material. • Verify that the installation minimizes bends and elbows and results in efficient arrangement.		
Concrete and Structural Work	• Verify that the proposed materials meet specification. • Verify line and grade of all concrete pads. • Review the requirements of the design drawings and specifications. • Review grade, size, and layout of reinforcing steel. • Review, inspect, and verify that the designed thickness of concrete slabs meets criteria. • Verify installation of equipment and equipment housing.	Specifications Section: 02234 Base Course 03100 Concrete Formwork 03200 Concrete Reinforcement 03251 Anchors and Inserts 03252 Expansion and Contraction Joints 03300 Cast in Place Concrete	• Statement of Compliance from Vendor • Daily CQC Report • Test Reports
Electrical Work	• Verify that the proposed materials meet specification. • Review the requirements of the design drawings and specifications.	Specifications Section: 16010 Basic Electrical Requirements 16050 Basic Electrical Materials and Methods 16450 Grounding 16455 Dry Type Transformers 16460 Feeder and Branch Circuits 16470 Equipment Connections 16500 Lighting 16900 Instrumentation and Control	Daily CQC Report

CQC= construction quality control
EPA= United States Environmental Protection Agency

TABLE 2.2

Initial Phase CQC Elements and Required Testing

CQC Element	Required Verification/Testing	Specifications Reference/Tests	Required Reporting
Mobilization/Site Preparation	• Verify that all health and safety measures are in place. • Verify that site security and access controls comply with requirements. • Verify that the contractor has mobilized sufficient equipment, materials, and labor to complete the work. • Verify that all personnel have current health and safety certificates.	Specifications Section: 01000 Site Description and Project Background 01010 Summary of Work 01039 Project Coordination and Meetings 01045 Cutting and Patching 01210 Preconstruction Conference 01501 Site Specific Requirements 01545 Protection of Work and Property 01600 Material and Equipment	Daily CQC Report
Utilities Survey	• Verify that all permits have been obtained. • Verify that all utilities have been marked out.	Specifications Section: 01010 Summary of Work 01050 Field Engineering 01545 Protection of Work and Property	Daily CQC Report
Conveyance and Utility Piping Construction	• Ensure that the job site is maintained in a neat and orderly manner. • Verify that all conveyance piping is pressure-tested for leaks.	Specifications Section: 02222 Excavation, Trenching, and Backfilling for SVE Piping 02610 Pipe and Fittings	• Daily CQC Report • Acceptance Certificates • Test Reports
Concrete and Structural Work	• Verify that provisions have been arranged for on-site monitoring.	Specifications Section: 01045 Cutting and Patching 02234 Base Course 03100 Concrete Formwork 03200 Concrete Reinforcement 03251 Anchors and Inserts 03300 Cast in Place Concrete	• Daily CQC Report
Site Restoration	• Verify that the contractor has employed all equipment, materials, and labor required to provide a high quality job.	Specifications Section: 01220 Progress Meetings 01300 Submittals 01400 Quality Control 01600 Materials and Equipment 01710 Final Cleaning	Daily CQC Report

CQC= construction quality control

TABLE 2.3

Follow-Up Phase CQC Elements and Required Testing

CQC Element	Required Verification/Testing	Specifications Reference/Tests	Required Reporting
Mobilization/Site Preparation	• Verify that all plans and procedures are being followed. • Verify that daily progress meetings are being performed.	Specifications, Division 1 through 16, specifically: 01220 Progress Meetings	Daily CQC Report
Conveyance and Utility Piping Construction	• Verify that proper installation methods and procedures are followed, particularly when backfilling and compacting the trench. • Verify that safety identification tape is installed as specified over entire length of pipeline. • Verify that as-built records are maintained. • Verify that photograph log is maintained. • Verify that PVC glues and primers are stored in the proper environment. • Verify that pipes are kept clean of debris. • Verify that enclosed pipes are covered at the end of the workday to prevent undesirable materials from entering pipelines. • Verify that all conveyance piping has been pressure tested and that leaking sections have been repaired/replaced.	Specifications Section: 01720 Project Record Documents 02222 Excavation, Trenching, and Backfilling for SVE Piping 02610 Pipe and Fittings	• Daily CQC Report • As-Built Records • Photograph Logs
Concrete and Structural Work	• Verify that testing results are in compliance. • Verify that proper workmanship is occurring.	Specifications Section: 03100 Concrete Formwork 03200 Concrete Reinforcement 03300 Cast in Place Concrete	Daily CQC Report

TABLE 2.3 (Continued)

CQC Element	Required Verification/Testing	Specifications Reference/Tests	Required Reporting
Site Restoration and Landscaping	• Verify that final grading matches pre-construction conditions. Verify that work complies with specifications.	Specifications Section: 01220 Progress Meetings 01300 Submittals 01400 Quality Control 01600 Materials and Equipment 01700 Project Closeout 01710 Final Cleaning 01720 Project Record Documents	CQC Daily report

2.3.4 Final Phase

At the completion of the site remedy construction, the CQC manager will conduct a pre-final inspection to ensure that the work is, in fact, completed and that all inspection documentation (including daily CQC, test, and acceptance reports) is up to date. The CQC manager will prepare a final punch list of items that do not conform to design drawings or required specifications, and provide an estimated date the deficiencies will be corrected. The CQC manager will also define what QC tests (if any) need to be performed and will review the test results and accept or reject the affected area of work.

After the deficiencies have been addressed, the CQC manager, the site construction manager, and an EPA representative will perform a final completion acceptance inspection. The CQC manager will prepare and submit a record of the final inspections.