PacifiCorp

LEWIS RIVER

ACCLIMATION PONDS

Crab Creek
Clear Creek
Muddy River

VOLUME I

Technical Specifications
60% Submittal

Derek Nelson, PE
Project Manager

McMILLEN, LLC

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PacifiCorp Energy
Lewis River Acclimation Ponds
Technical Specifications

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SECTION 01 10 00 - SUMMARY OF WORK

PART 1 -- GENERAL

1.1 SUMMARY

A. The WORK to be performed under this Contract shall consist of furnishing plant, tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The WORK shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the WORK in good faith shall be provided by the CONTRACTOR as though originally so indicated, at no increase in cost to the OWNER.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The WORK of this Contract comprises the construction of acclimation ponds including access, acclimation channels, temporary coffer dams, various precast concrete structures, pipelines, and related items as identified on the project documents and those items required for the required improvements though not specifically identified.

B. The WORK is at three locations on USDA Forest Service (USFS) property within the Lewis River Watershed as follows:

1. The Crab Creek Site is located on USFS Road 90 near the bridge located approximately one mile downstream from Lower Falls Recreation Site.

2. The Clear Creek Site is located on USFS Road 93 near the bridge approximately 1.5 miles upstream of the confluence with Muddy River.

3. The Muddy River Site is located on USFS Road 25 near the bridge located approximately 5 miles upstream from the confluence with the Lewis River. The site is located next to a day use recreation area just north of the bridge providing paved access to the site.

1.3 CONTRACT METHOD

A. The WORK hereunder will be constructed under a single unit-price contract.

1.4 WORK BY OTHERS

A. Where 2 or more contracts are being performed at one time on the same Site or adjacent land in such manner that work under one contract may interfere with work under another, the OWNER will determine the sequence and order of the Work in either or both contracts. When the Site of one contract is the necessary or convenient means of access for performance of work under another, the OWNER may grant privilege of access or other reasonable privilege to the contractor so desiring, to the extent, amount , and in manner and at time that the OWNER may determine. No OWNER determination of method or time or sequence or order of the work or access privilege shall be the basis for a claim for delay or damage except under provisions of the General Conditions for temporary suspensions of the work. The CONTRACTOR shall conduct its operations so

as to cause a minimum of interference with the work of such other contractors, and shall cooperate fully with such contractors to allow continued safe access to their respective portions of the Site, as required to perform work under their respective contracts.

B. **Interference With Work On Utilities:** The CONTRACTOR shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the WORK, and shall schedule the WORK so as to minimize interference with said relocation, altering, or other rearranging of facilities.

1.5 CONTRACTOR USE OF SITE

A. The CONTRACTOR's use of the Site shall be limited to its construction operations, including on-Site storage of materials, on-Site fabrication facilities, and field offices.

B. The CONTRACTOR shall provide traffic control for each project site to allow public use of the USFS roads. The CONTRACTOR shall provide a written traffic control plan to the OWNER two weeks prior to mobilization to any individual site for approval.

1.6 OWNER USE OF THE SITE

A. The OWNER may utilize all or part of the existing facilities during the entire period of construction for the conduct of the OWNER's normal operations. The CONTRACTOR shall cooperate and coordinate with the OWNER to facilitate the OWNER's operations and to minimize interference with the CONTRACTOR's operations at the same time. In any event, the OWNER shall be allowed access to the Site during the period of construction.

1.7 PUBLIC USE OF SITE

A. The CONTRACTOR shall provide traffic control for each project site to allow public use of USFS roads. The CONTRACTOR shall provide a written traffic control plan to the OWNER at the Preconstruction Conference for approval in accordance with Section 01 33 00 – Contractor Submittals.

1.8 PROJECT MEETINGS

A. Preconstruction Conference

1. Prior to the commencement of WORK at the Site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by the CONTRACTOR'S Project Manager, its superintendent, and its subcontractors as the CONTRACTOR deems appropriate. Other attendees will be:

   a. ENGINEER and the Resident Project Representative.

   b. Representatives of OWNER.

   c. Governmental representatives as appropriate including but not limited to USDA Forest Service.

   d. Others as requested by CONTRACTOR, OWNER, or ENGINEER.

2. The CONTRACTOR shall bring the preconstruction conference submittals in accordance with Section 01 33 00 - Contractor Submittals.

3. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the CONTRACTOR prior to the meeting date. However, the CONTRACTOR should be prepared to discuss all of the items listed below.

    a. Status of CONTRACTOR's insurance and bonds.

    b. CONTRACTOR's tentative schedules.

    c. Transmittal, review, and distribution of CONTRACTOR's submittals.

    d. Processing applications for payment.

    e. Maintaining record documents.

    f. Critical work sequencing.

    g. Field decisions and Change Orders.

    h. Use of Site, office and storage areas, security, housekeeping, and OWNER's needs.

    i. Major equipment deliveries and priorities.

    j. CONTRACTOR's assignments for safety and first aid.

    k. Daily Report Form which the OWNER will furnish.

    l. Submittal Transmittal Form which the OWNER will furnish.

4. The OWNER will preside at the preconstruction conference and will arrange for keeping and distributing the minutes to all persons in attendance.

5. The CONTRACTOR and its subcontractors should plan on the conference taking no less than 1 full working day. The conference will cover the items listed in paragraphs 2 and 3, and reviewing the Drawings and Specifications, in extensive detail, with the ENGINEER and the OWNER.

B. Progress Meetings

1. The OWNER will schedule and hold regular on-Site progress meetings at least monthly and at other times as requested by CONTRACTOR or as required by progress of the WORK. The CONTRACTOR, OWNER and OWNER’s Representative, and all subcontractors active on the Site shall attend each meeting. The ENGINEER will be available by teleconference at OWNER’s request. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers, and other subcontractors.

2. The OWNER will preside at the progress meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings is to review the progress of the WORK, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop. During each meeting, the CONTRACTOR shall present any issues that may impact its progress with a view to resolve these issues expeditiously.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 29 73 - SCHEDULE OF VALUES

PART 1 -- GENERAL

1.1 GENERAL

A. The Schedule of Values shall be developed independent but simultaneous with the development of the CPM Schedule activities and logic.

1.2 PRELIMINARY SCHEDULE OF VALUES

A. The CONTRACTOR shall submit a preliminary Schedule of Values for the major components of the WORK at the Preconstruction Conference in accordance with Section 01 10 00 - Summary of Work. The listing shall include, at a minimum, the proposed value for the following major WORK components:

1. Mobilization: 7 percent of Contract Price

2. The total value of mechanical WORK inclusive of excavation, pipe installation, testing and backfill of pipe, and all incidental WORK associated with underground pipe installations.

3. The total value of mechanical WORK, exclusive of yard mechanical WORK included in Item 2 above. This includes piping, valves, equipment, tanks, and appurtenances at new and existing structures. Additionally, this total value shall be broken down into separate values for each new and existing structure constructed or modified as a part of the WORK.

4. The total value of structural WORK inclusive of pre-cast structures, excavation, dewatering, subgrade preparation, backfill and incidental WORK for new structures. Additionally, this total value shall be broken down into separate values for each new structure constructed as a part of the WORK.

5. The total value of site civil WORK inclusive of clearing and grubbing, paving, grading and drainage WORK.

6. The total value of other WORK not specifically included in the above items.

B. The CONTRACTOR and OWNER shall meet and jointly review the preliminary Schedule of Values and make any adjustments in value allocations if, in the opinion of the OWNER, these are necessary to establish fair and reasonable allocation of values for the major WORK components. Front end loading will not be permitted. The OWNER may require reallocation of major WORK components from items in the above listing if in the opinion of the OWNER such reallocation is necessary. This review and any necessary revisions shall be completed within 15 Working Days from the date of Notice to Proceed.

1.3 DETAILED SCHEDULE OF VALUES

A. The CONTRACTOR shall prepare and submit a detailed final Schedule of Values to the OWNER within 30 Days from the date of Notice to Proceed. The detailed Schedule of Values shall be based on the accepted preliminary Schedule of Values for major WORK components. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through

cost loading of the CPM Schedule activities, sufficient detailed breakdown shall be provided to meet this requirement. The OWNER shall be the sole judge of acceptable numbers, details and description of values established. If, in the opinion of the OWNER, a greater number of Schedule of Values items than proposed by the CONTRACTOR are necessary, the CONTRACTOR shall add the additional items so identified by the OWNER.

1. The minimum detail of breakdown of the major WORK components is indicated below. Greater detail shall be provided if requested by the OWNER.

    a. Mobilization - no breakdown required.

    b. Section 01 32 16 - CPM Construction Schedule, broken down by submittal.

    c. All piping WORK shall be broken down into individual pipelines running from and to Contract termination points. Each pipeline shall be an individual pay item unless otherwise allowed by the OWNER.

    d. Mechanical WORK shall be broken down within each structure to identify individual piping systems, equipment installation by equipment name and number, and equipment testing and checkout.

    e. Concrete structures shall be broken down into excavation, subgrade preparation, and appurtenant pre-foundation WORK, pre-cast concrete construction, etc. (sufficient breakdown shall be provided to accommodate necessary Schedule detail), and backfill.

    f. Civil site WORK shall be broken down into individual drainage piping, drainage structures, grading, gravel placement, excavation cut and fill, removal of existing pipe, clearing and grubbing and any other items determined to be necessary for the establishment of Pay and Schedule Activity items.

    g. Other WORK not specifically included in the above items shall be broken down as necessary for establishment of pay and Schedule activity items.

2. The CONTRACTOR and OWNER shall meet and jointly review the detailed Schedule of Values within 35 Days from the date of Notice to Proceed. The value allocations and extent of detail shall be reviewed to determine any necessary adjustments to the values and to determine if sufficient detail has been proposed to allow acceptable cost loading of the CPM Schedule activities. Any adjustments deemed necessary to the value allocation or level of detail shall be made by the CONTRACTOR and a revised detailed Schedule of Values shall be submitted within 40 Days from the date of Notice to Proceed.

3. Following acceptance of the detailed Schedule of Values, the CONTRACTOR shall incorporate the values into the cost loading portion of the CPM Schedule. The CPM activities and logic shall have been developed concurrent with development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM Schedule activities, where interfacing these 2 documents will require changes to each document. Schedule activities may need to be added to accommodate the detail of the Schedule of Values. Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities. Where such instances arise, the CONTRACTOR shall propose changes

to the Schedule of Values and to the CPM Schedule activities to satisfy the CPM Schedule cost loading requirements.

1.4 CROSS REFERENCE LISTING

A. To assist in the correlation of the Schedule of Values and the CPM Schedule, the CONTRACTOR shall provide a Cross Reference Listing which shall be furnished in 2 parts. The first part shall list each Scheduled Activity with the breakdown of the respective valued items making up the total cost of the activity. The second part shall list the valued item with the respective Scheduled Activity or Activities that make up the total cost indicated. In the case where a number of schedule items make up the total cost for a valued item (shown in the Schedule of Values) the total cost for each scheduled item should be indicated.

B. These listings shall be updated and submitted in conjunction with the CPM monthly submittals as stated in Specification Section 01 33 00.

C. Approved change orders reflected in the CPM Schedule shall be incorporated into the Schedule of Values as a single unit identified by the change order number.

1.5 CHANGES TO SCHEDULE OF VALUES

A. Changes to the CPM Schedule which add activities not included in the original schedule but included in the original WORK (schedule omissions) shall have values assigned as approved by the OWNER. Other activity values shall be reduced to provide equal value adjustment increases for added activities as approved by the OWNER.

B. In the event that the CONTRACTOR and OWNER agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

1.6 LIQUIDATED DAMAGES

A. The Schedule of Values information is an integral part of the scheduling and reporting under Section 01 32 16 and the progress payment information. As such, it is critical information to evaluating progress and the proper planning of the OWNER's WORK-related effort as well as their financial obligations associated with this project. Accordingly, if any submittal required by this Section is found to be incomplete or is submitted later than required, the OWNER will suffer financial loss and, accordingly, liquidated damages will be assessed against the CONTRACTOR in accordance with Article 3 of the Agreement.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 32 16 - CPM CONSTRUCTION SCHEDULE

PART 1 -- GENERAL

1.1 GENERAL

A. The CONTRACTOR shall schedule the WORK in accordance with this Section.

B. Development of the schedule, the cost loading of the schedule, monthly payment requisitions and project status reporting requirements of the Contract shall employ computerized Critical Path Method (CPM) scheduling. The CPM Schedule shall be cost loaded based on the schedule of values as approved by the OWNER in accordance with Section 01 29 73 - Schedule of Values.

C. The CPM schedule and related reports should be prepared with the current version of **Primavera Project Planner (P3)** or **SureTrak** software.

1.2 DEFINITIONS

A. **CPM Scheduling**: The term shall be interpreted to be generally as outlined in the Association of General Contractors (AGC) publication, "The Use of CPM in Construction." except that either "i-j" arrow diagrams or precedence diagramming format may be utilized. In the case of conflicts between this Section and the AGC document, this Section shall govern.

B. **Float**: Unless otherwise indicated herein, float and total float are synonymous. Total float is the period of time measured by the number of Days each non-critical path activity may be delayed before it and its succeeding activities become part of the critical path. If a non-critical path activity is delayed beyond its float period, then that activity becomes part of the critical path and controls the end date of the WORK. Thus, delay of a non-critical path activity beyond its float period will cause delay to the project itself.

1.3 SCHEDULING QUALIFICATION SUBMITTALS

A. CONTRACTOR shall submit a statement of computerized CPM capability within 10 Days after Notice to Proceed to verify that either: (1) the CONTRACTOR has in-house capability qualified to use CPM techniques and the **Primavera P3** or **SureTrak** software or (2) that the CONTRACTOR will arrange for the services of a CPM consultant so qualified. In either event the statement shall identify the individual who will perform the CPM scheduling and shall describe the construction projects required below. The statement shall also identify the contact persons for the referenced projects with current telephone and address information.

B. **Criteria**: The individual performing scheduling shall have successfully applied computerized CPM technique to at least 2 projects of similar nature, scope, and value not less than one half the Total Bid Price of this project.

1.4 INITIAL SCHEDULE SUBMITTALS

A. Where submittals are required hereunder, the CONTRACTOR shall submit 4 copies of each submittal item.

B. The CONTRACTOR shall submit 2 schedule documents at the Preconstruction Conference which serve as the CONTRACTOR's plan of operation for the initial 60 Day

period of the Contract Times and identify the manner in which the CONTRACTOR intends to complete the WORK within the Contract Times.

1. Project Plan of Operation: During the initial 60 Days of the Contract Time, the CONTRACTOR shall conduct operations in accordance with a 60 Day bar chart type schedule. The chart so prepared shall show accomplishment of the CONTRACTOR's early activities (mobilization, permit acquisition, submittals necessary for early material and equipment procurement, submittals necessary for long lead equipment procurement, CPM submittals, initial sitework and other submittals and activities required in the first 60 Days).

C. The OWNER and the CONTRACTOR shall meet to review and discuss the 60 Day plan of operation and project overview bar chart within 5 Days after submittal to the OWNER. The ENGINEER's review and comment on the schedules will be limited to conformance with the sequencing and milestone requirements in the Contract Documents. The CONTRACTOR shall make corrections to the schedules necessary to comply with the requirements and shall adjust the schedules to incorporate any missing information requested by the OWNER.

1.5 CPM SCHEDULE SUBMITTALS

A. **Original CPM Schedule Submittal**: Within 10 Days after the commencement date stated in the Notice to Proceed, the CONTRACTOR shall submit for review by the OWNER a hard copy of the CPM schedule and the computerized schedule report tabulations. The CONTRACTOR shall also submit a CD that contains the schedule submittal information. The data shall be compatible with **Primavera P3** or **SureTrak** to generate network diagrams and schedule reports identical to the hard copies submitted. This submittal shall have already been reviewed and approved by the CONTRACTOR's Project Manager, superintendent, and estimator prior to submission. The CPM schedule shall be a time-scaled network diagram of the "i-j" activity-on-arrow or precedence type. The network diagram shall describe the activities to be accomplished and their logical relationships and shall show the critical path. The CONTRACTOR's attention is directed to the requirement that the schedule shall contain sufficient detail and information to cost load the CPM schedule in accordance with the approved schedule of values under Section 01 29 73 - Schedule of Values. Each installation and sitework activity shall be cost loaded as indicated.

B. The computerized schedule report tabulations shall include the following:

1. Report of activities sorted by activity number: Activity numbers, where practical, shall correlate to the area numbers designated on the Contract Drawings as further defined in Section 01 10 00 - Summary of Work.

2. Report of activities sorted by early start date.

3. Report of activities sorted by total float.

4. Report of activities sorted by responsibility code. Responsibility codes shall be established for the CONTRACTOR, OWNER, Subcontractors, Suppliers, etc. These codes shall be identified in the Network Diagram.

5. A successor-predecessor report which shall identify the successor and predecessor activities for each activity and ties between schedule activities.

C. Analysis

1. Early Completion

a. The CONTRACTOR may show early completion on the original CPM submittal if that is its plan.

b. An original CPM submittal showing early completion shall either be accompanied by:

1) Request for change of Contract Times at zero change of Contract Price, accompanied by documentation demonstrating that the Bid was based on early completion; or

2) Demonstration in the submittal that the time difference between early completion and the original Contract Time is total float.

c. An early completion schedule unaccompanied by one of these will not be accepted.

d. The OWNER will analyze a request for Change Order in accordance with the General Conditions.

2. Float Ownership: Neither the OWNER nor the CONTRACTOR owns the float time. The project owns the float time. Liability for delay to the project completion date rests with the party causing the delay. For example, if Party A is responsible for consuming a portion of the float time and Party B later consumes the remainder of the float time plus additional time beyond the float time, Party B is responsible for the time that is a delay past the completion date. Party A would not be responsible for any delay since it did not consume all the float time, additional float time remained after its delay, and the completion date was unaffected by its tardiness.

D. **Original CPM Schedule Review Meeting**: The CONTRACTOR shall, within 25 Days from the commencement date stated in the Notice to Proceed, meet with the OWNER to review the original CPM schedule submittal. The CONTRACTOR shall have the Project Manager, superintendent, and the scheduler in attendance. The OWNER 's review will be limited to conformance with the Contract Documents. However, the review may also include:

1. Clarifications of the design intent.

2. Directions to include activities and information missing from the submittal.

3. Requests to the CONTRACTOR to clarify and revise the schedule.

E. **Revisions to the Original CPM Schedule**: Within 45 Days after the commencement date stated in the Notice to Proceed, the CONTRACTOR shall revise the original CPM schedule submittal to address review comments from the original CPM schedule review meeting and resubmit the network diagrams and reports for the OWNER 's review. The OWNER, within 14 Days from the date that the CONTRACTOR submitted the revised schedule will either (1) accept the schedule and cost loaded activities as submitted, or (2) advise the CONTRACTOR in writing to review any part or parts of the schedule which either do not meet the requirements or are unsatisfactory for the OWNER to monitor the progress and status of WORK or evaluate monthly payment requests by the CONTRACTOR. The OWNER may accept the schedule conditional upon the first

monthly CPM schedule update correcting deficiencies identified. When the schedule is accepted, it shall be considered as the "Original CPM Construction Schedule" until an updated schedule has been submitted. The OWNER reserves the right to require that the CONTRACTOR adjust, add to, or clarify any portion of the schedule which may later be discovered to be insufficient for the monitoring of WORK or approval of partial payment requests. No additional compensation will be provided for such adjustments, additions, or clarifications.

F. Acceptance

1. Acceptance of the CONTRACTOR's schedule by the OWNER will be based solely upon compliance with the requirements. By way of the CONTRACTOR assigning activity durations and proposing the sequence of the WORK, the CONTRACTOR agrees to utilize sufficient and necessary management and other resources to perform WORK in accordance with the schedule. Upon submittal of a schedule update, the updated schedule shall be considered the "current" project schedule.

2. Submission of the CONTRACTOR's progress schedule to the OWNER shall not relieve the CONTRACTOR of total responsibility for scheduling, sequencing, and pursuing the WORK to comply with the requirements of the Contract Documents, including adverse effects such as delays resulting from ill-timed WORK.

G. Monthly Updates and Periodic CPM Schedule Submittals

1. Following acceptance of the CONTRACTOR's original CPM schedule, the CONTRACTOR shall monitor the progress of the WORK and adjust the schedule each month to reflect actual progress and any changes in planned future activities. Each schedule update submittal shall be complete including information requested in the original schedule submittal and be in the schedule report format indicated below. Each update shall continue to show WORK activities including those already completed. Completed activities shall accurately depict "as built" information by indicating when the WORK was actually started and completed.

2. Neither the submission nor the updating of the CONTRACTOR's original schedule submittal nor the submission, updating, change, or revision of any other report, curve, schedule, or narrative submitted by the CONTRACTOR, nor the OWNER 's review or acceptance of any such report, curve, schedule, or narrative shall have the effect of amending or modifying in any way the Contract Times or milestone dates or of modifying or limiting in any way the CONTRACTOR's obligations under the Contract. Only a signed, fully executed Change Order can modify contractual obligations.

3. The monthly schedule update submittal will be reviewed with the CONTRACTOR during a monthly construction progress meeting held on the 20th Day of each month. The goal of these meetings is to enable the CONTRACTOR and the OWNER to initiate appropriate remedial action to minimize any known or foreseen delay in completion of the WORK and to determine the amount of WORK completed since the last schedule update. The status of the WORK will be determined by the percent complete of each activity in the updated CPM schedule. These meetings are considered a critical component of the overall monthly schedule update submittal, and the CONTRACTOR shall have appropriate personnel attend. As a minimum, the CONTRACTOR's Project Manager and superintendent shall attend these meetings. The CONTRACTOR shall plan on the meeting taking no less than 6 hours. Within 7 Days after the monthly progress meeting, the CONTRACTOR shall submit the revised CPM schedule, the revised CPM computerized tabulations,

the revised successor/predecessor report, the project status reports as defined below and the CONTRACTOR's Application for Payment. Within 5 Days of receipt of the revised submittals, the OWNER will either accept or reject the monthly schedule update submittal. If accepted, the percent complete in the monthly update shall be the basis for the Application for Payment to be submitted by the CONTRACTOR. If rejected, the update shall be corrected and resubmitted by the CONTRACTOR before the Application for Payment for the update period will be processed.

H. **Schedule Revisions**: The CONTRACTOR shall highlight or otherwise identify changes to the schedule logic or activity durations made from the previous schedule. The CONTRACTOR shall modify any portions of the CPM schedule which become infeasible because activities are behind schedule or for any other valid reason.

1.6 CHANGE ORDERS

A. Upon approval of a Change Order or upon receipt by the CONTRACTOR of authorization to proceed with additional WORK, the change shall be reflected in the next submittal of the CPM Schedule. The CONTRACTOR shall utilize a sub-network in the schedule depicting the changed WORK and its effect on other activities. This sub-network shall be tied to the main network with appropriate logic so that a true analysis of the critical path can be made. Whenever the CONTRACTOR believes that a Change Order will extend the Contract Times, the sub-network analysis herein shall be submitted with the price proposal for the change. If the CONTRACTOR does not submit the sub-network demonstrating that the change affects the Contract Times, then no subsequent claim for additional time due to the change will be accepted.

1.7 CPM STANDARDS

A. **Construction Schedules**: Construction schedules shall include a graphic network diagram and computerized schedule reports as required below for status reporting.

B. **Networks**: The CPM network shall be in a form of a time scaled "i-j" activity-on-arrow or precedence type diagram and may be divided into a number of separate sheets with suitable match lines relating the interface points among the sheets. Individual sheets shall not exceed 36-inches by 60-inches.

C. Construction and procurement activities shall be presented in a time-scaled format with a calendar time line along the entire sheet length. Each activity arrow or node shall be plotted so that the beginning and completion dates of each activity are accurately represented along the calendar time line. Every activity shall use symbols that clearly distinguish between critical path activities, non-critical activities, and free float for each non-critical activity. Activity items shall be identified by their activity number, responsibility code, duration, and dollar value. Non-critical path activities shall show total float time in scale form by utilizing a dotted line or some other graphical means.

D. **Duration Estimates**: The duration estimate for each activity shall be computed in Days and shall represent the single best estimate considering the scope of the WORK and resources planned for the activity. Except for certain non-labor activities such as curing of concrete or delivery of materials, activity duration shall not exceed 10 Days nor be less than one Day, unless otherwise accepted by the OWNER.

1.8 SCHEDULE REPORT FORMAT

A. **Schedule Reports**: Schedule reports shall be prepared based on the CPM schedule, shall be submitted on paper and floppy disk or CD, depending on file size, and shall include the following minimum data for each activity:

1. Activity numbers and responsibility codes.
2. Work Order No.
3. CIP No.
4. Estimated activity duration.
5. Activity description.
6. Activity percent completion.
7. Early start date (calendar dated).
8. Early finish date (calendar dated).
9. Late start date (calendar dated).
10. Late finish date (calendar dated).
11. Status (whether critical).
12. Total float for each activity.
13. Free float for each activity.
14. Cost value for each activity.

B. **Project Information**: Each Schedule Report shall be prefaced with the following summary data:

1. Project name.
2. CONTRACTOR name.
3. Type of tabulation.
4. Project duration.
5. Contract Times (as revised by Change Orders).
6. The commencement date stated in the Notice to Proceed.
7. The data date and plot date of the CPM Schedule.
8. If an update, cite the new schedule completion date.

1.9 PROJECT STATUS REPORTING

A. The CONTRACTOR shall furnish monthly project status reports (overview bar chart and a written narrative report) in conjunction with the revised CPM schedules as indicated above. Status reporting shall be in the form below.

B. The CONTRACTOR shall prepare and submit monthly an overview bar chart schedule of the major project components. The overview bar chart schedule shall be a summary of the current CPM schedule (original and as updated and adjusted throughout the entire construction period). The major project components shall be represented as time bars which shall be subdivided into various types of WORK including demolition, excavation and earthwork, yard piping, concrete construction, and mechanical, electrical and instrumentation installations. Major components shall include each new structure by area designation, sitework, modifications to existing structures, tie-ins to existing facilities, and plant startups.

C. Each major component and subdivision shall be accurately plotted consistent with the project overview bar chart above. It shall represent the same status indicated by early start and finish activity information contained in the latest update of the CPM schedule. In addition, a percent completion shall be indicated for each major component and subdivision. The initial submittal of the overview bar chart schedule shall be made at the time that the revised original CPM schedule is submitted to the OWNER. The CONTRACTOR shall amend the overview schedule to include any additional detail required by the OWNER. The CONTRACTOR shall include any additional information requested by the OWNER at any time during the construction of the WORK.

D. The CONTRACTOR shall prepare monthly written narrative reports of the status of the project for submission to the OWNER. Status reports shall include:

1. The status of major project components (percent complete, amount of time ahead or behind schedule) and an explanation of how the project will be brought back on schedule if delays have occurred.

2. The progress made on critical activities indicated on the CPM schedule.

3. Explanations for any lack of WORK on critical path activities planned for the last month.

4. Explanations for any schedule changes, including changes to the logic and to activity durations.

5. A list of the critical activities scheduled to be performed in the next 2 months.

6. The status of major material and equipment procurement.

7. The value of materials and equipment properly stored at the Site but not yet incorporated into the WORK.

8. Any delays encountered during the reporting period.

9. An assessment of inclement weather delays and impacts to the progress of the WORK.

E. The CONTRACTOR may include any other information pertinent to the status of the WORK. The CONTRACTOR shall include additional status information requested by the OWNER.

1.10 INCLEMENT WEATHER PROVISIONS OF THE SCHEDULE

A. The CONTRACTOR's schedule shall include at least the number of Days of delay due to unusually severe weather as required by the General Conditions.

1.11 LIQUIDATED DAMAGES

A. If any submittal required by this Section is determined by the OWNER to be incomplete or is submitted later than required, the OWNER will suffer financial loss, and accordingly, the CONTRACTOR shall pay liquidated damages in accordance with Article 3 of the Agreement.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 33 00 - CONTRACTOR SUBMITTALS

PART 1 -- GENERAL

1.1 GENERAL

A. Wherever submittals are required in the Contract Documents, submit them to the OWNER which in turn will submit them to the ENGINEER for review as required.

B. Within 14 Days after the date of commencement as stated in the Notice to Proceed, the CONTRACTOR shall submit the following items for review:

1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitutes ("Or-Equal") submittals listed in the Bid. The schedule of submittals shall be based on CONTRACTOR's priority, planned construction sequence and schedule, long lead items, and size of submittal package. Allow time for re-submittals.

2. A list of permits and licenses the CONTRACTOR shall obtain, indicating the agency required to grant the permit and the expected date of submittal for the permit and required date for receipt of the permit.

1.2 PRECONSTRUCTION CONFERENCE SUBMITTALS

A. At the preconstruction conference of Section 01 10 00 - Summary of Work, the submit the following items to the OWNER for review:

1. A revised schedule of Shop Drawings, Samples, and proposed Substitute ("Or-Equal") submittals listed in the Bid.

2. A list of permits and licenses the CONTRACTOR shall obtain, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.

3. A preliminary schedule of values in accordance with Section 01 29 73 - Schedule of Values.

4. A complete project plan of operation in accordance with Section 01 32 16 - CPM Construction Schedule.

5. A detailed layout and planned location of the field office. The office shall not be shipped to the Site until the layout is approved by the OWNER.

6. A detailed traffic control plan to allow public access and use of the Forest Service Road system.

7. A detailed Storm Water Pollution and Prevention Plan that meets all federal, state, and local requirements.

1.3 SHOP DRAWINGS

A. Wherever called for in the Contract Documents or where required by the OWNER, the CONTRACTOR shall furnish two copies plus one reproducible copy and an electronic copy if available, of each Shop Drawing submittal. Shop Drawings may include detail

design calculations, shop-prepared drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. Whenever the CONTRACTOR is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state wherein the project is located, unless otherwise indicated.

B. Shop Drawing submittals shall be accompanied by a submittal transmittal form. A submittal without the form or where applicable items on the form are not completed will be returned for resubmittal.

C. Organization

1. A single submittal transmittal form shall be used for each technical specification section or item or class of material or equipment for which a submittal is required. A single submittal covering multiple sections will not be acceptable, unless the primary specification references other sections for components. Example: if a pump section references other sections for the motor, shop-applied protective coating, anchor bolts, local control panel, and variable frequency drive, a single submittal would be acceptable. A single submittal covering vertical turbine pumps and horizontal split case pumps would not be acceptable.

2. On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components. Relate the submittal components to specification paragraph and subparagraph, Drawing number, detail number, schedule title, room number, or building name, as applicable.

3. Unless indicated otherwise, terminology and equipment names and numbers used in submittals shall match those used in the Contract Documents.

D. Format

1. Minimum sheet size shall be 8-1/2 inches by 11-inches. Maximum sheet size shall be 11-inches by 17-inches. Every page in a submittal shall be numbered in sequence. Each copy of a submittal shall be collated and stapled or bound, as appropriate. The OWNER will not collate sheets or copies.

2. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with complete pertinent data capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports. Sufficient level of detail shall be presented for assessment of compliance with the Contract Documents.

3. Each submittal shall be assigned a unique number. Submittals shall be numbered sequentially, and the submittal numbers shall be clearly noted on the transmittal. Original submittals shall be assigned a numeric submittal number followed by a letter of the alphabet to distinguish between the original submittal and each resubmittal. For example, if submittal 25-A requires a resubmittal, the first resubmittal will bear the designation "25-B" and the second resubmittal will bear the designation "25-C" and so on.

E. Disorganized submittals that do not meet the requirements of the Contract Documents will be returned without review.

F. Except as may otherwise be indicated, the OWNER will return prints of each submittal to the CONTRACTOR with comments noted thereon, within 30 Days following receipt by

the OWNER. It is considered reasonable that the CONTRACTOR will make a complete and acceptable submittal to the OWNER by the first resubmittal on an item. The OWNER reserves the right to withhold monies due to the CONTRACTOR to cover additional costs of the OWNER's review beyond the first resubmittal. The OWNER'S maximum review period for each submittal or resubmittal will be 30 Days. Thus, for a submittal that requires 2 resubmittals before it is complete, the maximum review period could be 90 Days.

G. If a submittal is returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission will not be required.

H. If a submittal is returned marked "MAKE CORRECTIONS NOTED," CONTRACTOR shall make the corrections on the submittal, but formal revision and resubmission will not be required.

I. If a submittal is returned marked "AMEND-RESUBMIT," the CONTRACTOR shall revise it and shall resubmit the required number of copies. Re-submittal of portions of multi-page or multi-drawing submittals will not be allowed. For example, if a Shop Drawing submittal consisting of 10 drawings contains one drawing noted as "AMEND - RESUBMIT," the submittal as a whole is deemed "AMEND - RESUBMIT," and 10 drawings are required to be resubmitted.

J. If a submittal is returned marked "REJECTED-RESUBMIT," it shall mean either that the proposed material or product does not satisfy the specification, the submittal is so incomplete that it cannot be reviewed, or is a substitution request not submitted in accordance with Section 01 60 00 - Products, Materials, Equipment, and Substitutions. The CONTRACTOR shall prepare a new submittal and shall submit the required number of copies.

K. Re-submittal of rejected portions of a previous submittal will not be allowed. Every change from a submittal to a resubmittal or from a resubmittal to a subsequent resubmittal shall be identified and flagged on the resubmittal.

L. Fabrication of an item may commence only after the OWNER has reviewed the pertinent submittals and returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as changes to the contract requirements.

M. Submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR prior to submission to the OWNER. Each submittal shall be dated and signed by the CONTRACTOR as being correct and in strict conformance with the Contract Documents. In the case of Shop Drawings, each sheet shall be so dated and signed. Any deviations from the Contract Documents shall be noted on the transmittal sheet. The OWNER will only review submittals that have been so verified by the CONTRACTOR. Non-verified submittals will be returned to the CONTRACTOR without action taken by the OWNER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

N. Corrections or comments made on the CONTRACTOR's Shop Drawings during review do not relieve the CONTRACTOR from compliance with Contract Drawings and Specifications. Review is for conformance to the design concept and general compliance with the Contract Documents only. The CONTRACTOR is responsible for confirming and correlating quantities and dimensions, fabrication processes and

techniques, coordinating WORK with the trades, and satisfactory and safe performance of the WORK.

1.4 SAMPLES

A. The CONTRACTOR shall submit the number of samples indicated by the Specifications. If the number is not indicated, submit not less than 3 samples. Where the amount of each sample is not indicated, submit such amount as necessary for proper examination and testing by the methods indicated.

B. Samples shall be individually and indelibly labeled or tagged, indicating the salient physical characteristics and manufacturer's name. Upon acceptance by the OWNER, one set of the samples will be stamped and dated by the OWNER and returned to the CONTRACTOR, one set of samples will be retained by the OWNER, and one set shall remain at the Site in the OWNER's field office until completion of the WORK.

C. Unless indicated otherwise, the OWNER will select colors and textures from the manufacturer's standard colors and standard materials, products, or equipment lines. If certain samples represent non-standard colors, materials, products, or equipment lines that will require an increase in Contract Times or Price, the CONTRACTOR shall clearly state so on the transmittal page of the submittal.

D. The CONTRACTOR shall schedule sample submittals such that:

1. Sample submittals for color and texture selection are complete so the OWNER has 45 Days to assemble color panels and select color and texture dependent products and materials without delay to the construction schedule, and

2. After the OWNER selects colors and textures, the CONTRACTOR has sufficient time to provide the products or materials without delay to the construction schedule. The Contract Times will not be extended for the CONTRACTOR's failure to allow enough review and approval or selection time, failure to submit complete samples requiring color or texture selection, or failure to submit complete or approvable samples.

1.5 TECHNICAL MANUAL

A. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical, and instrumentation equipment in an organized manner in the Technical Manual. It shall be written so that it can be used and understood by the OWNER's operation and maintenance staff.

B. The Technical Manual shall be subdivided first by specification section number; second, by equipment item; and last, by "Category." The following "Categories" shall be addressed (as applicable):

1. Category 1 - Equipment Summary

a. Summary: A table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.

2. Category 2 - Operational Procedures

a. Procedures: Manufacturer-recommended procedures on the following shall be included in Part 2:

1) Installation

2) Adjustment

3) Startup

4) Location of controls, special tools, equipment required, or related instrumentation needed for operation

5) Operation procedures

6) Load changes

7) Calibration

8) Shutdown

9) Troubleshooting

10) Disassembly

11) Reassembly

12) Realignment

13) Testing to determine performance efficiency

14) Tabulation of proper settings for pressure relief valves, low and high pressure switches, and other protection devices

15) List of all electrical relay settings including alarm and contact settings

3. Category 3 - Preventive Maintenance Procedures

   a. Procedures: Preventive maintenance procedures shall include manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by maintaining the equipment in place.

   b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.

4. Category 4 - Parts List

   a. Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.

   b. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list. Part numbers shall appear on the drawings with arrows to the corresponding part.

5. Category 5 - Wiring Diagrams

a. Diagrams: Category 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

6. Category 6 - Shop Drawings

a. Drawings: This category includes approved shop or fabrication drawings with OWNER comments and corrections incorporated, complete with dimensions.

7. Category 7 - Safety

a. Procedures: This category describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

8. Category 8 - Documentation:

a. Equipment warranties, affidavits, certifications, calibrations, laboratory test results, etc. required by the Technical Specifications shall be placed in this category.

C. Format

1. Each Technical Manual shall be bound in standard size 3 ring hardcover binders labeled on the spine and cover with project name, OWNER's project number, specification section number, equipment name, and equipment identification number.

2. Each Binder shall contain its own detailed table of contents at the front, plus a summary level table of contents information for the other binders in a multi-binder set.

3. Documents in binders shall be 3 hole punched, no text shall be punched out, and pages larger than 8-1/2 by 11 shall be folded to 8-1/2 by 11.

4. Each final set of Technical Manuals shall include a CD with electronic files:

a. Project specific files created in Microsoft Office 2007, Auto Cad version 2010, Adobe Acrobat portable document format, or other software required by the specifications.

b. Manufacturer literature in Adobe Acrobat portable document format.

D. Review Process

1. The CONTRACTOR shall furnish 3 draft Technical Manuals for each Specification Section that requires a Manual. The OWNER will retain one copy and will return one copy to the CONTRACTOR with review comments.

2. The CONTRACTOR shall incorporate comments into the draft and submit 5 identical copies of the final Manual for acceptance.

E. Except where indicated otherwise, manuals shall be submitted in final form to the OWNER not later than the 75 percent of construction completion date. Discrepancies found by the OWNER shall be corrected within 30 Days from the date of written notification by the OWNER.

F. WORK under this Contract involves start-up and commissioning of equipment in multiple areas of the facility at independent times within the project schedule. Manuals shall be complete for each piece of equipment prior to placing equipment into service final acceptance of the equipment by the OWNER training of the OWNER's personnel. Except where indicated otherwise, manuals shall be submitted for review in final form a minimum of 30 Days prior to pre-commissioning and commissioning the start of performance testing for each piece of equipment. Discrepancies found by the OWNER shall be corrected within 30 Days from the date of written notification by the OWNER.

G. Manuals that are incomplete or unacceptable at the schedule criterion above will constitute sufficient justification for the OWNER to retain the amount in paragraph “Technical Manual Submittals" of Section 01 77 00 - Project Closeout, from any monies due the CONTRACTOR.

1.6 SPARE PARTS LIST

A. The CONTRACTOR shall furnish to the OWNER 5 identical sets of spare parts information for mechanical, electrical, and instrumentation equipment. The spare parts list shall include those spare parts that each manufacturer recommends be maintained by the OWNER in inventory.

1. Sources and Pricing: The spare parts list shall include a current list price of each spare part. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to assist the OWNER in ordering.

2. Format: The CONTRACTOR shall cross-reference spare parts lists to the equipment numbers designated in the Contract Documents. The spare parts lists shall be bound in standard size, 3 ring, loose-leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2-1/2 inches. Each copy of the spare parts lists shall be accompanied by a CD containing the lists in electronic format, in files created under Microsoft Office 2007.

1.7 RECORD DRAWINGS

A. The CONTRACTOR shall maintain one set of Drawings at the Site for the preparation of record drawings. On these, it shall mark every project condition, location, configuration, and any other change or deviation which may differ from the Contract Drawings at the time of award, including buried or concealed construction and utility features that are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of buried utilities that differ from the locations indicated, or that were not indicated on the Contract Drawings. Said record drawings shall be supplemented by any detailed sketches as necessary or as CONTRACTOR is directed, to fully indicate the WORK as actually constructed. These record drawings are the CONTRACTOR's representation of as-built conditions, shall include revisions made by addenda and change orders, and shall be maintained up-to-date during the progress of the WORK. Red ink shall be used for alterations and notes. Notes shall identify relevant Change Orders by number and date.

B. Paper copies of the record drawings shall be submitted on the 20th Day of every third month after the month in which the Notice to Proceed is given as well as at completion of WORK. Failure to submit complete record drawings on or before the 20th Day will enact the liquidated damages clause for interim record drawing submittals described in Article 3 of the Agreement.

C. In the case of those drawings that depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the record drawings shall be updated by indicating those portions which are superseded by change order drawings or final Shop Drawings, and by including appropriate reference information describing the change orders by number and the Shop Drawings by manufacturer, drawing, and revision numbers.

D. Disorganized or incomplete record drawings will not be accepted. The CONTRACTOR shall revise them and resubmit within 10 Days.

E. Record drawings shall be accessible to the OWNER during the construction period.

F. Final payment will not be acted upon until the record drawings have been completed and delivered to the OWNER. Said up-to-date record drawings shall be in the form of a set of prints with carefully plotted information overlaid and an electronic form under Microsoft Office 2007, Auto Cad Version 2010, or other software required by the Specifications.

G. Information submitted by the CONTRACTOR will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information.

1.8 QUALITY CONTROL (QC) SUBMITTALS

A. Quality control submittals are defined as those required by the Specifications to present documentary evidence to the OWNER that the CONTRACTOR has satisfied certain requirements of the Contract Documents.

B. Unless otherwise indicated, QC submittals shall be submitted:

1. Before delivery and unloading, for the following types of submittals:

a. Manufacturers' installation instructions

b. Manufacturers' and Installers' experience qualifications

c. Ready mix concrete delivery tickets

d. Design calculations

e. Affidavits and manufacturers' certification of compliance with indicated product requirements

f. Laboratory analysis results

g. Factory test reports

2. Within 30 Days of the event documented for the following types of submittals:

a. Manufacturers' field representative certification of proper installation

b. Field measurement

c. Field test reports

d. Receipt of permit

e. Receipt of regulatory approval

C. The OWNER will record the date that a QC submittal was received and review it for compliance with submittal requirements, but the review procedures above for Shop Drawings and samples will not apply.

1.9 INFORMATIONAL SUBMITTALS

A. Informational submittals formalize the flow of information between the CONTRACTOR and the OWNER and the ENGINEER. Forms will be employed for such purpose.

B. The following forms may be used but the list is not necessarily inclusive:

CM - 205 Allocation of Total Contract Price

CM - 302 Request for Clarification

CM - 306 Contractor's Submittal Transmittal Form

CM - 307 Memorandum of Delay

CM - 432 System Outage Request

CM - 503 Request for Shutdown

CM - 1001 Monthly Payment Estimate Summary

CM - 1003 Request for Payment for Material on Hand

CM - 1004 Request for Adjustment of Retainage

CM - 1005 Consent of Surety for Reduction of Partial Release of Retainage

CM - 1006 Consent of Surety for Final Payment

CM - 1007 Affidavit of Payment

CM - 1101 Field Order

CM - 1102 Initiator Change Order Request

CM - 1106 Deviation Request

CM - 1110 Substitution Request Form

CM - 1202 Contractor's Certification of Completion

CM - 1301 Partial Waiver of Lien

CM - 1302 Final Waiver of Lien

CM - 1303 Affidavit of Release of Lien

1.10 CONSTRUCTION PHOTOGRAPHS

A. Starting when the WORK begins and continuing for as long as the WORK is in progress, not less than 12 exposures at intervals no more than 1 week apart, consisting of different subjects or angles or view at different locations of progress on the Site. Digital electronic copies shall be furnished to the OWNER and ENGINEER within 1 week after exposure. Prints shall become sole property of the OWNER upon submittal by the CONTRACTOR.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 42 19 - REFERENCE STANDARDS

PART 1 -- GENERAL

1.1 GENERAL

A. **Titles of Sections and Paragraphs:** Titles and subtitles accompanying specification sections and paragraphs are for convenience and reference only and do not form a part of the Specifications.

B. **Applicable Publications:** Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is indicated, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Contract is advertised for Bids shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth in the Specifications or shown on the Drawings will be waived because of any provision of or omission from said standards or requirements.

C. **Specialists, Assignments:** In certain instances, specification text requires (or implies) that specific WORK is to be assigned to specialists or expert entities who must be engaged to perform that WORK. Such assignments shall be recognized as special requirements over which the CONTRACTOR has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the WORK; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of WORK is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract requirements remains with the CONTRACTOR.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The CONTRACTOR shall construct the WORK in accordance with the Contract Documents and the referenced portions of those referenced codes, standards, and specifications.

B. WORK is advertised for Bids shall apply to the WORK herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the OWNER for clarification and direction prior to ordering or providing any materials or furnishing labor. The CONTRACTOR shall bid for the most stringent requirements.

D. References to "OSHA Regulations for Construction" shall mean **Title 29, Part 1926, Construction Safety and Health Regulations,** Code of Federal Regulations (OSHA), including all changes and amendments thereto.

E. References to "OSHA Standards" shall mean **Title 29, Part 1910, Occupational Safety and Health Standards,** Code of Federal Regulations (OSHA), including all changes and amendments thereto.

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

A. The CONTRACTOR shall be responsible that all WORK included in the Contract Documents, regardless if indicated or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other federal, state, and local regulations governing the storage and conveyance of hazardous materials, including petroleum products.

B. Where no specific regulations exist and the OWNER has not waived the requirement in writing, chemical, hazardous, and petroleum product piping and storage in underground locations shall be double containment piping and tanks or be installed in separate concrete trenches and vaults with an approved lining that cannot be penetrated by the chemicals.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 45 00 - QUALITY CONTROL

PART 1 -- GENERAL

1.1 DEFINITION

A. Specific quality control requirements for the WORK are indicated throughout the Contract Documents. The requirements of this Section are primarily related to performance of the WORK beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements.

1.2 INSPECTION AT PLACE OF MANUFACTURE

A. Unless otherwise indicated, all products, materials, and equipment shall be subject to inspection by the OWNER, OWNER's Representative and/or ENGINEER at the place of manufacture.

B. The presence of the OWNER, OWNER's Representative and/or ENGINEER at the place of manufacturer, however, shall not relieve the CONTRACTOR of the responsibility for providing products, materials, and equipment which comply with all requirements of the Contract Documents. Compliance is a duty of the CONTRACTOR, and said duty shall not be avoided by any act or omission on the part of the OWNER.

1.3 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing will be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, the OWNER reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of the ENGINEER will assure the OWNER that the quality of the workmanship is in full accord with the Contract Documents.

B. Any waiver by the OWNER of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the testing or other quality assurance requirements originally indicated, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial WORK, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, the OWNER reserves the right to make independent investigations and tests, and failure of any portion of the WORK to meet any of the requirements of the Contract Documents, shall be reasonable cause for the OWNER to require the removal or correction and reconstruction of any such WORK in accordance with the General Conditions.

1.4 INSPECTION AND TESTING SERVICE

A. Inspection and testing laboratory service shall comply with the following:

1. Unless indicated otherwise by the Technical Specifications, the OWNER will appoint, employ, and pay for services of an independent firm to perform inspection and testing or will perform inspection and testing itself.

2. The OWNER or independent firm will perform inspections, testing, and other services as required by the OWNER under Paragraph 1.3C above.

3. Reports of testing, regardless of whether the testing was the OWNER'S or the CONTRACTOR'S responsibility, will be submitted to the OWNER in duplicate indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

4. The CONTRACTOR shall cooperate with the OWNER or independent firm and furnish samples of materials, design mix, equipment, tools, storage, and assistance as requested.

5. The CONTRACTOR shall notify OWNER 24 hours prior to the expected time for operations requiring inspection and laboratory testing services.

6. Retesting required because of non-conformance to requirements shall be performed by the same independent firm on instructions by the OWNER. The CONTRACTOR shall bear all costs from such retesting.

7. For samples and tests required for CONTRACTOR'S use, the CONTRACTOR shall make arrangements with an independent firm for payment and scheduling of testing. The cost of sampling and testing for the CONTRACTOR'S use shall be the CONTRACTOR'S responsibility.

PART 2 -- EXECUTION

2.1 INSTALLATION

A. **Inspection**: The CONTRACTOR shall inspect materials or equipment upon the arrival on the job site and immediately prior to installation, and reject damaged and defective items.

B. **Measurements**: The CONTRACTOR shall verify measurements and dimensions of the WORK, as an integral step of starting each installation.

C. **Manufacturer's Instructions**: Where installations include manufactured products, the CONTRACTOR shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents.

PART 3 -- PRODUCTS (NOT USED)

- END OF SECTION -

SECTION 01 50 10 - PROTECTION OF EXISTING FACILITIES

PART 1 -- GENERAL

1.1 GENERAL

A. The CONTRACTOR shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than prior to such damage or temporary relocation, all in accordance with the Contract Documents.

1.2 RIGHTS-OF-WAY

A. The CONTRACTOR shall not do any WORK that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure, nor shall the CONTRACTOR enter upon the rights-of-way involved until notified that the OWNER has secured authority therefor from the proper party.

B. After authority has been obtained, the CONTRACTOR shall give said party due notice of its intention to begin work, if required by said party, and shall remove, shore, support, or otherwise protect such pipeline, transmission line, ditch, fence, or structure, or replace the same.

1.3 PROTECTION OF STREET OR ROADWAY MARKERS

A. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced. Survey markers or points disturbed by the CONTRACTOR shall be accurately restored after street or roadway resurfacing has been completed.

1.4 RESTORATION OF PAVEMENT

A. **General:** All paved areas including cut or damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Temporary and permanent pavement shall conform to the requirements of the affected pavement owner. Pavements which are subject to partial removal shall be neatly saw cut in straight lines.

B. **Temporary Resurfacing:** Wherever required by the public authorities having jurisdiction, the CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.

C. **Permanent Resurfacing:** In order to obtain a satisfactory junction with adjacent surfaces, the CONTRACTOR shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and

other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

D. **Restoration of Sidewalks or Private Driveways:** Wherever sidewalks or private roads have been removed for purposes of construction, the CONTRACTOR shall place suitable temporary sidewalks or roadways promptly after backfilling and shall maintain them in satisfactory condition for the period of time fixed by the authorities having jurisdiction over the affected portions. If no such period of time is so fixed, the CONTRACTOR shall maintain said temporary sidewalks or roadways until the final restoration thereof has been made.

1.5 EXISTING UTILITIES AND IMPROVEMENTS

A. **General:** The CONTRACTOR shall protect underground Utilities and other improvements which may be impaired during construction operations, regardless of whether or not the Utilities are indicated on the Drawings. The CONTRACTOR shall take all possible precautions for the protection of unforeseen Utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. Except where the Drawings indicate Utilities have been field located during design or certain Utility locations shall be exposed as part of the WORK, the CONTRACTOR shall be responsible for exploratory excavations as it deems necessary to determine the exact locations and depths of Utilities which may interfere with its work. All such exploratory excavations shall be performed as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR's progress. When such exploratory excavations show the Utility location as shown on the Drawings to be in error, the CONTRACTOR shall so notify the OWNER.

C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the Utility.

D. **Utilities to be Moved:** In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of the CONTRACTOR, be notified by the OWNER to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, the CONTRACTOR shall notify the OWNER a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

E. **Utilities to be Removed:** Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing Utility or other improvement which is indicated, the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such Utility or improvement in a manner satisfactory to the OWNER and the owner of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the Utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

F. **OWNER's Right of Access:** The right is reserved to the OWNER and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the WORK of this Contract.

G. **Underground Utilities Indicated:** Existing Utility lines that are indicated or the locations of which are made known to the CONTRACTOR prior to excavation and that are to be retained, and all Utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced by the CONTRACTOR, unless otherwise repaired by the owner of the damaged Utility. If the owner of the damaged facility performs its own repairs, the CONTRACTOR shall reimburse said owner for the costs of repair.

H. **Underground Utilities Not Indicated:** In the event that the CONTRACTOR damages existing Utility lines that are not indicated or the locations of which are not made known to the CONTRACTOR prior to excavation, a verbal report of such damage shall be made immediately to the OWNER and a written report thereof shall be made promptly thereafter. If the OWNER is not immediately available, the CONTRACTOR shall notify the Utility owner of the damage. If directed by the OWNER, repairs shall be made by the CONTRACTOR under the provisions for changes and extra work contained in General Conditions.

I. Costs of locating and repairing damage not due to failure of the CONTRACTOR to exercise reasonable care, and removing or relocating such Utility facilities not indicated in the Contract Documents with reasonable accuracy, and for equipment on the project which was actually working on that portion of the WORK which was interrupted or idled by removal or relocation of such Utility facilities, and which was necessarily idled during such work will be paid for as extra work in accordance with the provisions of General Conditions.

J. **Approval of Repairs:** All repairs to a damaged Utility or improvement are subject to inspection and approval by an authorized representative of the Utility or improvement owner before being concealed by backfill or other work.

K. **Maintaining in Service:** Unless indicated otherwise, oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the WORK shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the OWNER are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. The CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.6 TREES OR SHRUBS WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

A. **General:** Except where trees or shrubs are indicated to be removed, the CONTRACTOR shall exercise **all necessary precautions so as not to damage or destroy any trees or shrubs**, including those lying within street rights-of-way and project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or OWNER. Existing trees and shrubs which are damaged during construction shall be trimmed or replaced by the CONTRACTOR or a certified tree company under permit from the jurisdictional agency and/or the OWNER. Tree trimming and replacement shall be accomplished in accordance with the following paragraphs.

B. **Trimming:** Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. Cuts over 1-1/2 inches in diameter shall be coated with a

tree paint product that is waterproof, adhesive, and elastic, and free from kerosene's, coal tar, creosote, or other material injurious to the life of the tree.

C. **Replacement:** The CONTRACTOR shall immediately notify the jurisdictional agency and/or the OWNER if any tree or shrub is damaged by the CONTRACTOR's 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 or shrub at its own expense. The tree or shrub shall be of a like size and variety as the one damaged, or, if of a smaller size, the CONTRACTOR shall pay to the owner of said tree a compensatory payment acceptable to the tree or shrub owner, subject to the approval of the jurisdictional agency or OWNER. The size of the tree or shrub shall be not less than 1-inch diameter nor less than 6 feet in height. Planting of replacement trees and shrubs shall be in accordance with standards of the area and the jurisdictional agency. Unless otherwise indicated, the CONTRACTOR shall water and maintain the replacement trees and shrubs for 1 month after planting.

D. **Recovery:** The CONTRACTOR shall attempt to recover all shrubs and trees for replanting as directed by the OWNER's Representative. The tree or shrub shall have a sufficient root ball mass to sustain the plant during excavation. The trees and shrubs shall have burlap or similar material wrapped around the root ball and watered daily to maintain moisture in the root ball. The tree shall be cared for as directed by the jurisdictional agency and the OWNER. The tree or shrub shall be replanted at the top of constructed channels, in back fill locations near but not directly over pipelines, or in locations directed by the OWNER's Representative. Unless otherwise indicated, the CONTRACTOR shall water and maintain the trees and shrubs for 1 month after planting.

1.7 NOTIFICATION BY THE CONTRACTOR

A. The CONTRACTOR shall a minimum of 7 days prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state before starting work contact the Local Agency responsible to provide utility line location. If the CONTRACTOR begins excavation work without the utility lines being located the CONTRACTOR shall be solely responsible for any and all costs to repair the damaged utility.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 55 00 - SITE ACCESS AND STORAGE

PART 1 -- GENERAL

1.1 HIGHWAY LIMITATIONS

A. The CONTRACTOR shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the WORK. It shall be the CONTRACTOR's responsibility to construct and maintain any haul roads required for its construction operations.

1.2 TEMPORARY CROSSINGS

A. **General**: Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, and hospitals. Safe and adequate public transportation stops and pedestrian crossings at intervals not exceeding 300-feet shall be provided. The CONTRACTOR shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time.

B. **Temporary Bridges**: Wherever necessary, to maintain vehicular crossings, the CONTRACTOR shall provide suitable temporary bridges or steel plates over unfilled excavations, except in such cases as the CONTRACTOR shall secure the written consent of the responsible individuals or authorities to omit such temporary bridges or steel plates, which written consent shall be delivered to the OWNER prior to excavation. Such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the CONTRACTOR shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

C. **Street Use:** Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public road, street, alleyway, or parking area during the performance of the WORK hereunder and it shall conduct its operations to not interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No road or street shall be closed to the public without first obtaining permission of the OWNER and proper governmental authority. Where excavation is being performed in primary streets or highways, one lane in each direction shall be kept open to traffic at all times unless otherwise indicated. Toe boards shall be provided to retain excavated material if required by the OWNER or the agency having jurisdiction over the street or highway. Fire hydrants on or adjacent to the WORK shall be kept accessible to fire-fighting equipment. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks and the proper functioning of gutters, storm drain inlets, and other drainage facilities.

D. **Traffic Control:** For the protection of traffic in public or private streets and ways, the CONTRACTOR shall provide, place, and maintain necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and

Highway Construction and Maintenance Operations," published by U.S. Department of Transportation, Federal Highway Administration. The CONTRACTOR shall provide a written traffic control plan to the OWNER at the Preconstruction Conference for approval in accordance with Section 01 33 00 – Contractor Submittals.

1. The CONTRACTOR shall take necessary precautions for the protection of the WORK and the safety of the public. Barricades and obstructions shall be illuminated at night, and lights shall be kept burning from sunset until sunrise. The CONTRACTOR shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions.

2. The CONTRACTOR shall contact the local approving agency for approval a minimum of 2 weeks prior to construction.

3. The CONTRACTOR shall remove traffic control devices when no longer needed, repair damage caused by installation of the devices, and shall remove post settings and backfill the resulting holes to match grade.

E. **Temporary Street Closure:** If closure of any street is required during construction, the CONTRACTOR shall apply in writing to the local approving agency to receive approval prior to any actual closure.

F. **Temporary Driveway Closure**: The CONTRACTOR shall notify the owner or occupant (if not owner-occupied) of the closure of the driveways to be closed more than one 8 hour work day at least 3 working days prior to the closure. The CONTRACTOR shall minimize the inconvenience and minimize the time period that the driveways will be closed. The CONTRACTOR shall fully explain to the owner/occupant how long the closure will take and when closure will start.

1.3 CONTRACTOR'S WORK AND STORAGE AREA

A. The CONTRACTOR shall coordinate with the OWNER and jurisdictional agency to utilize a portion of the property adjacent to the WORK for its exclusive use during the term of the Contract as a storage and shop area for its construction operations on the WORK. At completion of WORK, the CONTRACTOR shall return this area to its original condition, including grading and landscaping.

B. The CONTRACTOR shall make its own arrangements for any necessary off-Site storage or shop areas necessary for the proper execution of the WORK.

C. Should the CONTRACTOR find it necessary to use any additional land for its camp or for other purposes during the construction of the WORK, it shall arrange for the use of such lands at its own expense.

D. The CONTRACTOR shall construct and use a separate storage area for hazardous materials used in constructing the WORK.

1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, 2 part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.

2. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.

3. The CONTRACTOR shall obtain and submit to the OWNER a single EPA number for wastes generated at the Site.

4. The separate storage area shall meet the requirements of authorities having jurisdiction over the storage of hazardous materials.

1.4 PARKING

A. The CONTRACTOR shall:

1. When space on the Site is not available, the CONTRACTOR shall make additional spaces available for the OWNER's use.

2. The CONTRACTOR shall direct its employees to park in areas indicated by the OWNER and jurisdictional agency.

3. Traffic and parking areas shall be maintained in a sound condition, free of excavated material, construction equipment, mud, and construction materials. The CONTRACTOR shall repair breaks, potholes, low areas which collect standing.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 57 19 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 -- GENERAL

1.1 STORM WATER POLLUTION AND PREVENTION CONTROL PLAN (SWPPP)

A. CONTRACTOR shall develop a SWPPP to be submitted and approved by the OWNER that meets all federal, state, and local requirements. The general erosion and sediment control plan illustrated in the contact drawings is provided to aid the contractor in developing the SWPPP. The SWPPP development and implementation shall be included in the CONTRACTOR CPM Schedule, Section 01 32 16. The SWPPP shall encompass the following requirements.

1.2 DUST ABATEMENT

A. The CONTRACTOR shall prevent its 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 of the Site. The CONTRACTOR shall be responsible for any damage resulting from dust originating from its operations. Dust abatement measures shall be continued until the CONTRACTOR is relieved of further responsibility by the OWNER.

B. **Storage Piles**: Enclose, cover, water (as needed), or apply non-toxic soil binders according to manufacturer's specifications on material piles (i.e. gravel, sand, dirt) with a silt content of 5 percent or greater.

C. **Active Areas of Site**: Water active construction areas and unpaved roads as needed and as requested by OWNER.

D. **Inactive Areas of Site**: Apply non-toxic soil stabilizers according to manufacturer's specifications to inactive construction areas, or water as needed to maintain adequate dust control.

E. **Vehicle Loads**: Cover or maintain at least 2-feet of freeboard vertical distance between the top of the load and the top of the trailer sides on trucks hauling dirt, sand, soil, or other loose materials off of the Site.

F. **Roads**: When there is visible track-out onto a paved public road, install construction entrance gravel as detailed in the Erosion and Sediment Control Sheets. Sweep the paved street at the end of each shift with a **Mobil Athey** or similar water spray pick-up broom-type street sweeper as necessary or as directed.

G. **Vehicle Speeds**: If watering of unpaved roads is not sufficient to control dust, reduce vehicle speeds to 15 mph or less on such roads.

1.3 SEDIMENTATION ABATEMENT

A. The CONTRACTOR shall be responsible for collecting, storing, hauling, and disposing of spoil, silt, and waste materials in compliance with applicable federal, state, and local rules and regulations and the Contract Documents.

B. Install and maintain erosion and sediment control measures, such as swales, grade stabilization structures, berms, dikes, waterways, filter fabric fences, and sediment basins.

C. Filter fabric barrier systems, if used, shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

D. Remove and dispose of sediment deposits at the designated spoil area. If a spoil area is not indicated, dispose of sediment off-Site at a location not in or adjacent to a stream or floodplain. Sediment to be placed at the spoil area should be spread evenly, compacted, and stabilized. Sediment shall not be allowed to flush into a stream or drainage way.

E. Maintain erosion and sediment control measures until final acceptance or until requested by the OWNER to remove it.

1.4 RUBBISH CONTROL

A. During the progress of the WORK, the CONTRACTOR shall keep the Site and other areas for which it is responsible in a neat and clean condition and free from any accumulation of rubbish. The CONTRACTOR shall dispose of rubbish and waste materials of any nature and shall establish regular intervals of collection and disposal of such materials and waste. The CONTRACTOR shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of rubbish and surplus materials shall be off the Site in accordance with local codes and ordinances governing locations and methods of disposal and in conformance with applicable safety laws and the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

1.5 SANITATION

A. **Toilet Facilities:** Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.

B. **Sanitary and Other Organic Wastes:** The CONTRACTOR shall establish a regular daily collection of sanitary and organic wastes. 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 Laws and Regulations pertaining thereto.

1.6 CHEMICALS

A. Chemicals used on the WORK or furnished for facility 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. Use of such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer. In addition, see the requirements set forth in the General Conditions.

1.7 CULTURAL RESOURCES

A. The CONTRACTOR's attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").

B. In the event potential cultural resources are discovered during subsurface excavations at the Site, the following procedures shall be instituted:

1. The OWNER will issue a temporary Notice to Suspend Work directing the CONTRACTOR to cease construction operations at the location of such potential cultural resources find.

2. The suspension Notice will contain the following:

   a. A clear description of the WORK to be suspended.

   b. Instructions regarding issuance of further orders by the CONTRACTOR for material services.

   c. Guidance as to the action to be taken on subcontracts.

   d. Suggestions to the CONTRACTOR to minimize incurred costs.

   e. Estimated duration of the temporary suspension.

3. Such suspension shall be effective until such time as a qualified archeologist can assess the value of the potential cultural resources and make recommendations in accordance with State Requirements.

4. The CONTRACTOR shall cease WORK in the area of a discovery until appropriate actions have been determined in accordance with this paragraph.

5. If human remains are discovered, WORK in the immediate vicinity of the find shall stop. The County Sheriff and County Coroner shall be notified.

C. If the archeologist determines that the potential find is a bonafide cultural resource, as established by State Requirements the OWNER will extend the duration of the suspension.

D. Changes to the Contract Price and Contract Times for suspension due to discovery of a potential cultural resource may be made in the following manner:

1. Contract Times

   a. If the WORK temporarily suspended is on the “critical path”, the total number of Days for which the suspension is in effect will be added to the Contract Times.

   b. If a portion of WORK at the time of such suspension is not on the “critical path”, but subsequently becomes WORK on the critical path, the Contract Times will be computed from the date such WORK is classified as on the critical path.

2. Contract Price

   a. If, as a result of a cultural resources suspension, the CONTRACTOR sustains a loss that could not have been avoided by judicious handling of forces and equipment or redirection of forces or equipment to perform other WORK on the contract, there will be paid an amount based on time and materials for the loss in accordance with the following:

1) Idle Time of Equipment: Compensation for equipment idle time will be determined in accordance with the General Conditions for equipment time and equipment rental time.

2) Idle Time of Labor: Compensation for idle time of workers will be determined in accordance with the General Conditions for labor.

b. Costs of labor will be compensated only to the extent such cost was in fact caused by the suspension.

c. Compensation for loss due to idle time of either equipment or labor will not include markup for profit.

d. The hours for which compensation will be paid will be the actual normal working time during which such suspension lasts, but will in no case exceed eight hours in any single Day.

e. The days for which compensation will be paid exclude Saturdays, Sundays, and legal holidays during the suspension.

PART 2 -- GENERAL (NOT USED)

PART 3 -- PRODUCTS (NOT USED)

- END OF SECTION -

SECTION 01 60 00 - PRODUCTS, MATERIALS, EQUIPMENT AND SUBSTITUTIONS

PART 1 -- GENERAL

1.1 DEFINITIONS

A. The word "Products," as used in the Contract Documents is defined to include purchased items for incorporation into the WORK, regardless of whether specifically purchased for the project or taken from CONTRACTOR's stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form WORK. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying, and erection of the WORK.

1.2 QUALITY CONTROL

A. **Source Limitations:** To the greatest extent possible for each unit of WORK, the CONTRACTOR shall provide products, materials, and equipment of a singular generic kind from a single source.

B. **Compatibility of Options:** Where more than one choice is available as options for CONTRACTOR's selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.3 PRODUCT DELIVERY AND STORAGE

A. The CONTRACTOR shall deliver and store the WORK in accordance with manufacturer's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at the Site and overcrowding of construction spaces. In particular, the CONTRACTOR shall ensure coordination to ensure minimum holding or storage times for flammable, hazardous, easily damaged, or sensitive materials to deterioration, theft, and other sources of loss.

1.4 TRANSPORTATION AND HANDLING

A. Products shall be transported by methods to avoid damage and shall be delivered in undamaged condition in manufacturer's unopened containers and packaging.

B. The CONTRACTOR shall provide equipment and personnel to handle products, materials, and equipment (including those furnished by OWNER) by methods to prevent soiling and damage.

C. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.5 STORAGE AND PROTECTION

A. Products shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.

B. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.

C. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter.

D. Storage shall be arranged to provide access for inspection. The CONTRACTOR shall periodically inspect to assure products are undamaged and are maintained under required conditions.

E. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.6 MAINTENANCE OF PRODUCTS IN STORAGE

A. Stored products shall be periodically inspected on a scheduled basis. The CONTRACTOR shall maintain a log of inspections and shall make the log available on request.

B. The CONTRACTOR shall comply with manufacturer's product storage requirements and recommendations.

C. The CONTRACTOR shall maintain manufacturer-required environmental conditions continuously.

D. The CONTRACTOR shall ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.

E. For mechanical and electrical equipment, the CONTRACTOR shall provide a copy of the manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.

F. Products shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document prior to final acceptance by the OWNER in accordance with the Contract Documents.

1.7 PROPOSED SUBSTITUTIONS OR "OR-EQUAL" ITEM

A. Whenever materials or equipment are indicated in the Contract Documents by using the name of a proprietary item or the name of a particular manufacturer, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words "or equal" indicating that a substitution is permitted, materials or equipment of other manufacturers may be accepted if sufficient information is submitted by the CONTRACTOR to allow the OWNER and ENGINEER to determine that the

material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

1. The burden of proof as to the type, function, and quality of any such substitution product, material or equipment shall be upon the CONTRACTOR.

2. The ENGINEER will be the sole judge as to the type, function, and quality of any such substitution and the ENGINEER's decision shall be final.

3. The ENGINEER may require the CONTRACTOR to furnish additional data about the proposed substitution.

4. The OWNER may require the CONTRACTOR to furnish a special performance guarantee or other surety with respect to any substitution.

5. Acceptance by the OWNER and ENGINEER of a substitution item proposed by the CONTRACTOR shall not relieve the CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitution.

6. The CONTRACTOR shall pay all costs of implementing accepted substitutions, including redesign and changes to WORK necessary to accommodate the substitution.

B. The procedure for review by the OWNER and ENGINEER will include the following:

1. If the CONTRACTOR wishes to provide a substitution item, the CONTRACTOR shall make written application to the OWNER and ENGINEER on the "Substitution Request Form."

2. Unless otherwise provided by law or authorized in writing by the OWNER, the "Substitution Request Form(s)" shall be submitted within the 30-day period after award of the Contract.

3. Wherever a proposed substitution item has not been submitted within said 35-day period, or wherever the submission of a proposed substitution material or equipment has been judged to be unacceptable by the OWNER and ENGINEER, the CONTRACTOR shall provide the material or equipment indicated in the Contract Documents.

4. The CONTRACTOR shall certify by signing the form that the list of paragraphs on the form are correct for the proposed substitution.

5. The OWNER and ENGINEER will evaluate each proposed substitution within a reasonable period of time.

6. As applicable, no shop drawing submittals shall be made for a substitution item nor shall any substitution item be ordered, installed, or utilized without the OWNER 'S prior written acceptance of the CONTRACTOR'S "Substitution Request Form."

7. The OWNER will record the time required by the OWNER AND ENGINEER in evaluating substitutions proposed by the CONTRACTOR and in making changes by the CONTRACTOR in the Contract Documents occasioned thereby.

C. The CONTRACTOR's application shall address the following factors which will be considered by the OWNER and ENGINEER in evaluating the proposed substitution:

1. Whether the evaluation and acceptance of the proposed substitution will prejudice the CONTRACTOR's achievement of Substantial Completion on time.

2. Whether acceptance of the substitution for use in the WORK will require a change in any of the Contract Documents to adapt the design to the proposed substitution.

3. Whether incorporation or use of the substitution in connection with the WORK is subject to payment of any license fee or royalty.

4. Whether all variations of the proposed substitution from the items originally specified is identified.

5. Whether available maintenance, repair, and replacement service are indicated. The manufacturer shall have a local service agency (within 100 miles of the site) which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

6. Whether an itemized estimate is included of all costs that will result directly or indirectly from acceptance of such substitution, including cost of redesign and claims of other contractors affected by the resulting change.

7. Whether the proposed substitute item meets or exceeds the experience and/or equivalency requirements listed in the appropriate technical specifications.

D. Without any increase in cost to the OWNER, the CONTRACTOR shall be responsible for and pay all costs in connection with proposed substitutions and of inspections and testing of equipment or materials submitted for review prior to the CONTRACTOR's purchase thereof for incorporation in the WORK, whether or not the OWNER accepts the proposed substitution or proposed equipment or material. The CONTRACTOR shall reimburse the OWNER for the charges of the ENGINEER for evaluating each proposed substitution.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 75 00 - TESTING AND STARTUP

PART 1 -- GENERAL

1.1 GENERAL

A. Plant startup is prerequisite to satisfactory completion of the contract requirements and shall be completed within the Contract Times.

B. Conduct all tests, check out, startup, and related requirements indicated in the Contract Documents and provide documentation of same to the OWNER prior to requesting Substantial Completion from the OWNER. Where manufacturer onsite inspections are required before startup, the manufacturer shall furnish a written statement that the installation and check out is complete and proper and that the item(s) are ready for startup.

C. Startup is an operation requiring the combined expertise of the CONTRACTOR, Subcontractors, the ENGINEER, and the OWNER. The CONTRACTOR shall be responsible for coordinating all parties for a successful startup: the ENGINEER and OWNER may be available for technical and operational advice prior to and during startup.

D. General requirements for startup activities are included in this Section. More specific requirements may also be included in other portions of the Contract Documents.

E. Temporary facilities may be necessary. If so, CONTRACTOR shall design, provide, operate, and later decommission them.

1.2 DEFINITIONS

A. Startup is defined as testing, demonstrations, and other activities as required to achieve Substantial Completion. Startup includes pre-commissioning and commissioning activities, manufacturer's services, certifications of readiness for testing, and troubleshooting, checkout, and shakedown activities.

B. Pre-commissioning is the systematic demonstration through testing and extended operation that major equipment and auxiliary systems, including related components, sub-systems, and systems operate properly and consistent with their intended function. Pre-commissioning involves balancing, adjustments, calibration, loop checks, and loop validation. Pre-commissioning shall simulate shutdown conditions, failure conditions, power fail and restart, bypass conditions, and failure resets. Pre-commissioning will not be considered complete until successful results and documentation of tests and manufacturer's certifications required by the Contract Documents are submitted and accepted by the OWNER. Pre-commissioning of all portions of the WORK shall be successfully completed prior to starting Commissioning.

C. Commissioning is the verification that the complete WORK functions on an extended basis in full conformance with the Contract requirements.

1.3 SUBMITTALS

A. **Schedule:** The schedule for startup shall be submitted under Section 01 32 16 - CPM Construction Schedule.

B. **Startup Plan:** Not less than 30 Days prior to startup, submit for review a detailed Startup Plan. The CONTRACTOR shall revise the Plan as necessary based on review comments. The Plan shall include:

1. Schedules for manufacturers' equipment certifications.

2. Schedules for submitting final Technical Manuals,

3. Schedule for training the OWNER's personnel,

4. Description of temporary facilities and schedule for installation and decommissioning them.

5. List of OWNER and CONTRACTOR-furnished supplies.

6. Detailed schedule of operations to achieve successful pre-commissioning and commissioning.

7. Checklists and data forms for each item of equipment.

8. Address coordination with the OWNER's staff.

9. Designate a representative of the CONTRACTOR who has the authority to act in matters relating to startup. The Plan shall also designate the roles and responsibilities of any Subcontractors that may be involved in startup activities.

10. Safety, startup, and testing procedures and proposed inspection and certification forms and records.

11. Interconnection of new to existing facilities.

    a. Date and time frame of proposed shutdown or interconnection, including sequence of events and activities to be conducted.

    b. A detailed description of sequences and activities for the planned shutdown and interconnection.

    c. Staff, equipment, and materials that will be at the Site before commencing the shutdown.

    d. Other provisions so that interconnection, testing, and startup will be completed within the planned time.

12. Hydrostatic testing of water-holding structures and pipelines and other potable water equipment. Schedule and plan shall indicate source of water, testing and disinfection sequence, disinfection procedures, and the disposal of the water following disinfection.

C. **System Outage Requests:** Request for shutdown of existing systems as necessary to test or start up new facilities.

D. Records and Documentation

1. Where required by the specifications, submit equipment installation certifications under those sections.

2. Records of startup as indicated below.

1.4 MALFUNCTIONS

A. During the extended operational demonstrations, all components, subsystems, systems, and equipment must properly run continuously 48 hours per day at rates indicated by the OWNER or ENGINEER throughout the test period. The test period will begin upon filling and establishing sustained rate of flow through the facilities. Unless indicated otherwise, if any item fails or malfunctions during the test, the item shall be repaired and the test restarted at time zero with no credit given for the operating time before the failure or malfunction. Malfunctions satisfying all 3 of the following conditions will allow the demonstration period to resume at the elapsed time when the malfunction started:

1. Malfunction did not cause any interruption of the continuous operation of any other components, subsystems, systems, and equipment.

2. Malfunction was corrected without causing or requiring any components, subsystems, systems, and equipment to cease operations.

3. Malfunction was corrected within one hour of the time the malfunction was detected (the one hour period includes the time required to locate the cause of the malfunction, beginning upon CONTRACTOR's notification to or from the OWNER that a malfunction has occurred and ending when the item is corrected and the system is successfully placed back into operation).

B. The CONTRACTOR shall arrange for manufacturer's representatives to visit the Site as often as necessary to correct malfunctions.

1.5 PREREQUISITES

A. Pre-commissioning and commissioning activities shall be scheduled according to Section 01 32 16. The demonstrations shall start prior to midday on a Monday, Tuesday, or Wednesday. Testing periods shall not include holidays, based on the OWNER's calendar.

B. The following shall be completed before pre-commissioning begins.

1. All Technical Manual information required by the Contract Documents has been submitted.

2. Safety equipment, protective guards and shields, emergency repair kits, safety chains, handrails, gratings, safety signs, and valve and piping identification required by the Contract Documents are provided. Devices and equipment shall be fully functional, adjusted, and tested.

3. Manufacturer's certifications of proper installation have been accepted.

4. Leakage tests, electrical tests, and adjustments have been completed.

5. The OWNER has approved the Startup Plan.

6. Temporary facilities are functional, adjusted, and ready for use.

7. Individual instrumentation loops (analog, status, alarm, and control) have been verified functionally.

8. Individual interlocks between the field-mounted control devices and the motor control circuits, control circuits of variable-speed controllers, and packaged system controls have been verified.

1.6 GENERAL

A. **Startup Records:** The CONTRACTOR shall maintain the following during testing and startup and submit originals to OWNER:

1. Lubrication and service records for each mechanical and electrical equipment item.

2. Hours of daily operation for each mechanical and electrical equipment item.

3. Equipment alignment and vibration measurement records.

4. Logs of electrical measurements and tests.

5. Instrumentation calibration and testing logs.

6. Factory and field equipment settings.

7. Log of problems encountered and remedial action taken.

8. Other records, logs, and checklists as required by the Contract Documents.

1.7 PRE-COMMISSIONING

A. After individual equipment items and subsystems have been tested and certified as required by the Technical Specifications, tests of systems comprised of single or multiple equipment items with appurtenant equipment and instruments and controls shall be conducted. Items of equipment shall be tested as part of a system to the maximum extent possible.

B. Subject to the malfunction criteria above, each system shall be demonstrated for a continuous, 48 hour period unless otherwise directed by the OWNER. If any system malfunctions, the item or equipment shall be repaired and the test restarted at time zero with no credit given for the elapsed time before the malfunction.

C. The CONTRACTOR shall demonstrate the manual and automatic modes of operation to verify proper control sequences, software interlocks, proper operation of software logic and controllers, etc. System testing shall include the use of water or other process media, as applicable, to simulate the actual conditions of operation.

D. Systems testing activities shall follow the detailed procedures and checklists in the Testing and Startup Plan. Completion of systems shall be documented by a report.

E. The CONTRACTOR shall demonstrate safety equipment, and other support systems before whole process systems.

F. Furnish the OWNER at least 10 Days written notice confirming the start of pre-commissioning. The OWNER's staff will observe pre-commissioning.

1.8 COMMISSIONING

A. Defects that appear shall be promptly corrected. Time lost for wiring corrections, control point settings, or other reasons that interrupt the test may, at the judgement of the OWNER, be cause for extending the demonstration an equal amount of time.

B. Commissioning shall not begin until leakage tests, instrumentation tests and adjustments, electrical tests and adjustments, equipment field tests, and system tests have been completed to the satisfaction of the OWNER.

C. During commissioning, the CONTRACTOR shall:

1. Lubricate and maintain equipment in accordance with the manufacturers' recommendations.

2. Clean or replace strainers, screens, and filter elements.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 77 00 - PROJECT CLOSEOUT

PART 1 -- GENERAL

1.1 FINAL CLEANUP

A. The CONTRACTOR shall promptly remove from the vicinity of the completed WORK, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the WORK by the OWNER will be withheld until the CONTRACTOR has satisfactorily performed the final cleanup of the Site.

1.2 CLOSEOUT TIMETABLE

A. The CONTRACTOR shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow the OWNER, the ENGINEER, and their authorized representatives sufficient time to schedule attendance at such activities.

1.3 TECHNICAL MANUAL SUBMITTAL

A. The CONTRACTOR's attention is directed to the condition that 2% percent of the Contract Price will be retained from any monies due the CONTRACTOR as progress payments, if at the 75 percent construction completion point; the approved Technical Manual complying with Section 01 33 00 has not been submitted. The aforementioned amount will be retained by the OWNER as the agreed, estimated value of the approved Technical Manual. Any such retention of money for failure to submit the approved Technical Manual on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to the CONTRACTOR under the General Conditions.

1.4 FINAL SUBMITTALS

A. The CONTRACTOR, prior to requesting final payment, shall obtain and submit the following items to the OWNER:

1. Written guarantees, where required.

2. Technical Manuals and instructions.

3. New permanent cylinders and key blanks for all locks.

4. Maintenance stock items; spare parts; special tools.

5. Completed record drawings.

6. Bonds for roofing, maintenance, etc., as required.

7. Certificates of inspection and acceptance by local governing agencies having jurisdiction.

8. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

1.5 MAINTENANCE AND GUARANTEE

A. The CONTRACTOR shall comply with the maintenance and guarantee requirements contained in the General Conditions.

B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the CONTRACTOR which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the CONTRACTOR shall have obtained a statement in writing from the affected private owner or public agency releasing the OWNER from further responsibility in connection with such repair or resurfacing.

C. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from the OWNER. If the CONTRACTOR fails to make such repairs or replacements promptly, the OWNER reserves the right to do the WORK and the CONTRACTOR and its surety shall be liable to the OWNER for the cost thereof.

1.6 BOND

A. The CONTRACTOR shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee" above, and the General Conditions.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 02 15 00 - COFFERDAMS

PART 1 -- GENERAL

1.1 DESCRIPTION OF WORK

A. The WORK includes furnishing all design, labor and equipment necessary to construct and maintain all cofferdams and protective works necessary during construction of facilities located in or adjacent to static or moving bodies of water as specified herein.

B. Remove all of temporary cofferdams or other temporary protective works upon completion of the facilities located in or adjacent to bodies of water.

1.2 SUBMITTALS

A. The CONTRACTOR shall submit a proposed plan for cofferdams and protective works in accordance with Section 01 33 00 – Contractor Submittals which shall address, as a minimum, the following items:

1. Type of cofferdam or other protective works to be used.

2. Sequence of construction for cofferdam or other protective works related Work items.

3. Provision for limiting siltation or other effects on the rivers, streams and creeks and water bypass areas.

4. Provisions for removal of temporary cofferdams or protective works and replacement or grading of the foundation areas following removal.

5. Provisions for excavating and dewatering insides of the cofferdams or protective works.

6. Regulatory requirements for cofferdams sand cofferdam related activities.

7. All calculations required to substantiate the design of the cofferdam and protective works.

B. The submittal will be prepared and signed by a Professional Engineer registered in the State of Washington experienced with cofferdam design.

C. The plan shall be submitted a minimum of 30 work days prior to planned cofferdam work, shall be subject to review, permitting and acceptance by governing authorities and the owners of any facilities utilized for water conveyance; as well as OWNER however, these reviews will not relieve the CONTRACTOR of full responsibility for the adequacy of the cofferdams and protective works.

D. The CONTRACTOR shall be responsible to coordinate with the OWNER and submit required documentation and obtain all necessary approvals from the governing authorities prior to beginning installation of the coffer dam. The time to obtain the required permits shall be included in Section 01 32 16 - CPM Construction Schedule.

1.3 DEFINITIONS

A. **Original Ground**: The elevation of the original ground surface before construction (including original ground surfaces under water).

B. **Finish Grade**: Represents the grade required by the Contract Documents to be the finished ground surface upon completion of construction.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The type of construction used for cofferdams or other protective works (e.g., sheet pile cofferdams, or sandbag cofferdam) shall be at the choice of the CONTRACTOR, provided that the selected alternative fulfills the requirements of project permits and the Contract Documents.

B. Cofferdams or other protective works shall be constructed, maintained, and removed using materials and methods which do not produce siltation or other degradation of the water quality of the river or stream which exceeds the limits of applicable federal, state and local regulations.

C. Cofferdams shall be designed and constructed of such a size that in no instance they encroach within 10 feet of disturbed areas for other work.

D. Sheeting or any other methods requiring disturbance below original ground surface may not be used in any archeologically sensitive areas.

2.2 WOOD SHEETING

A. Wood used for sheeting, shoring and bracing will be sound; straight grained; free from shakes, loose knots, and other defects liable to impair its strength or durability; and will be Southern Yellow Pine, Douglas Fir, or equivalent and will be either tongue-and-grooved or splined. Wood sheeting will not be less than nominal 2 inches thick.

2.3 STEEL SHEETING

A. Steel sheeting will conform to ASTM A328.

2.4 STRUCTURAL STEEL

A. All structural steel will conform to ASTM A36.

2.5 SANDBAGS IN WATER

A. All temporary sandbags if used to be placed in water will conform to all applicable federal, state and local laws and regulations.

PART 3 -- EXECUTION

3.1 COFFERDAMS

A. Cofferdams shall be designed and construction methods will be selected by the CONTRACTOR.

1. The design of the cofferdams will take into account the range of flows which can be expected during the time allowed for in-water construction. The CONTRACTOR shall review available flow records to make this determination. If there are no flow records available, CONTRACTOR shall utilize generally accepted hydrologic models to approximate the range of expected design flows with an appropriate factor of safety.

B. Cofferdam areas shall be dewatered such that the bottoms of the excavations within the cofferdams are firm, free of standing water, and in all respects acceptable to the CSR as foundation. The dewatering methods used shall prevent boiling, quick conditions, or softening of foundation strata and shall maintain the bottom of the excavation in a condition so that every phase of the Work can be performed in the dry. Dewatering shall be performed in accordance with the requirements of Section 31 23 19 - Dewatering.

C. After construction, the cofferdams shall be removed after areas are graded to finished grade, where indicated, or otherwise returned to original grades; however, removal of cofferdams will not occur prior to the installation and backfill of all buried utilities which lie within 30 feet of the cofferdam areas. If options have been selected with below grade construction, it may be possible to cut off the structures at grade if the CONTRACTOR obtains approval of the appropriate jurisdictional authority.

D. Any loss of water and any damage to ground, structures, facilities, agricultural projects, fishery resources, or any other existing items that may be affected by the CONTRACTOR's cofferdam operations, shall be the responsibility and liability of the CONTRACTOR and will be repaired or restored by the CONTRACTOR as required, to the OWNER's satisfaction. Any damage or injury to a person directly or indirectly caused by the CONTRACTOR's cofferdam operations shall be the responsibility of the CONTRACTOR.

E. It is the CONTRACTOR's responsibility to design, install, and maintain functionally effective and structurally sound cofferdams. The failure of the cofferdam either in function or structurally for any reason, subsurface conditions inclusive, and the consequences of such a failure and liability for such a failure, will be the responsibility of the CONTRACTOR. In the event the cofferdam has failed or is not functional as designed; the CONTRACTOR shall repair or rebuild the cofferdam at no additional cost to OWNER.

- END OF SECTION -

SECTION 03 21 00 - REINFORCEMENT STEEL

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide reinforcement steel and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Shop Drawings

1. Shop bending diagrams, placing lists, and drawings of reinforcement steel prior to fabrication. The shop bending diagrams shall show the actual lengths of bars to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. Include bar placement diagrams that clearly indicate the dimensions of each bar splice.

2. Details of the concrete reinforcement steel and concrete inserts shall be submitted at the earliest possible date after receipt by the CONTRACTOR of the Notice to Proceed. Said details of reinforcement steel for fabrication and erection shall conform to ACI 315 - Details and Detailing of Concrete Reinforcement and the requirements herein.

3. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, the CONTRACTOR shall submit manufacturer's literature which contains instructions and recommendations for installation for each type of coupler used; certified test reports that verify the load capacity of each type and size of coupler used; and Shop Drawings that show the location of each coupler with details of how they are to be installed in the formwork.

1.3 QUALITY CONTROL

A. If requested by the OWNER, the CONTRACTOR shall furnish samples from each heat of reinforcement steel in a quantity adequate for testing. Costs of initial tests will be paid by the OWNER. Costs of additional tests if material fails initial tests shall be the CONTRACTOR’s responsibility.

PART 2 -- PRODUCTS

2.1 MATERIAL REQUIREMENTS

A. Materials that may remain or leave residues on or within the concrete shall be certified as compliant with NSF Standard 61- Drinking Water System Components.

2.2 REINFORCEMENT STEEL

A. Reinforcement steel for cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar shall conform to ASTM A 615 - Deformed and Plain Billet - Steel Bars, for Grade 60 reinforcement unless otherwise indicated.

2. Welded wire fabric reinforcement shall conform to ASTM A 185 - Welded Steel Wire Fabric, Plain, for Concrete Reinforcement, and the details indicated. Welded wire fabric with longitudinal wire of W4 size wire and smaller shall be in flat sheets or in rolls with a core diameter of not less than 10-inches. Welded wire fabric with longitudinal wires larger than W4 size shall be in flat sheets only.

B. Accessories

1. Accessories shall include necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. Bar supports shall meet the requirements of the CRSI Manual of Standard Practice, including special requirements for supporting epoxy-coated reinforcing bars. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating that extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.

2. Concrete blocks (dobies) used to support and position reinforcement steel shall have the same or higher compressive strength as required for the concrete in which they are located. Wire ties shall be embedded in concrete block bar supports.

2.3 MECHANICAL COUPLERS

A. Mechanical couplers shall be provided where indicated and where approved by the OWNER. The couplers shall develop a tensile strength that exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.

B. Where the type of coupler used is composed of more than one component, components required for a complete splice shall be provided. This shall apply to mechanical splices, including those splices intended for future connections.

C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.

D. Couplers shall be **Lenton Form Saver** by **Erico Products, Dowel Bar Splicer System** by **Dayton/Richmond**, or equal.

2.4 EPOXY GROUT

A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet Section 03 60 00 - Grout.

PART 3 -- EXECUTION

3.1 GENERAL

A. Reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the Building Code and the supplementary requirements herein.

3.2 FABRICATION

A. General

1. Reinforcement steel shall be accurately formed to the dimensions and shapes indicated, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318 - Building Code Requirements for Reinforced Concrete, except as modified by the Drawings. Bars shall be bent cold. Bars shall be bent per ACI 318.

2. The CONTRACTOR shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings.

B. **Fabricating Tolerances:** Bars used for concrete reinforcement shall satisfy the following fabricating tolerances:

1. Sheared length: plus and minus 1-inch.

2. Depth of truss bars: plus zero, minus 1/2-inch.

3. Stirrups, ties, and spirals: plus and minus 1/2-inch.

4. Other bends: plus and minus 1-inch.

3.3 PLACING

A. Reinforcement steel shall be accurately positioned as indicated and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. Reinforcement steel shall be supported by concrete, plastic or metal support spacers, or metal hangers that are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. Concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties that are embedded in the blocks. For concrete over formwork, the CONTRACTOR shall provide concrete, metal, plastic, or other acceptable bar chairs and spacers.

B. Limitations on the use of bar support materials shall be as follows.

1. Concrete Dobies

a. Permitted at any location except where architectural finish is required.

b. Required for slabs on grade and surfaces in contact with or above ozonated process water.

2. Wire Bar Supports: permitted only at slabs over dry areas, interior dry wall surfaces, and exterior wall surfaces.

3. Plastic Bar Supports: permitted at every location except on grade.

C. Tie wires shall be bent away from the forms in order to provide the required concrete coverage.

D. Bars additional to those indicated that may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at its own expense.

E. Unless otherwise indicated, reinforcement placing tolerances shall be within the limits in Section 7.5 of ACI 318 except where in conflict with the Building Code.

F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter or enough to exceed the above tolerances, the resulting arrangement of bars shall be as reviewed and accepted by the OWNER's representative.

G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters. Slab bolsters shall be spaced not more than 30-inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane indicated.

H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3-feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

I. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

3.4 SPACING OF BARS

A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars, nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than one-inch.

B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall be not less than one-inch.

C. In columns, the clear distance between longitudinal bars shall be not less than 1-1/2 times the bar diameter, nor less than 1-1/2 times the maximum size of the coarse aggregate, nor less than 1-1/2 inches.

D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

3.5 SPLICING

A. General

1. Reinforcement bar splices shall only be used at locations indicated. When it is necessary to splice reinforcement at points other than where indicated, the character of the splice shall be as reviewed and accepted by the OWNER and ENGINEER.

2. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.

B. Splices of Reinforcement

1. The length of lap for reinforcement bars, unless otherwise indicated, shall be in accordance with ACI 318, Section 12.15.1 for a Class B splice.

2. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

C. **Bending or Straightening:** Reinforcement shall not be straightened or re-bent in a manner which will injure the material. Bars shall be bent or straight as indicated. Do not use bends different from the bends indicated. Bars shall be bent cold, unless otherwise permitted by the OWNER. No bars partially embedded in concrete shall be field-bent except as indicated or specifically permitted by the OWNER.

D. Couplers that are located at a joint face shall be a type that can be set either flush or recessed from the face as indicated. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections shall be recessed a minimum of 1/2-inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs which have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged.

E. Unless indicated otherwise, mechanical coupler spacing and capacity shall match the spacing and capacity of the reinforcing indicated for the adjacent section.

3.6 CLEANING AND PROTECTION

A. Reinforcement steel shall always be protected from conditions conducive to corrosion until concrete is placed around it.

B. The surfaces of reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be re-inspected and, if necessary, re-cleaned.

3.7 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS

A. Hole Preparation

1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 1/4-inch greater than the diameter of the outer surface of the reinforcing bar deformations.

2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless indicated otherwise.

3. The hole shall be drilled by methods that do not interfere with the proper bonding of epoxy.

4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.

5. The hole shall be blown clean with clean, dry compressed air to remove dust and loose particles.

B. Embedment

1. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that insures excess material will be expelled from the hole during dowel placement.

2. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.

- END OF SECTION -

SECTION 03 41 13 - STRUCTURAL PRECAST CONCRETE

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the precast concrete work in accordance with the Contract Documents.

B. This Section covers the design, fabrication, delivery and installation of all precast concrete units, including connections, complete, in place, as shown and specified.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

ANSI/ACI 315	Concrete Reinforcement
ANSI/ACI 318	Concrete Construction
ANSI/AWS A5.4	Welding Rods and Electrodes
AWS B2.1	
ANSI/AWS D1.1	Welding and Cutting
ANSI/AWS D1.4	Welding and Cutting
ASTM A 184	Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement
ASTM A 193	Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 351	Steel Castings, Austenitic, for High-Temperature Service
ASTM A 497	Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A 580	Stainless and Heat-Resisting Steel Wire
ASTM A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 666	Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications
ASTM A 775	Epoxy-Coated Reinforcing Steel Bars
ASTM C 33	Concrete Aggregates
ASTM C 67	Method for Sampling and Testing Brick and Structural Clay Tile

ASTM C 127	Test Method for Specific Gravity and Absorption of Coarse Aggregate
ASTM C 128	Test Method for Specific Gravity and Absorption of Fine Aggregate
ASTM C 150	Portland Cement
ASTM C 173	Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 204	Test Method for Fineness of Portland Cement by Air Permeability Apparatus
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Air-Entraining Admixtures for Concrete
ASTM C 311	Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 494	Test Method for Shear Fatigue of Sandwich Core Materials
ASTM D 2240	Test Method for Rubber Property -- Durometer Hardness

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Shop Drawings:

1. Shop Drawings shall show details in accordance with ACI 315 and ACI 318 including installation details and design computations.

2. Shop drawings, including design computations, shall be stamped and signed by a structural Engineer registered in the State and shall be approved by the OWNER.

3. Shop Drawings shall indicate precast unit identification marks, location of units in the WORK, elevations, fabrication details, welding details, reinforcement, connections, dimensions, interface with adjacent members, and special handling instructions in sufficient detail to cover manufacture, handling, and erection.

4. Shop Drawings shall be divided into complete separate submittals for each structure. Each complete submittal shall consist of Shop Drawings.

a. Shop Drawings: Showing all elevations, dimensions, horizontal and vertical sections, openings, inserts, reinforcing, anchorage devices, details, design computations, and other requirements for each different type of structure to be incorporated into the portion of the project covered by the submittal. Drawings shall be 24 inches x 36 inches maximum.

C. **Mix Proportions:** Prior to commencing operations a statement shall be submitted giving the nominal maximum aggregate size and proportions of all ingredients that will be used in the manufacture of concrete. The statement shall include test results from an

approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made in materials used in the concrete mix without approval and additional tests to verify that the concrete properties are satisfactory. A copy shall be submitted of concrete mix with each set of samples.

D. **Test Reports:** Tests for compressive strength of concrete shall be performed by an independent commercial testing laboratory. Copies of test reports including all test data and all test results shall be submitted.

E. **Certificates of Compliance:** Certificates of compliance shall be submitted attesting that materials and products meet or exceed specified requirements.

F. **Manufacturer's Qualifications:** Prior to commencing operations, a statement shall be submitted giving the qualifications of the precast concrete manufacturer, and evidence that the manufacturer and plant are PCI certified.

1.4 QUALITY CONTROL

A. **General Requirements:** Design members under direct supervision of a professional structural Engineer.

1. Welding shall be in accordance with AWS D1.1, AWS D12.1, AWS B2.1, and AWS A5.4.

2. Manufacture, Transportation and Installation: The manufacturer shall specialize in providing precast products and services normally associated with precast concrete construction with finishes similar to that indicated on drawings.

1.5 DESIGN REQUIREMENTS

A. **General:** The precast concrete structures and connection designs shown represent minimum precast construction requirements. The manufacturer shall verify the structure and connection designs for all handling, erection, and service conditions, and shall provide any additional materials necessary to meet the design conditions.

B. **Concrete Mix:** The concrete mix shall be designed by the manufacturer and approved by the OWNER, using the materials and quantities specified to meet all of the requirements of this specification.

1. Proportioning of Concrete Mixes: Mixes shall be proportioned by weight except water and admixtures may be batched by volume if desired. Trial mixes and testing to meet requirements of the strengths of concrete specified is the CONTRACTOR's responsibility. Design mix shall contain similar materials as those proposed for use in the WORK.

2. Admixtures: Concrete shall contain an air entraining admixture in proportion so as to provide 4 percent plus or minus 1 percent total air in the concrete as determined by ASTM C 173 or C 231. Set retarding admixtures may be used provided cement content is not reduced. Water reducing admixtures may be used provided they are used in the mix design studies. High-range water reducers (superplasticizers) shall be used only where specifically called for in this Section, otherwise superplasticizers shall not be used without written approval from the OWNER. No admixture may contain chlorides, bromides, or fluorides.

3. Water: Clean, potable water. The CONTRACTOR shall provide tests to assure that no more than 200 parts per million total aggregated content of chlorides, bromides, and fluorides are present.

C. **Formwork:** Formwork shall be designed to withstand high-frequency vibration and to ensure finished units.

D. **Pickup Points and Boxouts:** Pickup points, boxouts, and inserts on structure faces and surfaces to be exposed are prohibited except as approved.

1.6 DELIVERY, STORAGE AND HANDLING

A. **General:** Precast members shall be handled to position consistent with their shape and design; they shall be lifted and supported from design incorporated support points and provided with strong backs and other devices as required. Lifting or handling equipment shall be capable of maintaining units during manufacture, storage, transportation, erection, and in position for fastening.

B. Blocking and supports, lateral restraints and protective materials during transport and storage shall be clean, nonstaining, without causing harm to exposed surfaces, including temporary support to prevent bowing and warping. Lateral restraints shall be provided to prevent undesirable horizontal movement. Edges and exposed faces of members shall be protected to prevent straining, chipping, or spalling of concrete.

C. Units shall be marked with date of production.

D. Precast units shall be stored off the ground in a manner to prevent warpage and they shall be protected from weather, marring, and overload.

E. **Stainless Steel Hardware:** Stainless steel hardware shall be transported, handled, stored, and protected in wood crates.

PART 2 -- PRODUCTS

2.1 CONCRETE MATERIALS

Cement	ASTM C 150, Type II, "low alkali," white color. "Low alkali" requirement may be waived if not reactive as defined in Appendix to ASTM C 33. Submit laboratory test reports.
Aggregate	ASTM C 33, 1/2-inch max coarse aggregate size fine aggregate ratio to total aggregate volume = 0.35 min, 0.55 max.
Water Absorption, Coarse	ASTM C 127
Water Absorption, Fine	ASTM C 128

Reinforcing Steel	ASTM A 615, Grade 60, deformed epoxy coated in accordance with ASTM A 775
Welded Wire Fabric Plain Deformed Steel Fabricated Steel Bar or Rod Mats	 ASTM A 185, epoxy coated ASTM A 497, epoxy coated ASTM A 184, epoxy coated
Tie Wire	ASTM A 580, Type 316L, cold finished annealed, **Huntington Alloy Co. "Monel"** or **"Inconel."**
Air Entrainment Admixture	ASTM C 260
Water Reducing or Retarding Admixtures	ASTM C 494, Type C, D, or F/G, with no chloride, bromide, and fluoride ingredients

2.2 SUPPORT DEVICES

Connecting and Support Devices	ASTM A 666, Type 316L stainless steel
Bolts	ASTM A 193, Grade B8M (Type 316)
Nuts and Washers	ASTM A 194, Grade 8M (Type 316)
Weld Filler Metal for Stainless Steel	Stainless steel to stainless steel; AWS A5.4, Grade 316L filler metal; stainless steel to carbon steel, AWS A5.4, Grade 309 filler metal, 3/32-inch diameter

2.3 FORMS

Forms	Manufacturer's standard with smooth, hard, dense, and rigid casting surface; without bow, warpage, oil canning, or other imperfections
Form Release Agent	Manufacturer's standard, nonstaining, nonpetroleum based; compatible with concrete surface sealer

2.4 FABRICATION

A. General:

1. Precast concrete units shall be fabricated by a licensed shop in accordance with ACI 318. Plant records and quality control program shall be maintained during production of precast units. Records and access to plant shall be available to the OWNER upon request.

2. Rigid molds shall be used, constructed to maintain precast unit uniform in shape, size, and finish, free from castings and dents, gouges, oil canning, or other irregularities that will adversely affect appearance or strength of units. Consistent quality shall be maintained during manufacture.

3. Reinforcing steel, anchors, inserts, plates, angles, and other cast-in-place items shall be embedded as indicated on shop drawings. Reinforcement shall be fabricated and placed in conformance with ACI 318. No tack welding of or to reinforcement permitted. No carbon steel chairs, spacers, nails or tie wire shall be used in positioning reinforcing and embedments.

4. Adequate reinforcing steel shall be provided to control cracking. Maximum permissible crack width:

   a. Surfaces exposed to weather: 0.005 inch

   b. Surfaces exposed to view but not weather: 0.01 inch

5. Connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories shall be fabricated to permit initial placement and final attachment.

6. Anchors, inserts, lifting devices, and other accessories shall be placed and embedded in accordance with approved shop drawings, accurately positioned in their designed location and anchored to prevent dislocation during construction. Flashing reglets shall be placed and embedded continuous and straight, with lifting devices to permit removal after erection.

7. Units shall be moist cured with water mist to develop concrete quality and to minimize surface drying and appearance blemishes such as nonuniformity, staining, or surface cracking.

8. Precast units shall be removed from formwork using procedures conforming to PCI MNL-117. Minor patching in plant acceptable, providing structural adequacy and appearance of units are not impaired. Each precast unit shall be identified with corresponding code on erection drawings, in location not visible to finished work.

B. Fabrication and Tooling of Stainless Steel Connections and Embedments:

1. All tools used during fabrication shall be made of stainless steel. Use of carbon steel tools is prohibited.

2. Welding of stainless steel shall conform to AWS A5.4, AWS B2.1 and AWS D1.1, using tungsten inert gas procedures and 316L filler metal for stainless steel to stainless steel and 309 filler metal for stainless steel to carbon steel. Surfaces shall be sanded smooth (do not grind), and oxidized discoloration removed (blue heat tint). Threaded parts of stainless steel bolts shall be lubricated with graphite suspended in alcohol (**Neo-Lube**) every time that nut is run on or off the threads. No other lubricant is acceptable.

3. Erection slings, cables, blocking, hardware and restraints shall be nonmetallic or stainless steel. Cribbing or crating shall be wood.

2.5 FINISH OF PRECAST UNITS

A. Smooth, dense, uniform surface free from blemishes. Defects in backs and sides (unexposed edges) shall be repaired as approved.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **Examination:** The CONTRACTOR shall verify that structure, anchors, devices, and openings are ready to receive work of this Section. Beginning of installation means acceptance of existing condition.

B. Erection:

1. The units shall be erected without damage to shape or finish or adjacent work. Damaged members shall be replaced or repaired. Unless otherwise shown, members shall be erected level and plumb.

2. The CONTRACTOR shall align and maintain uniform horizontal and vertical joints as erection progresses, provide approved shims and wedges as required, and when members required adjustment beyond design criteria, discontinue affected work. Units shall be secured in place and field welds, scratches and otherwise damaged steel surfaces shall be touched up.

3. Pickup points, boxouts, inserts and bearing surfaces shown shall be grouted with non-shrink grout in accordance with Section 03 60 00 - Grout. The color and texture of concrete surfaces of adjacent areas shall be finished to match in the same plane.

C. **Tolerances:** In accordance with requirements of PCI MNL-117 unless otherwise indicated.

1. Variation from Plane of Location: 1/4-inch in 10 feet and 3/8-inch in 100 feet maximum, compensating not cumulative.

2. Offset from True Alignment between Two Connecting Members: 1/4-inch maximum.

3. Out of Square: 1/8-inch in 10 feet maximum, noncumulative.

4. Variation in Dimensions Indicated in Shop Drawings: Plus or minus 1/8-inch.

5. Misalignment of Anchors, Inserts, Openings: 1/8-inch, maximum.

6. Bowing or Warpage of Units: 1/700 of panel dimension.

7. Exposed Joint Dimension: 3/4-inch plus or minus 1/8-inch.

8. Location of Reglets: 1/4-inch from true position.

3.2 PROTECTION

A. Adjacent surfaces shall be protected from damage during sealing and cleaning operations and against damage, disfiguration or discoloration from subsequent operations. Noncombustible shielding shall be used during welding operations.

- END OF SECTION -

SECTION 03 60 00 - GROUT

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide grout, complete and in place, in accordance with the Contract Documents.

B. The following types of grout are covered in this Section:

1. Cement Grout

2. Non-Shrink Grout - Class I (cement-based)

3. Non-Shrink Grout - Class II (cement-based)

4. Epoxy Anchor Grout for Adhesive Anchors

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

1. Certified testing lab reports for tests indicated herein.

2. Test results and service report from the field tests and the demonstration and training session verifying the requirements indicated herein.

3. Certifications that grouts used on the project contain no chlorides or other chemicals that cause corrosion.

4. Manufacturer’s literature containing instructions and recommendations on the mixing, handling, placement, curing, and appropriate uses for each type of grout used in the WORK, and location of use. ICBO/ES report shall be submitted for epoxy anchor grout for adhesive anchors.

5. Manufacturer’s certification that its non-shrink grout does not contain aluminum, zinc, or magnesium powders as a method of expansion.

6. Submit manufacturer's written warranty as indicated herein.

7. Name and telephone number of grout manufacturer's representative who will give on-Site service. The representative shall have at least one year of experience with the indicated grouts.

1.3 QUALITY CONTROL

A. Field Tests

1. Compression test specimens will be taken from the first placement of each type of grout, and at intervals thereafter selected by the OWNER. The specimens will be made by the OWNER or its representative.

2. Compression tests and fabrication of specimens for cement grout and cement based non-shrink grout will be performed in accordance with ASTM C 1107 -

Packaged Dry, Hydraulic-Cement Grout (Nonshrink), at intervals during construction selected by the OWNER. A set of 3 specimens will be made for testing at 7 Days, 28 Days, and each additional time period as appropriate.

3. The cost of laboratory tests on grout will be paid by the OWNER except where test results show the grout to be defective. In such case, the CONTRACTOR shall pay for the tests, removal and replacement of Defective Work, and re-testing, all as part of the WORK.

4. The CONTRACTOR shall assist the OWNER in obtaining specimens for testing and shall furnish materials necessary for fabricating the test specimens.

1.4 SPECIAL CORRECTION OF DEFECTS PROVISIONS

A. Manufacturer's Warranty

1. Furnish one year warranty for WORK provided under this section.

2. Manufacturer's warranty shall not contain a disclaimer limiting responsibility to the purchase price of products or materials.

PART 2 -- PRODUCTS

2.1 APPLICATION

A. Unless indicated otherwise, grouts shall be provided as listed below whether indicated on the Drawings or not.

Application	Type of Grout
Anchor bolts and reinforcing steel required to be set in grout that is not in high temperature or high fire risk areas.	Epoxy Anchor Grout
Beam and column (1 or 2 story) base plates less than 16-inches in the least dimension.	Non-Shrink - Class I
Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.	Non-Shrink - Class I (Class II where placement time exceeds 20 min.)
Surface repairs	Cement Grout
Repair of holes and defects in concrete members which are not water bearing and not in contact with soil or other fill material	Non-Shrink - Class I
Repair of holes and defects in concrete members which are water bearing or in contact with soil or other fill materials	Non-Shrink - Class II

Application	Type of Grout
Any application not listed above, where grout is indicated	Non-Shrink Class I, unless specifically indicated otherwise

2.2 CEMENT GROUT

A. Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 Days shall be 4000 psi.

2.3 NON-SHRINK GROUTS (cement-based)

A. General

1. Cement-based non-shrink grout shall be a prepackaged, inorganic, fluid, non-gas liberating, non-metallic, cement type grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used.

2. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout shall be as recommended by the manufacturer for the particular application.

3. Grout shall not contain chlorides or additives that may contribute to corrosion.

4. Grout shall be formulated to be used at any consistency from fluid to plastic.

5. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency, at 28 Days:

a. Minimum tensile splitting strength of 500 psi per ASTM C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

b. Minimum flexural strength of 1000 psi per ASTM C 580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

c. Minimum bond strength (concrete to grout) of 1900 psi per modified ASTM C 882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

d. Grout shall be certified for use in freeze/thaw environments.

B. Class I Non-Shrink Grout

1. Class I non-shrink grout shall have a minimum 28 Day compressive strength of 5000 psi when mixed at a fluid consistency.

2. Class I non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C, when mixed to fluid, flowable, and plastic consistencies.

3. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827 – Test Method for Early Volume Change of Cementitious Mixtures. The grout when tested shall not bleed or segregate at maximum allowed water.

4. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C 1090 - Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.

5. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.

6. Class I Non-Shrink Grout shall be **Masterflow 713 Plus** by **MBT/Degussa Building Systems, Five Star Grout** by **Five Star Products, Sikagrout 212** by **Sika Corporation, Premier** by **L&M Construction Chemicals; High-Flow Grout** by **Euclid Chemical Company, CG 200 PC** by **Hilti,** or equal.

C. Class II Non-Shrink Grout

1. Class II non-shrink grout shall be a high precision, fluid, extended working time, grout. The minimum 28-Day compressive strength shall be 7500 psi, when mixed at a fluid consistency.

2. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827.

3. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C 1090.

4. Class II non-shrink grout shall have an extended working time of 30 minutes minimum when mixed to a fluid consistency as defined in ASTM C 827 at temperature extremes of 45 to 90 degrees F in accordance with ASTM C 1107.

5. Class II non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C 939.

6. The grout when tested shall not bleed or segregate at maximum allowed water content.

7. Provide certification that its non-shrink property is not based on gas production or gypsum expansion.

8. Class II non-shrink grout shall be **Masterflow 928** by **MBT/Degussa Building Systems, Five Star Fluid Grout 100** by **Five Star Products, Crystex** by **L&M Construction Chemicals,** or equal.

2.4 EPOXY ANCHOR GROUT

A. Epoxy anchor grout shall conform to ASTM C 881 - Epoxy-Resin-Base Bonding Systems for Concrete, Type IV, Class A, B and C, Grade 3 with the exception of gel time.

B. Heat deflection temperature per ASTM D 648 -- Test Method for Deflection Temperature of Plastics Under Flexural Load shall be a minimum 120 degrees F.

C. Manufacturer shall certify that the epoxy anchor grout will maintain 90 percent of its strength up to a temperature of 125 degrees F.

D. Grout shall come in a 2 chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall also come with a static mixer nozzle to thoroughly mix the hardener and resin together.

E. Epoxy anchor grout shall be capable of being used in submersed applications once cured.

F. Compressive strength per ASTM D 695 - Test Method for Compressive Properties of Rigid Plastics shall be 10,000 psi minimum.

G. Whenever possible, overhead anchors subject to vibration, anchors in fire-resistive construction or high fire risk areas, and anchors subject to working or operating temperatures above 100 degrees F shall be cast-in-place anchors. Whenever cast-in-place anchors cannot be used in these applications, use cement based non-shrink grout and oversized holes.

H. Embedment of adhesive anchors/rebar shall be deep enough to develop the anchor/rebar. Embedment shall not exceed 67 percent of the member depth.

I. Epoxy anchor grout shall be **Epcon C6** by **ITW Ramset/Red Head; Power-Fast Epoxy Injection Gel** by **Powers Fasteners; RE 500** by **Hilti, Sikadur AnchorFix-4,** or equal.

2.5 CURING MATERIALS

A. Curing materials shall be as recommended by the manufacturer of pre-packaged grouts.

2.6 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is defined such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.

B. The slump for topping grout and concrete/grout fill shall be adjusted to match placement and finishing conditions but shall not exceed 4-inches.

2.7 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurements shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 -- EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Grout shall be stored in accordance with manufacturer's recommendations.

3.2 GENERAL

A. CONTRACTOR shall arrange for the manufacturer of prepackaged grouts to provide on-Site technical assistance within 72 hours of request, as part of the WORK.

B. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by the OWNER.

C. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of the saturation period, excess water shall be removed with clean, oil free compressed air prior to grouting. Concrete substrate shall not be wet prior to placement of epoxy grouts.

D. The finish of the grout surface shall match that of the adjacent concrete unless otherwise indicated.

E. Surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete, and other deleterious materials.

F. Shade the WORK from sunlight for at least 24 hours before and 48 hours after grouting.

G. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

3.3 GROUTING PROCEDURES

A. **General:** Mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

B. Structural, equipment, tank, and piping support bases shall be grouted, unless indicated otherwise.

1. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum one-inch thickness of grout or other thickness if indicated.

2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout through a headbox of appropriate size. The mixture shall be of a fluid consistency and poured continuously into the space between the plate and the base concrete. Forms for grout shall be tight against retaining surfaces, and joints shall be sealed as recommended by the grout manufacturer to be liquid-tight. Forms shall be coated as recommended by the grout manufacturer for easy form release. Where this method of placement is not practical or where required by the OWNER, alternate grouting methods shall be submitted for acceptance by the OWNER.

3. Concrete equipment pads for equipment bases that will be epoxy-grouted shall be sized so that, when the equipment base is fully grouted, the epoxy grout is stopped not less than 4-inches from the edge of the pad.

C. Drilled anchors and Reinforcing Bars

1. General

a. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, and cleaned. Drilled anchors shall not be installed until the concrete has reached the required 28 Day compressive strength. Anchors shall not be loaded until the grout has reached its indicated strength in accordance with the manufacturer's instructions.

b. The CONTRACTOR shall identify position of reinforcing steel and other embedded items prior to drilling holes. Care shall be exercised in coring and drilling to avoid damaging existing reinforcing or embedded items. Notify the OWNER if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and communications conduit, and piping.

2. Epoxy Adhesive Anchors

a. Grout shall be proportioned and mixed with automatic equipment.

b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO/ES report, but shall not be less than 8 diameters for threaded rod or 12 diameters for reinforcing or smooth bars.

c. Holes shall be dry.

3. Cement Based Non-Shrink Grout

a. In places of high temperature or fire hazard, anchor bolts shall be grouted in using cement based non-shrink grout, Class I.

b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO/ES report, but shall not be less than 16 diameters for threaded rod or 24 diameters for reinforcing or smooth bars.

c. When the bolt diameter is one-inch or less, the hole diameter should be a minimum of 2-inches. When the bolt diameter is greater than one-inch, the hole diameter should be at least twice the bolt diameter.

d. Drilled holes shall be saturated with water for not less than 24 hours before installation of anchor/rod/rebar.

e. The non-shrink grout should be placed in the holes in a non-sag (trowelable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.

3.4 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, to assure that the space to be grouted is completely filled.

3.5 CURING

A. Cement based grouts shall be cured per the manufacturer's recommendations.

- END OF SECTION -

SECTION 05 50 00 - MISCELLANEOUS METALS

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide miscellaneous metalwork and appurtenances, complete and in place, as indicated in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Federal Specifications

MIL-G-18015 A (3)	(Ships) Aluminum Planks. (6063-T6)
MIL-A-907E	Anti-seize Thread Compound, High Temperature

B. Codes

OSHA 1927.10	Fixed Ladders

C. Commercial Standards

AA-M32C22A41	Aluminum Assn.
AASHTO HS-20	Truck Loading
AISC	Manual of Steel Construction
AISI	Design of Light Gauge, Cold-Formed Steel Structural Members
ASTM A 36	Carbon Structural Steel
ASTM A 48	Gray Iron Castings
ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 193	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A 307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 992	Steel for Structural Shapes for Use in Building Framing
ANSI/AWS D1.1	Structural Welding Code - Steel
ANSI/AWS D1.2	Structural Welding Code - Aluminum
ANSI/AWS QC1	Qualification and Certification of Welding Inspectors

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01 33 00 – Contractor Submittals.

B. Shop Drawings

1. Shop Drawings shall conform to AISC recommendations and specifications, and shall show holes, and the like, as may be required for other parts of the WORK.

2. Shop Drawings shall include complete details of members and connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams for the sequence of erection.

3. Anchors

a. Submit an ICBO report listing the ultimate load capacity in tension and shear for each size and type of concrete anchor.

b. Submit manufacturer's recommended installation instructions and procedures for adhesive anchors.

c. Upon review by the OWNER, these instructions shall be followed specifically.

d. No substitution for the indicated adhesive anchors will be considered unless accompanied with ICBO report verifying strength and material equivalency, including temperature at which load capacity is reduced to 90 percent of that determined at 75 degrees F.

1.4 QUALITY CONTROL

A. Weld procedures and welder qualifications shall be available in the CONTRACTOR's field office for review.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Stainless Steel

1. Unless otherwise indicated, stainless steel metalwork and bolts shall be fabricated from Type 316 stainless steel.

B. Aluminum

1. Unless otherwise indicated, aluminum metalwork shall be fabricated from Alloy 6061-T6.

2. Aluminum in contact with concrete, porous materials or dissimilar metals shall have contact surfaces coated.

2.2 BOLTS AND ANCHORS

A. Standard Service (Non-Corrosive Application)

1. Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be fabricated from steel as indicated.

2. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing.

3. Except as otherwise indicated, steel for bolt material, anchor bolts, and cap screws shall be in accordance with the following requirements:

a. Structural Connections: ASTM A 307, Grade A or B, hot-dip galvanized.

b. Anchor Bolts: ASTM A 307, Grade A or B, or ASTM A 36, hot-dip galvanized.

c. High-Strength Bolts, where indicated: ASTM A 325.

d. Pipe and Equipment Flange Bolts: ASTM A 193, Grade B-7.

B. Corrosive Service

1. Bolts, nuts, and washers in the locations listed below shall be fabricated from stainless steel as indicated.

a. Buried locations.

b. Submerged locations.

c. Locations subject to seasonal or occasional flooding.

d. Inside hydraulic structures below the top of the structure.

e. Inside buried vaults, manholes, and structures that do not drain through a gravity sewer or to a sump with a pump.

f. Inside trenches, containment walls, and curbed areas.

g. Locations indicated or designated by the ENGINEER to be provided with stainless steel bolts.

C. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be fabricated from Type 316 stainless steel, Class 2, conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts.

D. Coating

1. Threads on stainless steel bolts shall be protected with an anti-seize lubricant suitable for submerged stainless steel bolts, meeting government specification MIL-A-907E.

2. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.

3. Anti-seize lubricant shall be classified as acceptable for potable water use by the NSF.

4. Anti-seize lubricant shall be "PURE WHITE" by **Anti-Seize Technology,** Franklin Park, IL, 60131, **AS-470** by **Dixon Ticonderoga Company,** Lakehurst, NJ, 08733, or equal.

E. Bolt Requirements

1. The bolt and nut material shall be free-cutting steel.

2. The nuts shall be capable of developing the full strength of the bolts.

3. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads.

4. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

5. Bolts and nuts shall be installed with washers fabricated from material matching the base material of bolts, except that hardened washers for high-strength bolts shall conform to the requirements of the AISC Specification.

6. Lock washers fabricated from material matching the bolts shall be installed where indicated.

7. The length of each bolt shall be such that the bolt extends at least 1/8 inch beyond the outside face of the nut before tightening, except for anchor bolts which shall be flush with the face of the nut before tightening.

2.3 DRILLED ANCHORS

A. General

1. Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors.

2. No substitutions will be considered unless accompanied with an ICBO report verifying strength and material equivalency.

B. Epoxy Anchors

1. Epoxy adhesive anchors are required for drilled anchors for outdoor installations, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars.

2. Epoxy shall be in accordance with the requirements of Section 03 60 00 – Grout.

3. Threaded rod shall be galvanized for general purpose applications and fabricated from Type 316 stainless steel for use in corrosive applications.

4. Epoxy anchors shall not be permitted in areas where the concrete temperature is in excess of 100 degrees F or higher than the limiting temperature recommended by the manufacturer, whichever is lower.

5. Epoxy anchors shall not be used where anchors are subject to vibration or fire.

6. Embedment depth shall be as the manufacturer recommends for the load to be supported.

7. Unless otherwise indicated, glass capsule, polyester resin adhesive anchors will be permitted in locations not included above, and shall be **Hilti HVA**, **Cobra Anchors**, or equal.

8. Threaded rod shall be fabricated from galvanized steel.

C. Expanding-Type Anchors

1. Expanding-type anchors, if indicated or permitted, shall be fabricated from galvanized steel, shall be of the expansion type, and shall be **ITW Ramset/Redhead Trubolt** anchors, **McCullock Industries Kwick-Bolt,** or equal.

2. Lead caulking anchors will not be permitted.

3. Size shall be as indicated.

4. Embedment depth shall be as the manufacturer recommends for the load to be supported.

5. Expansion-type anchors that are to be embedded in grout may be fabricated from steel.

6. Non-embedded buried or submerged anchors shall be fabricated from stainless steel.

D. Non-Shrink Grouted Anchors

1. Anchors, if indicated or permitted, shall be grouted with a non-shrink cementitious grout in accordance with the manufacturer's recommendations.

2. Embedment depth shall be as the manufacturer recommends for the load to be supported.

3. Non-shrink grout material shall be Class B or C in accordance with Section 03 60 00 – Grout.

PART 3 -- EXECUTION

3.1 WELDING

A. Method

1. Welding shall be performed by the metal-arc method or gas-shielded arc method as described in the American Welding Society "Welding Handbook" as supplemented by other pertinent standards of the AWS.

2. The qualification of the welders shall be in accordance with the AWS Standards.

B. Quality

1. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained in order to minimize distortion and for control of dimensions.

2. Weld reinforcement shall be as indicated by the AWS Code.

3. Upon completion of welding, remove weld splatter, flux, slag, and burrs left by attachments.

4. Welds shall be repaired in order to produce a workmanlike appearance, with uniform weld contours and dimensions.

5. Sharp corners of material that is to be painted or coated shall be ground to a minimum of 1/32 inch on the flat.

3.2 DRILLED ANCHORS

A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions.

B. Holes shall be roughened with a brush on a power drill, and then cleaned and dried.

C. Drilled anchors shall not be installed until the concrete has reached the required 28-day compressive strength.

D. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

- END OF SECTION -

SECTION 11 88 48 – PORTABLE FIRE FIGHTING TANKS

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall procure and install portable fire fighting tanks (tanks) as indicated in theses specification and delivered to the project site.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00.

B. Shop Drawings

1. Complete Shop Drawings of portable fire fighting tanks.

2. Manufacturer literature for the portable fire fighting tanks including specifications of materials for the frame and the liner.

3. Certified statement of proof-of-design tests from the manufacturer.

1.3 QUALITY ASSURANCE

A. Tanks shall be subjected to performance, leakage, and tests in the field upon construction completion.

PART 2 -- PRODUCTS

2.1 PORTABLE FIRE FIGHTING TANKS

A. **General:** Tanks shall be portable folding frame design with a durable UV resistant liner.

B. **Properties:** The tanks shall have an aluminum double folding frame when fully erected shall be 60 feet long, 4 feet wide, and 4 feet tall. The tanks shall be able to withstand a 3 foot water depth. The liner shall be NSF-61 approved for potable water.

C. Manufacturers, or Equal

1. **Husky, Portable Containment**

PART 3 -- EXECUTION

3.1 INSTALLATION

A. CONTRACTOR shall provide and install 3 portable fire fighting tanks as per the contract documents. The tanks shall be filled and tested as part of construction. The tanks shall be filled and operated as if under normal operation for a minimum of 48 hours.

- END OF SECTION -

SECTION 31 10 00 - SITE PREPARATION

PART 1 -- GENERAL

1.1 SUMMARY

A. In its initial move onto the Site, the CONTRACTOR shall protect roads, bridges, and structures down slope of construction areas from damage due to boulders, trees, or other objects dislodged during the construction process and clear, grub, strip; and re-grade certain areas, in accordance with the Contract Documents.

1.2 SITE INSPECTION

A. Prior to moving onto the Site, the CONTRACTOR shall inspect the Site conditions and review maps of the Site and off-Site and facilities delineating the project property.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 PRIMARY SITE ACCESS

A. The CONTRACTOR shall develop any necessary access to the Site, including access barriers to prohibit entry of unauthorized persons.

B. **Utility Interference:** Where existing utilities interfere with the WORK, notify the Utility Owner before proceeding in accordance with the General Conditions.

3.2 CLEARING, GRUBBING, AND STRIPPING

A. Construction areas shall be cleared of grass and weeds to at least a depth of 6-inches and cleared of debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the WORK, create a hazard to safety, or impair the subsequent usefulness of the WORK, or obstruct its operation. Loose boulders within 10-feet of the top of cut lines shall be incorporated in the acclimation channel or removed from the Site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction. Every effort shall be taken to protect and maintain trees and shrubs lining the proposed acclimation channels.

B. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove stumps, roots, buried logs, and other above ground and underground structures, debris or waste shall be removed if found on the Site. Objectionable material from the clearing and grubbing process shall be removed from the Site and disposed of in an approved off site locations.

C. The stripped materials shall be stockpiled and incorporated into restoring the excavated areas.

D. Unless otherwise indicated, native trees larger than 3-inches in diameter at the base shall not be removed without the OWNER’s or ENGINEER's approval. The removal of any trees, shrubs, fences, or other improvements, if necessary for the CONTRACTOR's choice of means and methods, shall be arranged with the OWNER, and shall be removed and replaced, as part of the WORK.

E. The CONTRACTOR shall attempt to recover shrubs and trees for replanting as directed by the OWNER's Representative. The trees or shrubs shall have a sufficient root ball mass to sustain the plant during construction. The trees and shrubs shall have burlap or similar material wrapped around the root ball and watered daily to maintain moisture in the root ball. The trees shall be cared for as directed by the jurisdictional agency and the OWNER. The trees or shrubs shall be replanted at the top of constructed channels, in back fill locations near but not directly over pipelines, or in locations directed by the OWNER's Representative. Unless otherwise indicated, the CONTRACTOR shall water and maintain the trees and shrubs for 1 month after planting.

3.3 OVEREXCAVATION, REGRADING, AND BACKFILL

A. Any steep, very abrupt rock faces and irregularly shaped rock outcrops of bedrock shall be re-graded as directed by the OWNER.

B. Pipeline alignments shall be regarded to near pre-existing condition.

- END OF SECTION -

SECTION 31 23 19 - DEWATERING

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall dewater trench and structure excavations, in accordance with the Contract Documents. The CONTRACTOR shall secure all necessary permits to complete the requirements of this Section of the Specifications.

1.2 CONTRACTOR SUBMITTALS

A. Prior to commencement of excavation, the CONTRACTOR shall submit a detailed plan and operation schedule for dewatering of excavations. The CONTRACTOR may be required to demonstrate the system proposed and to verify that adequate equipment, personnel, and materials are provided to dewater the excavations at all locations and times. The CONTRACTOR's dewatering plan is subject to review by the OWNER.

1.3 QUALITY CONTROL

A. It shall be the sole responsibility of the CONTRACTOR to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

B. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the CONTRACTOR.

C. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement which may develop. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the CONTRACTOR. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the CONTRACTOR.

PART 2 -- PRODUCTS

2.1 EQUIPMENT

A. Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, and other means. Standby pumping equipment shall be maintained on the Site.

PART 3 -- EXECUTION

3.1 GENERAL REQUIREMENTS

A. The CONTRACTOR shall provide all equipment necessary for dewatering. It shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workmen for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.

B. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.

C. At all times where possible, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

E. The CONTRACTOR shall maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation construction, backfilling, and up to acceptance.

F. Flotation shall be prevented by the CONTRACTOR by maintaining a positive and continuous removal of water. The CONTRACTOR shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.

G. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sand packed and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check by the CONTRACTOR shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

H. The CONTRACTOR shall dispose of water from the WORK in accordance with the State of Washington requirements in a suitable manner without damage to adjacent property. CONTRACTOR shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work built or under construction without prior consent of the OWNER or ENGINEER. Water shall be filtered using an approved method to remove sand and fine-sized soil particles before disposal into any drainage system.

I. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines, and sewers.

J. Dewatering of trenches and other excavations shall be considered as incidental to the construction of the WORK and all costs thereof shall be included in the various contract prices in the Bid Forms, unless a separate bid item has been established for dewatering.

- END OF SECTION -

SECTION 31 30 00 - EARTHWORK

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall perform earthwork as indicated and required for construction of the WORK, complete and in place, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit samples of materials proposed for the WORK in conformance with the requirements of Section 01 33 00 – Contractor Submittals. Sample sizes shall be as determined by the testing laboratory

B. CONTRACTOR's Detailed Excavation Plan

1. The CONTRACTOR, prior to beginning any trench or structure excavation 5 feet deep or deeper, shall submit to the OWNER and shall be in receipt of the OWNER's written acceptance of the CONTRACTOR's detailed plan showing the design of shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation.

2. The CONTRACTOR’s plan shall be prepared and signed and sealed by a Professional Engineer experienced in the field of geotechnical engineering and licensed in the State where the WORK is being performed.

3. The OWNER’s acceptance of said plan will be for verification of submittal of the plan with this requirement.

PART 2 -- PRODUCTS

2.1 FILL AND BACKFILL MATERIAL REQUIREMENTS

A. General

1. Fill, backfill, and embankment materials shall be selected or shall be processed and clean fine earth, rock, gravel, or sand, free from grass, roots, brush, other vegetation and organic matter.

2. Fill and backfill materials that are to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3 inches.

B. Suitable Materials

1. Materials not defined below as unsuitable will be considered as suitable materials and may be used in fills, backfilling, and embankment construction, subject to the indicated requirements.

2. If acceptable to the OWNER, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

3. Mixing or blending of materials to obtain a suitable composite is the CONTRACTOR's option but is subject to the approval of the OWNER.

4. Suitable materials may be obtained from on-Site excavations, may be processed on-Site materials, or may be imported.

5. If imported materials are required by this Section or are required in order to meet the quantity requirements of the WORK, the CONTRACTOR shall provide the imported materials as part of the WORK, unless a unit price item is included for imported materials in the Bidding Schedule.

C. **Types of Suitable Materials:** The following types of suitable materials are defined:

1. 3/4-inch minus granular backfill: Crushed rock or gravel, and sand conforming to the requirements as required by the appropriate section of the Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction. Do not use pea gravel as granular backfill:

2. Structural Fill: Structural Fill may consist of imported materials or natural on-site materials and shall conform to the appropriate section of the Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction.

3. Topsoil: Stockpiled topsoil material which has been obtained at the Site by removing soil to a depth not exceeding 1 foot. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris.

4. Gravel Backfill for Pipe Bedding: Aggregate bedding material shall conform to the appropriate section of the Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction.

5. Acclimation Channel Cobbles: Acclimation channel substrate for the project may be obtained from on-Site excavations, may be processed on-Site materials, or may be imported materials but shall conform to the appropriate streambed cobble section of the Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction.

6. Acclimation Channel Habitat Boulders: Acclimation channel habitat boulders for the project may be obtained from on-Site excavations or may be imported materials but shall conform to the appropriate boulders section of the Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction.

7. Aggregate for Gravel Base: Gravel base material shall conform to the appropriate section of the Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction.

D. Unsuitable Materials

1. Soils which, when classified under ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System), fall in the classifications of PT, OH, CH, MH, or OL shall be classified as unsuitable materials.

2. In addition to the materials identified as unsuitable in the table above, a material shall be classified as unsuitable if one of the following conditions is present:

a. Soils which cannot be compacted sufficiently to achieve the density specified for the intended use.

b. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.

2.2 MATERIALS TESTING

A. Samples

1. Soils testing of samples submitted by the CONTRACTOR will be performed by a testing laboratory of the OWNER's choice and at the CONTRACTOR's expense.

2. The OWNER may direct the CONTRACTOR to supply samples for testing of any material used in the WORK.

B. Particle size analysis of soils and aggregates will be performed using ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils.

C. Determination of sand equivalent value will be performed using ASTM D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

D. Unified Soil Classification System

1. References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487.

2. The CONTRACTOR shall be bound by applicable provisions of ASTM D 2487 in the interpretation of soil classifications.

2.3 IDENTIFICATION TAPE

A. Unless otherwise indicated, identification tape shall be placed above buried pipelines that are not comprised of magnetic components at least in part.

B. Identification tape shall be 6-inches wide, yellow in color, composed of polyethylene, and provided with an integral metallic wire.

C. Tape shall be labeled with CAUTION – BURIED UTILITIES.

PART 3 -- EXECUTION

3.1 EXCAVATION AND BACKFILLING - GENERAL

A. General

1. Except when specifically provided to the contrary, excavation shall include the removal of materials, including obstructions that would interfere with the proper execution and completion of the WORK.

2. The removal of such materials shall conform to the lines and grades indicated or ordered.

3. The CONTRACTOR shall furnish, place, and maintain supports and shoring that may be required for the sides of excavations.

4. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable state safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

5. The CONTRACTOR shall provide quantity surveys where so required to verify quantities for Unit Price Contracts.

6. Surveys shall be performed prior to beginning WORK and upon completion by a surveyor licensed in the state where the Site is located.

B. Removal and Exclusion of Water

1. The CONTRACTOR shall remove and exclude water, including stormwater, groundwater, irrigation water, and wastewater, from excavations.

2. Dewatering wells, well points, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least 2 feet below the bottom of excavations before the excavation WORK begins at each location.

3. Water shall be removed and excluded until backfilling is complete and field soils testing have been completed.

3.2 OVER-EXCAVATION

A. Indicated

1. Where areas are indicated to be over-excavated, excavation shall be to the depth indicated, and backfill shall be installed to the grade indicated.

B. Not Indicated

1. When ordered to over-excavate areas deeper and/or wider than required by the Contract Documents, the CONTRACTOR shall over-excavate to the dimensions ordered and backfill to the indicated grade.

C. Neither Indicated nor Ordered

1. Any over-excavation carried below the grade that is neither ordered or nor indicated shall be backfilled and compacted to the required grade with the indicated material as part of the WORK.

3.3 EXCAVATION IN VICINITY OF TREES

A. Except where trees are indicated to be removed, trees shall be protected from injury during construction operations.

B. No tree roots larger than 6 inches in diameter shall be cut without the express permission of the OWNER unless otherwise specified on the project plans.

C. Trees shall be supported during excavation by any means previously reviewed and accepted by the OWNER.

3.4 ROCK EXCAVATION

A. It is expected that a majority of the excavation will be Rock related:

1. The CONTRACTOR is responsible to review the site and existing records during the development of his bid and shall be responsible to develop the method to remove all necessary excavation. No additional compensation will be allowed if the CONTRACTOR is required to modify the planned method of excavation.

B. Rock excavation shall include removal and disposal of the following items:

1. Boulders measuring 1/3 of a cubic yard or more in volume;

2. Rock material in ledges, bedding deposits, and un-stratified masses that cannot be removed using conventional equipment as defined herein and which require systematic drilling and blasting for removal;

3. Concrete or masonry structures that have been abandoned; and,

4. Conglomerate deposits that are so firmly cemented that they possess the characteristics of solid rock and cannot be removed using conventional equipment as herein defined and require systematic drilling and blasting for removal.

C. Scope and Payment

1. Payment for rock excavation shall be as set forth in the Bid form as a unit price item. If a unit price item for rock excavation is not provided in the Bid form, the extra cost for excavation of rock will be treated as a change.

2. Otherwise, payment will be made in accordance with a negotiated price.

D. Explosives and Blasting: Blasting shall not be permitted.

E. Minor pipeline realignment shall be allowed to adjust for rock excavation at the OWNER representative's approval.

3.5 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. Unless otherwise indicated, excess excavated material shall be the property of the CONTRACTOR.

B. The CONTRACTOR shall be responsible for the removal and disposal of excess excavated material.

C. The CONTRACTOR shall remove and dispose of excess excavated material at a location selected by the CONTRACTOR and as approved by the OWNER or at an off-Site location selected and arranged for by the CONTRACTOR. The CONTRACTOR shall be required to provide written documentation that the site is allowed to be used.

D. The CONTRACTOR shall obtain required permits and landowner and agency approvals for disposal of excess excavated material on-Site or off-Site and shall submit copies of related documents to the OWNER for information prior to disposal. CONTRACTOR shall pay costs associated with the removal and disposal.

3.6 BACKFILL

A. General

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

2. Backfill shall not be placed around nor upon any structure until the concrete has attained sufficient strength to withstand the loads imposed.

3. Backfill around water-retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

B. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall be placed after water is removed from the excavation and the trench sidewalls and bottom have been dried to moisture content suitable for compaction.

C. Pre-Placement Conditions

1. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have any loose, sloughing, or caving soil and rock materials removed.

2. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

D. Layering

1. Backfill materials shall be placed and spread evenly in layers.

2. When compaction is achieved using mechanical equipment, the layers shall be evenly spread such that when each layer compacted shall not exceed 6 inches in thickness.

E. During spreading, each layer shall be thoroughly mixed as necessary in order to promote uniformity of material in each layer.

F. Moisture Content

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

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

3.7 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION AND BACKFILL

A. Excavation Beneath Structures and Embankments

1. Except where indicated otherwise for a particular structure or where ordered by the OWNER, excavation shall be carried to an elevation 6 inches below the bottom of the footing or slab and brought back to grade with compacted materials acceptable for placement beneath structures.

2. The area where a fill or embankment is to be constructed shall be cleared of vegetation, roots, and foreign material.

3. Where indicated or ordered, areas beneath structures or fills shall be over-excavated.

4. The subgrade areas beneath embankments shall be excavated to remove not less than the top 6 inches of native material and where such subgrade is sloped, the native material shall be benched.

5. When such over-excavation is indicated, both the over-excavation and the subsequent backfill to the required grade shall be performed by the CONTRACTOR.

6. After the required excavation or over-excavation for fills and embankments has been completed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density.

B. Notification of OWNER

1. The CONTRACTOR shall notify the OWNER at least 3 Days in advance of completion of any structure or roadway excavation and shall allow the OWNER a review period of at least one day before the exposed foundation is scarified and compacted or is covered with backfill or with any construction materials.

C. Compaction of Fill, Backfill, and Embankment Materials

1. Each layer of backfill materials as defined herein, where the material is graded such that 10 percent or more passes a No. 4 sieve, shall be mechanically compacted to the indicated percentage of density.

2. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.

3. Each layer of coarse granular backfill materials with less than 10 percent passing the No. 4 sieve shall be compacted by means of at least 2 passes from a vibratory compactor that is capable of obtaining the required density in 2 passes.

D. Heavy Equipment

1. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the vertical depth of the fill above undisturbed soil at that time.

2. Hand-operated power compaction equipment shall be used where the use of heavier equipment is impractical or restricted due to weight limitations.

E. Layering

1. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers.

2. Each layer shall be moistened and aerated as necessary.

3. Unless otherwise approved by the ENGINEER, no layer shall exceed 6 inches of compacted thickness.

4. The embankment and fill shall be compacted in conformance with the following requirements.

F. Embankments and Fills

1. When an embankment or fill is to be constructed and compacted against hillsides or fill slopes steeper than 4:1, the slopes of the hillsides or fills shall be horizontally benched in order to key the embankment or fill to the underlying ground.

2. A minimum of 12 inches perpendicular to the slope of the hillside or fill shall be removed and re-compacted as the embankment or fill is brought up in layers.

3. Material thus cut shall be re-compacted along with the new material.

G. Compaction Requirements

1. Compaction shall meet the requirements of the Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction.

3.8 PIPELINE AND UTILITY TRENCH EXCAVATION AND BACKFILL

A. Exploratory Excavations

1. The CONTRACTOR shall excavate and expose buried points of connection to existing utilities as indicated.

2. Excavation shall be performed prior to the preparation of Shop Drawings for connections and before the fabrication of the pipe.

3. The data obtained from exploratory excavations shall be used in preparing the Shop Drawings.

4. Data, including dates, locations excavated, and dimensioned sketches, shall be submitted to the ENGINEER within one week of excavation.

5. Damage to utilities from excavation activities shall be repaired by the CONTRACTOR in accordance with the General Conditions.

B. General

1. Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches with minimum widths as indicated.

C. Trench Bottom

1. Except where pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe.

2. Excavations for pipe bells and welding shall be made as required.

3. Where pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe bedding.

D. Open Trenches

1. The maximum amount of open trench permitted in any one location shall be 500 feet or the length necessary to accommodate the amount of pipe installed in a single Day, whichever is greater.

2. Trenches shall be fully backfilled at the end of each Day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each Day.

3. These requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure; in such cases, however, barricades and warning lights meeting appropriate safety requirements shall be provided and maintained.

E. Embankments, Fills and Structural Backfills

1. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

2. Upon completion of the embankment or structural backfill, a trench conforming to the appropriate detail may be excavated and the pipe may be installed.

F. Trench Shield

1. If a moveable trench shield is used during excavation operations, the trench width shall be wider than the shield such that the shield is free to be lifted and then moved horizontally without binding against the trench sidewalls and causing sloughing or caving of the trench walls.

2. If the trench walls cave or slough, the trench shall be excavated as an open excavation with sloped sidewalls or with trench shoring, as indicated and as required by the pipe structural design.

3. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally.

4. The CONTRACTOR shall not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.

G. Placing and Spreading Of Backfill Materials

1. Each layer of backfill materials according to Section 2.1 shall be compacted to the required density as per Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction and is acceptable to the OWNER's representative.

2. Where such materials are used for pipe zone backfill, vibratory compaction shall be used at vertical intervals of the lesser of:

   a. One-half the diameter of the pipe; or

   b. 24 inches, measured in the un-compacted state.

3. In addition, these materials shall be subjected to vibratory compaction at the spring line of the pipe and the top of the pipe zone backfill, regardless of whether that dimension is less than 24 inches or not.

4. Each layer of backfill material shall be compacted using mechanical compactors suitable for the WORK.

5. The material shall be placed and compacted under the haunch of the pipe and up each side evenly so as not to move the pipe during the placement of the backfill.

6. The material shall be placed in lifts that will not exceed 6 inches when compacted to the required density.

H. Mechanical Compaction

1. Backfill around and over pipelines that is mechanically compacted shall be compacted using light, hand-operated vibratory compactors and rollers that do not damage the pipe.

2. After completion of at least 2 feet of compacted backfill over the top of pipeline, compaction equipment weighing no more than 8,000 pounds may be used to complete the trench backfill.

I. Pipe And Utility Trench Backfill

1. Pipe Zone Backfill

a. Definitions

1) The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane below the bottom surface of the pipe and a plane at a point above the top surface of the pipe as indicated.

2) The bedding is defined as that portion of pipe zone backfill material between the trench subgrade and the bottom of the pipe.

3) The embedment is defined as that portion of the pipe zone backfill material between the bedding and a level line as indicated.

b. Final Trim

1) After compacting the bedding, the CONTRACTOR shall perform a final trim for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.

2) Excavation for pipe bells and welding shall be made as required.

c. The pipe zone shall be backfilled with the indicated backfill material.

d. Pipe zone backfill materials shall be manually spread evenly around the pipe, maintaining the same height on both sides of the pipe such that when compacted the pipe zone backfill will provide uniform bearing and side support.

e. The CONTRACTOR shall exercise care in order to prevent damage to the pipeline coating, cathodic bonds, and the pipe itself during the installation and backfill operations.

2. Trench Zone Backfill

a. After the pipe zone backfill has been placed, backfilling of the trench zone may proceed.

b. The trench zone is defined as that portion of the vertical trench cross-section lying as indicated between a plane above the top surface of the pipe and a plane at a point 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade.

3. Final Backfill

a. Final backfill is defined as backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, backfill within 18 inches of the roadway subgrade.

J. Identification Tape

1. Install identification tape as indicated.

2. Terminate the tape in a precast concrete box either adjacent to or part of the valve box, manhole, vault, or other structure into which the non-metallic pipe enters or at the end of the non-metallic pipeline.

3. The termination box shall be covered with a cast iron lid.

4. The box shall be located at grade in paved areas or 6 inches above grade in unpaved areas.

K. Trench Shield

1. If a moveable trench shield is used during backfill operations, the shield shall be lifted to a location above each layer of backfill material prior to compaction of the layer.

2. The CONTRACTOR shall not displace the pipe or backfill while the shield is being moved.

L. Compaction Requirements

1. Compaction shall meet the requirements of the Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction.

3.9 FIELD TESTING

A. General

1. Field soils testing will be performed by a testing laboratory of the OWNER's choice at the CONTRACTOR’s expense, except as indicated below.

B. Density

1. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with Method C of ASTM D 1557.

2. Where cohesion less, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254.

3. Field density in-place tests will be performed in accordance with ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method, ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth), or by such other means acceptable to the OWNER.

C. Remediation

1. In case the test of the fill or backfill shows non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to ensure compliance.

2. Subsequent testing to show compliance shall be by a testing laboratory selected by the OWNER and paid by the CONTRACTOR.

D. CONTRACTOR's Responsibilities

1. The CONTRACTOR shall provide test trenches and excavations, including excavation, trench support and groundwater removal for the OWNER's field soils testing operations.

2. The trenches and excavations shall be provided at the locations and to the depths as required by the OWNER.

– END OF SECTION –

SECTION 31 34 19 - GEOTEXTILES

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide geotextiles, complete and in place, in accordance with the Contract Documents.

B. **Definitions:** The following definitions apply to the WORK of this Section:

1. Fabric: Geotextile, a permeable geosynthetic comprised solely of textiles.

2. Minimum Average Roll Value (MinARV): Minimum of series of average roll values representative of geotextile provided.

3. Maximum Average Roll Value (MaxARV): Maximum of series of average roll values representative of geotextile provided.

4. Nondestructive Sample: Sample representative of finished geotextile, prepared for testing without destruction of geotextile.

5. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

6. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D 4884.

7. Woven geotextile: A geotextile fabric composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern.

8. Nonwoven geotextile: A geotextile fabric composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The following standards are referenced in this Section:

ASTM D 4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D 4595	Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile

ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4884	Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Sewn Geotextiles
ASTM D 4886	Standard Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method)

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Shop Drawings

1. Manufacturer material specifications and product literature.

2. Installation drawings showing geotextile sheet layout, location of seams, direction of overlap, and sewn seams.

3. Description of proposed method of geotextile deployment, sewing equipment, sewing methods, and provisions for holding geotextile temporarily in place until permanently secured.

C. Samples

1. Geotextile: One-piece, minimum 18-inches long, taken across full width of roll of each type and weight of geotextile. Label each with brand name and furnish documentation of lot and roll number from which each sample was obtained.

2. Field Sewn Seam: 5-foot length of seam, 12-inches wide with seam along center, for each type and weight of geotextile.

3. Securing Pin and Washer: 1 each.

D. Certifications

1. Certification from geotextile manufacturer that products satisfy the indicated requirements.

2. Field seam efficiency test results.

PART 2 -- PRODUCTS

2.1 WOVEN GEOTEXTILE

A. Woven geotextile shall be composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern. Products shall be calendared or finished so that yarns will retain their relative position with respect to each other.

B. Polymeric yarn shall be long-chain synthetic polymers (polyester or polypropylene) with stabilizers or inhibitors added to make filaments resistant to deterioration due to heat and ultraviolet light exposure.

C. **Sheet Edges:** Selvaged or finished to prevent outer material from separating from sheet.

D. Unseamed Sheet Width: Minimum 12 feet.

E. Nominal Weight per Square Yard: 6.

F. **Physical Properties:** Conform to requirements below.

Property	Test Method
Apparent Opening Size (AOS)	ASTM D 4751
Water Permittivity	ASTM D 4491 (Falling Head)
Vertical Waterflow Rate	
Wide Width Strip Tensile Strength	ASTM D 4595
Wide Width Strip Elongation	
Trapezoidal Tear Strength	ASTM D 4533
Puncture Strength	ASTM D 4833
Abrasion Resistance	ASTM D 4886
Ultraviolet Radiation Resistance	ASTM D 4355

2.2 NONWOVEN GEOTEXTILE

A. Non-woven geotextile shall be composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern. Products shall be calendared or finished so that yarns will retain their relative position with respect to each other.

B. Polymeric yarn shall be long-chain synthetic polymers (polyester, polypropylene, or polyethylene) with stabilizers or inhibitors added to make filaments resistant to deterioration due to heat and ultraviolet light exposure.

C. **Geotextile Edges:** Selvaged or finished to prevent outer material from separating from sheet.

D. **Unseamed Sheet Width:** Minimum 6-feet.

E. **Nominal Weight per Square Yard:** 12 ounces.

F. **Physical Properties:** Conform to requirements below.

Property	Test Method
Apparent Opening Size (AOS)	ASTM D 4751
Water Permittivity	ASTM D 4491 (Falling Head)
Vertical Water flow Rate	
Wide Width Strip Tensile Strength	ASTM D 4595
Wide Width Strip Elongation	ASTM D 4595
Trapezoidal Tear Strength	ASTM D 4533
Puncture Strength	ASTM D 4833
Ultraviolet Radiation Resistance	ASTM D 4355

2.3 SEWING THREAD

A. Sewing thread shall be polypropylene, polyester, or Kevlar thread with durability equal to or greater than durability of geotextile sewn.

2.4 SECURING PINS

A. Securing pins shall be steel rods or bars conforming to the following:

1. 3/16-inch diameter.

2. Pointed at one end; head on other end, sufficiently large to retain washer.

3. Minimum Length: 12-inches.

B. Steel washers for securing pins shall be:

1. Outside Diameter: Not less than 1-1/2 inches.

2. Inside Diameter: 1/4-inch.

3. Thickness: 1/8-inch.

C. Steel Wire Staples

1. U-shaped.

2. 10-gauge.

3. Minimum 6-inches long.

PART 3 -- EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver each roll with sufficient information attached to identify manufacturer and product name or number.

B. Handle products in manner that maintains undamaged condition.

C. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in a way that protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

3.2 LAYING GEOTEXTILE

A. Notify the OWNER whenever geotextiles are to be placed. Do not place geotextile prior to obtaining OWNER approval of underlying materials.

B. Lay and maintain geotextile smooth and free of tension, folds, wrinkles, or creases.

3.3 ORIENTATION ON SLOPES

A. Orient geotextile with long dimension of each sheet parallel to direction of slope.

B. Geotextile may be oriented with long dimension of sheet transverse to direction of slope only if sheet width, without unsewn seams, is sufficient to cover entire slope and anchor trench and extend at least 18-inches beyond toe of slope.

3.4 JOINTS

A. Unseamed Joints

1. Unseamed joints shall be overlapped to the following dimensions unless otherwise indicated:

a. Foundation/Subgrade Stabilization: Minimum 18-inches.

b. Riprap: Minimum 18-inches.

c. Drain Trenches: Minimum 18-inches, except overlap shall equal trench width if trench width is less than 18-inches.

d. Other Applications: Minimum 12-inches.

B. Sewn seams shall be used wherever stress transfer from one geotextile sheet to another is necessary. Sewn seams, as approved by OWNER, also may be used instead of overlap at joints for applications that do not require stress transfer.

1. Seam efficiency shall be minimum 70 percent, verified by preparing and testing minimum of one set of nondestructive samples per acre of each type and weight of geotextile provided. Test according to ASTM D 4884.

2. Type: "J" type seams are preferred, but flat or butterfly seams are acceptable.

3. Stitch Count: Minimum 3 to maximum 7 stitches per inch.

4. Stitch Type: Double-thread chain stitch, Type 401, Federal Standard No. 751a.

5. Stitch Location: 2-inches from geotextile sheet edges, or more if necessary to develop required seam strength.

6. Sewing Machines: Capable of penetrating 4 layers of geotextile.

3.5 SECURING GEOTEXTILE

A. Secure geotextile during installation as necessary with sand bags or other means approved by OWNER.

B. Securing Pins

1. Insert securing pins with washers through geotextile, midway between edges of overlaps and 6-inches from free edges.

2. Spacing

Slope	**Maximum Pin Spacing, feet**
Steeper than 3:1	2
3:1 to 4:1	3
Flatter than 4:1	5

3. Install additional pins across each geotextile sheet as necessary to prevent slippage of geotextile or to prevent wind from blowing geotextile out of position.

4. Push each securing pin through geotextile until washer bears against geotextile and secures it firmly to subgrade.

3.6 PLACING PRODUCTS OVER GEOTEXTILE

A. Notify OWNER before placing material over geotextile; do not cover installed geotextile prior to receiving authorization from the OWNER to proceed.

B. If tears, punctures, or other geotextile damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged geotextile. Repair damage as indicated below.

3.7 INSTALLING GEOTEXTILE IN TRENCHES

A. Place geotextile in ways that will completely envelope granular drain material to be placed in trench and with indicated overlap at joints. Overlap geotextile in direction of flow. Place geotextile in a way and with sufficient slack for geotextile to contact trench bottom and sides fully when trench is backfilled.

B. After granular drain material is placed to grade, fold geotextile over top of granular drain material, unless otherwise indicated. Maintain overlap until overlying fill or backfill is placed.

3.8 RIPRAP APPLICATIONS

A. Overlap geotextile at each joint with upstream sheet of geotextile overlapping downstream sheet.

B. Sew joints where wave runup may occur.

3.9 GEOTEXTILE-REINFORCED EARTH WALL APPLICATIONS

A. Sew exposed joints; extend sewn seams minimum 3-feet behind face of wall.

B. Protect exposed geotextile from damage and deterioration until permanent facing is applied.

3.10 SILT FENCE APPLICATIONS

A. Install geotextile in one piece or continuously sewn to make one piece, for full length and height of fence, including portion of geotextile buried in toe trench.

B. Install bottom edge of sheet in toe trench and backfill in a way that securely anchors geotextile in trench.

C. Securely fasten geotextile to a wire mesh backing and each support post in a way that will not result in tearing of geotextile when fence is subjected to service loads.

D. Promptly repair or replace silt fence that becomes damaged.

3.11 REPAIRING GEOTEXTILE

A. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged geotextile. Repair damaged geotextile by placing patch of undamaged geotextile over damaged area plus at least 18-inches in all directions beyond damaged area. Remove interfering material as necessary to expose damaged geotextile for repair. Sew patches or secure them with pins and washers, as indicated above for securing geotextile, or by other means approved by manufacturer.

3.12 REPLACING CONTAMINATED GEOTEXTILE

A. Protect geotextile from contamination that would interfere, in OWNER's opinion, with its intended function. Remove and replace contaminated geotextile with clean geotextile.

- END OF SECTION -

SECTION 31 35 26 - EROSION CONTROL BARRIER

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide erosion control barriers, complete and in place, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 - Contractor Submittals.

B. **Product Data:** Manufacturer's catalog sheets on geotextile fabrics.

PART 2 -- PRODUCTS

2.1 FABRIC

A. Fabric may be woven or non-woven, made from polypropylene, polyethylene, or polyamid, and shall contain sufficient UV inhibitors so that it will last for 2 years in outdoor exposure.

B. Fabric shall have the following properties:

Parameter	Standard Method	Value
Grab tensile strength	ASTM D 4632	100 lb
Burst strength	ASTM D 3786	200 psi
Apparent opening size	ASTM D 4751	Between 200 and 70 sieve size

C. **Fabric Manufacturer, or equal: Mirafi**

2.2 POSTS

A. Posts shall be wood, at least 2 inches by 2 inches, at least 6 feet long.

B. Posts shall be steel, 1 1/2-inch, T-shaped, at least 6 feet long with protective coating.

2.3 FENCING

A. Woven wire fabric fencing shall be galvanized, mesh spacing of 6 inches, maximum 14-gauge, at least 30 inches tall.

2.4 FASTENERS

A. Fasteners to wood posts shall be steel, at least 1 1/2 inches long.

B. Fasteners to steel posts shall be galvanized clips.

PART 3 -- EXECUTION

3.1 PREPARATION

A. Provide erosion control barriers at the indicated locations and as required to prevent erosion and silt loss from the Site.

B. CONTRACTOR shall not commence clearing, grubbing, earthwork, or other activities which may cause erosion until barriers are in place.

3.2 INSTALLATION

A. Barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the woven wire fencing to the posts that are spaced a maximum of 6 feet apart and embedded a minimum of 12 inches. Install posts at a slight angle toward the source of the anticipated runoff.

C. Trench in the toe of the filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow. Lay fabric along the edges of the trench. Backfill and compact.

D. Securely fasten the fabric materials to the woven wire fencing with tie wires.

E. Reinforced fabric barrier shall have a height of 18 inches.

F. Provide the filter fabric in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, splice the fabric together only at a support post with a minimum 6-inch overlap and seal securely.

3.3 MAINTENANCE

A. Regularly inspect and repair or replace damaged components of the barrier. Unless otherwise directed, maintain the erosion control system until final acceptance; then remove erosion and sediment control systems promptly.

Remove sediment deposits when silt reaches a depth of 6 inches or 1/2 the height of the barrier, whichever is less. Dispose of sediments on the Site, if a location is indicated on the Drawings, or at a site arranged by the CONTRACTOR which is not in or adjacent to a stream or floodplain.

- END OF SECTION -

SECTION 31 35 28 - EROSION CONTROL

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide erosion protection including fertilizing, seeding, and mulching for all disturbed areas that are not to be paved or otherwise treated areas as indicated in accordance with the Contract Documents.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. **Fertilizer:** Fertilizer shall be a commercial, chemical type, uniform in composition, free-flowing, conforming to state and federal laws and suitable for application with equipment designed for that purpose. Fertilizer shall have a guaranteed analysis showing not less than 11percent nitrogen, 8 percent available phosphoric acid, and 4 percent water soluble potash. Fertilizer shall meet US Forest Service Requirements.

B. **Seed:** Seed shall be delivered in original unopened packages bearing an analysis of the contents. Seed shall be guaranteed 95 percent pure with a minimum germination rate of 80 percent.

1. Seed mix shall be as follows as per US Forest Service Requirements:

a.	Blue Wildrye	Elymus glaucus	20 lbs/acre
b.	California brome	Bromus carinatus	20 lbs/acre
c.	Slender hairgrass	Deschampsia elongate	10 lbs/acre

C. **Mulch:** Mulch shall be a certified weed-free straw. Mulch shall meet Forest Service Requirments.

D. Erosion Control Fabric:

1. Materials: Shall meet or exceed the USDA Forest Service requirements, Washington Department of Transportation Standard Construction Requirements and the Washington Department of Ecology.

2. Anchorage Devices: Shall be a minimum of nine-inch, 2-legged staples from the manufacturer or staples of the proper length as recommended by the manufacturer for specific soil condition.

E. Manufacturers**,** or Equal

1. **North American Green**

2. **Synthetic Industries**

PART 3 -- EXECUTION

3.1 GENERAL

A. **Weather Conditions:** Fertilizing, seeding, or mulching operations will not be permitted when wind velocities exceed 15 miles per hour or when the ground is frozen, unduly wet, or otherwise not in a tillable condition.

B. **Soil Preparation:** The ground to be seeded shall be graded in conformance with the Drawings and shall be loose and reasonably free of large rocks, roots, and other material which will interfere with the work.

C. **Method of Application:** Fertilizer, seed, and mulch may be applied separately (Dry Method), or they may be mixed together with water and the homogeneous slurry applied by spraying (Hydraulic Method), except that all slopes steeper than 3 units horizontal to 1 unit vertical shall be stabilized by the Hydraulic Method.

3.2 DRY METHOD

A. **Fertilizing:** The fertilizer shall be spread uniformly at the rate of 800 lbs per acre (approximately 1 lb per 55 square feet). The fertilizer shall be raked in and thoroughly mixed with the soil to a depth of approximately 2-inches prior to the application of seed or mulch.

B. **Seeding:** The seed shall be broadcast uniformly at the rate of 60 lbs/acre (approximately 1 lb per 730 sq ft). After the seed has been distributed it shall be incorporated into the soil by raking or by other approved methods.

C. **Mulch Application:** Mulch shall be applied at the rate of 1,500 lb (air dried weight) per acre (approximately 1 lb per 30 sq ft).

3.3 HYDRAULIC METHOD

A. The hydraulic method consists of the uniform application by spraying of a homogeneous mixture of water, seed, fertilizer, and mulch. The slurry shall be prepared by mixing the ingredients in the same proportions as indicated above. The slurry shall have the proper consistency to adhere to the earth slopes without lumping or running. Mixing time of materials shall not exceed 45 minutes from the time the seeds come into contact with the water in the mixer to the complete discharge of the slurry onto the slopes, otherwise the batch shall be recharged with seed. The mixture shall be applied using equipment containing a tank having a built-in, continuous agitation and recirculation system, and a discharge system which will allow application of the slurry to the slopes at a continuous and uniform rate. The application rates of the ingredients shall be the same as those specified for the Dry Method. The nozzle shall produce a spray that does not concentrate the slurry nor erode the soil.

3.4 EROSION CONTROL BLANKET

A. Placement

1. Biodegradable erosion control blanket shall be used on all slopes 4H:1V and steeper.

2. The erosion control shall be spread only on prepared, fertilized and seeded surfaces.

3. On all slopes, the erosion control blanket shall be laid up-and-down the slope in the direction of water flow.

4. Waste of erosion control material shall be minimized by limiting overlaps as specified and by utilizing the full length of the netting at roll ends.

B. Anchorage

1. Ends and sides of adjoining pieces of material shall be overlapped 6-inches and 4-inches respectively, and stapled. Six anchors shall be installed across ends. A common row of staples shall be used at side joints. Staple through both blankets, placing staples approximately 6-inches apart.

2. The top edge of the erosion control blanket shall be anchored in a 6-inch deep by 6-inch wide trench. Backfill and compact trench after stapling.

3. Anchorage shall be by means of 9-inch long, 2-legged staples driven vertically and full-length into the ground. The legs shall be spread 3-inches to 4-inches apart at the ground to improve resistance to pull-out. In loose soils the use of 18-inch metal/washer pins may be required to properly anchor the blankets.

4. All slopes which are 3:1 or greater shall be stapled with 2 staples per square yard in a triangular pattern. Staples shall be installed per the manufacturer's recommended staple pattern guide.

5. The erosion control blanket shall not be stretched, but should be laid loosely over the ground to avoid pulling the blanket down slope.

6. The erosion control blanket shall not be rolled out onto ground containing frost within the 9-inch penetration zone of the anchorage staples. Further, no stapling shall be undertaken while any frost exists within the staple penetration zone.

3.5 WATERING

A. Upon completion of the erosion control seeding, the entire area shall be soaked to saturation by a fine spray. The new planting shall be kept watered by a sprinkling system on the Site during dry weather or whenever necessary for proper establishment of the planting until final project acceptance. At no time shall the planting be allowed to dry out. Care shall be taken to avoid excessive washing or puddling on the surface and any such damage caused thereby shall be repaired by the CONTRACTOR.

3.6 MAINTENANCE PRIOR TO FINAL ACCEPTANCE

A. The CONTRACTOR shall maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include the filling, leveling, and repairing of any washed or eroded areas, as may be necessary and sufficient watering to maintain the plant materials in a healthy condition. The OWNER may require replanting of any areas in which the establishment of the vegetative ground cover does not appear to be developing satisfactorily.

- END OF SECTION -

SECTION 31 36 00 - GABIONS

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide wire mesh baskets or containers known as gabions and all appurtenant work, including the furnishing and placement of all rock fill, compacted embankment or other fill material, excavation, final grading, and disposal of excess or waste material, all in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. All CONTRACTOR submittals shall be in accordance with the requirements of Section 01 33 00 - Contractor Submittals.

B. The CONTRACTOR shall submit specifications and samples of the proposed gabions including clips, rings, and cobbles to be installed to the OWNER for review prior to ordering.

PART 2 -- PRODUCTS

2.1 GABION MATERIALS

A. Gabions shall be fabricated in such a manner that the sides, ends, lid and diaphragms can be assembled at the Site into rectangular baskets of the sizes indicated. Gabions shall be of single unit construction; the base, lid, ends, and sides shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the connecting point is at least equal to that of the mesh. Where the length of the gabion exceeds one and one-half its horizontal width, the gabion shall be divided by diaphragms of the same mesh and gage as the body of the gabions, into cells whose length does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying is required at this juncture. The wire mesh shall be fabricated in such a manner as to be non-raveling. This is defined as the ability to resist pulling apart at any of the twists or connections forming the mesh when a single wire strand in a section of mesh is cut.

2.2 GALVANIZED STEEL WIRE MESH GABIONS

A. Gabion basket units shall be of non-raveling construction and fabricated from a double twisted hexagonal mesh of hot dipped galvanized steel wire having a diameter of 0.118 inches (approx. U.S. Ga. 11) after galvanizing. The steel wire used shall be galvanized prior to weaving into mesh. All wire used in the fabrication of the gabion shall equal or exceed Federal Specification QQ-W-461H, possess soft tensile strength, and a Finish 5 Class 3 zinc coating of not less than 0.80 oz/sq ft of uncoated wire surface. The mesh opening shall be hexagonal in shape and uniform in size measuring not more than 3-1/4 inches by 4-1/2 inches approximately. Selvedge or perimeter basket frame wire shall be of a heavier gage than the mesh wire with a diameter of 0.150 inches (approx. U.S. Ga. 9) after galvanizing. Lacing and connecting wire shall meet the same specifications as the wire used in the gabion body except that its diameter shall be of 0.0866 inches (approx. U.S. Ga. 13-1/2) after galvanization. Locking wire fastener clips with twisted hook ends may be used in place of lacing wire. Fastener clips shall be fabricated from

wire meeting the requirements of ASTM A 764 and when closed and locked shall have a minimum tensile pull strength of 650 lb.

2.3 WIRE MESH DEFORMATION

A. The wire mesh shall have deformability sufficient to permit a minimum mesh elongation equivalent to 10 percent of the un-stretched length of the mesh test section without reducing the gauge or tensile strength of the individual wire strands to values less than those for similar wire, one gauge smaller in diameter.

2.4 ROCK FILL MATERIALS

A. Rock fill shall consist of durable, angular field or quarry stone of approved quality which is sound, hard, and free from seams, cracks, or other structural defects. The minimum dimension of any rock or stone shall be 4-inches and the maximum dimension shall not be greater than 12-inches. The rocks or stones shall be graded in size so as to produce a reasonably dense mass. Rock fill shall be hauled from a pit or site approved by the OWNER.

PART 3 -- EXECUTION

3.1 FOUNDATION PREPARATION

A. The foundation areas for the gabions shall be excavated and backfilled to the slopes lines and grades shown and prepared in accordance with the applicable requirements of Section 31 30 00 - Earthwork. Geotextile fabric shall be installed on the prepared surfaces in accordance with the requirements of Section 31 34 19 - Geotextiles.

3.2 ASSEMBLY AND INSTALLATION OF GABIONS

A. Gabions shall be assembled and installed in accordance with the manufacturer's recommendations. Empty gabion units shall be assembled individually and placed on the prepared surface to the lines and grades indicated. The sides, ends, and diaphragms shall be erected in such a manner as to insure the correct position of all creases and that the tops of all sides are uniform. All adjoining gabion units shall be connected by tie wire lacing along the perimeter of their contact surfaces in order to obtain a monolithic structure. Lacing of adjoining basket units shall be accomplished by continuous stitching with alternating single and double loops, with a half-hitch on each double loop, spaced at intervals of not more than 6-inches. All lacing wire terminals shall be securely fastened. Locking wire fastener clips may be used in lieu of tie wire lacing and shall be spaced at an interval of not more than 6-inches for all connections, including internal diaphragm to basket connections. Fastener clips used for assembly of gabion units shall only be attached when the basket units are empty.

B. After adjoining empty basket units are set to the desired lines and grades and common sides with adjacent units thoroughly laced, they shall be placed in tension and stretched to remove any kinks from the mesh and to form a uniform alignment. The stretching of empty basket units shall be accomplished in such a manner as to prevent any possible unraveling.

3.3 PLACING ROCK FILL

A. Rock filling operations shall carefully proceed with placement by hand or machine so as not to damage the wire coating, to assure a minimum of voids between the stones, and the maintenance of alignment throughout the filling process. Undue bulging of the mesh

shall be avoided. To avoid localized deformation, the basket units in any row are to be filled in stages consisting of maximum 12-inch courses, and at no time shall any cell be filled to a depth exceeding one foot more than the adjoining cell. The maximum height from which the stone may be dropped into the basket units shall be 36-inches.

B. Along all exposed faces, the outer layer of stone shall be carefully placed and arranged by hand to insure a neat and compact appearance. The last layer of stone shall be leveled with the top of the gabion to allow for proper closing of the lid and to provide an even surface that is uniform in appearance. All stones used on exposed faces shall have no dimension smaller than the mesh opening size.

C. Each partitioned section of the gabion shall be filled and leveled at the 1/3 point for 3-ft high gabions or the 1/2 point for 1.0-ft or 1.5-ft high gabions and shall be cross tied through the middle with connecting wire from end to end and side to side. Connecting wires shall be looped around one mesh opening at each basket face and the wire terminals shall be securely twisted to prevent their loosening.

D. Lids shall be stretched tight over the stone fill using crowbars or lid closing tools, until the lid meets the perimeter edges of the front and end panels. The lid shall then be tightly laced with tie wire along all edges, ends, and internal cell diaphragms by continuous stitching with alternating single and double loops, with a half-hitch on each double loop, spaced at intervals of not more than 6-inches. Special attention shall be given to assure that all projections or wire ends are turned into the baskets. The CONTRACTOR shall have the option of securing the lids by using locking wire fastener clips spaced at intervals of not more than 6-inches along all edge, end, and internal cell diaphragm connections.

3.4 PROTECTION OF THE WORK

A. The construction sequence shall be planned and carried out in such a manner that no tracked or wheeled vehicles nor any heavy equipment will travel over or on a completed gabion.

- END OF SECTION -

SECTION 43 00 00 – GENERAL REQUIREMENTS FOR MECHANICAL WORK

PART 1 -- GENERAL

1.1 SUMMARY

A. Provide all labor, materials, and equipment required to perform and complete the mechanical work specified in this Section and this Division and on the Drawings.

B. Advise subcontractors, suppliers, and vendors involved in the work specified in this section of the applicable requirements.

C. Include the services of manufacturer's representatives where required to place equipment into proper operation or for advice on installation procedures, or where specifically called for in the Specifications.

D. Comply with manufacturer's requirements over and above those shown on the Drawings or specified with respect to connections, servicing and installation of the particular equipment.

1.2 CODES

A. Codes having jurisdiction include, but are not limited to:

1. Life Safety Code, NFPA 101
2. International Building Code
3. International Mechanical Code
4. Uniform Plumbing Code
5. National Electrical Code

B. All work must be performed in accordance with the requirements of all pertinent National, State, and local building codes and regulations. Furnish specialties and make mechanical installations in conformance with applicable codes and regulations.

C. This specification section is developed to provide the general requirements for the mechanical trade portions of the Work. Failure to comply with the requirements of the other Divisions of the specifications shall not relieve the CONTRACTOR of responsibility or be used as a basis for additional compensation due to omission of civil, architectural and structural details from the mechanical and electrical drawings.

D. Where requirements of specifications exceed code or regulations requirements, specifications will govern. Where requirements of code or regulations exceed specifications, code or regulations will govern.

E. Notify OWNER in advance of ordering or fabrication of any materials or apparatus believed to be inadequate, unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction.

1.3 DRAWINGS

A. The accompanying drawings in some instances are diagrammatic and are intended to show the general arrangement and the extent of the work that, when completed, shall be complete in every respect. They do not show every offset, bend or elbow which may be required in the Work for installation in the space allotted. The CONTRACTOR shall follow the Drawings as closely as practical and shall install additional bends, offsets, etc. as may be required for proper installation of the Work. The exact location and arrangement of all parts shall be determined after equipment has been selected and as the work progresses to conform, in the opinion of the OWNER, the best possible manner with the surroundings. Figured dimensions shall be followed without regard to scale.

B. Minor details, special conditions, and additional details as well as materials and equipment usually furnished with the systems specified shall be included in the work as if herein specified whether mentioned or not. Items of equipment and fixtures are specified in singular; however, the CONTRACTOR shall provide the numbers of such items as are indicated on the Drawings, and as required for a complete system.

1.4 MANUALS

A. Provide operating and maintenance data in accordance with SECTION 01 33 00.

1.5 PERMITS AND INSPECTIONS

A. CONTRACTOR shall:

1. Obtain and pay for all permits and licenses required by codes and ordinances and not provided by OWNER

2. Obtain amounts of respective levied costs prior to bidding and include in bid. Verification of costs quoted by respective bureau is CONTRACTOR's responsibility; additional compensation to the CONTRACTOR by OWNER for differences between quoted and actual costs will not be considered.

3. Request, arrange and schedule required code inspections as work progresses and at final completion of the work. Deliver copies of inspection certificates to the OWNER.

1.6 REFERENCES

A. This section references the latest edition and amendments of the following documents. They are a part of this section as specified and modified. In a case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ABAI	American Boiler and Affiliated Industrial
ADC	Air Diffusion Council
AGA	American Gas Association
AMCA	Air Moving and Conditioning Association

ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CISP	Cast Iron Soil Pipe Institute
HI	Hydronics Institute
ISO	International Standards Organization
MSS	Manufacturers Standardization Society of the Valve & Fittings Industry
NEMA	National Electric Manufacturers' Association
NPFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
SAMA	Scientific Apparatus Makers Association
SBI	Steel Boilers Institute
SMACNA	Sheet Metal and Air Conditioning CONTRACTORs National Association, Inc.
TEMA	Tubular Exchanger Manufacturer's Association
UL	Underwriter's Laboratories

PART 2 -- PRODUCTS

2.1 GENERAL

A. Like materials shall be identical with multiple items coming from the same product line and the same manufacturer.

B. Miscellaneous steel. Provide structural steel as required for adequate support of all mechanical equipment. The structural steel shall be angle, channel, plate I or H sections suitable for the application. Support holes shall be drilled or burned only in flanges of

structural shapes. Holes shall be drilled or burned in only one leg of any one angle and as far from the center of length as possible.

2.2 MATERIALS

A. Identification of materials. The CONTRACTOR shall deliver materials to the project site with the manufacturer's labels intact and legible.

B. Material storage and handling. Materials shall be handled with care to avoid damage. Materials shall be stored protected by the weather, dirt, construction dust, and potential damage.

C. CONTRACTOR shall be responsible for all damage or vandalism to equipment while stored at the job site.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Locating and positioning equipment: Observe all OSHA and State of Washington safety codes and regulations and use good construction practices in locating and installing mechanical equipment and material so that the completed installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment. The installation of any equipment with less than the minimum clearances indicated by the manufacturer as required for proper maintenance will not be accepted. Set fixtures, valves, and equipment to provide for ready access to any parts requiring inspection and service.

B. Cutting and patching. The CONTRACTOR shall not cut, burn, drill, excavate or otherwise weaken building structural members and underpinning without the written permission of the OWNER. Any structural members or structural surfaces adversely impacted by the CONTRACTOR's work will be corrected. Surfaces damaged by the CONTRACTOR shall be patched and refinished to match adjacent surfaces.

C. Protection. Protect equipment and materials during installation to prevent damage. Temporarily cap or plug all pipe openings.

D. Safety requirements. Belts, pulleys, chains, gears, couplings, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with state safety codes and OSHA requirements.

E. Electrical requirements. Electrical wiring of mechanical equipment and systems such as motors, starters, and controls shall be provided as necessary for complete and operable systems from the power source indicated on the specification drawings.

F. Equipment, valve, and accessories labeling. Label all mechanical equipment, equipment starters, equipment switches, and exposed valves and piping accessories, with equipment identification name and mark number as indicated.

G. Where dissimilar metals meet, provide protection to prevent galvanic action.

H. Review Drawings and Specifications, become familiar with the building construction and finishes, the work of other trades, space available for mechanical equipment and installations, and obvious interferences requiring special attention.

I. Coordinate the work of the various mechanical trades, mechanical subcontractors, and the general mechanical work with the work of other trades and subcontractors to avoid interferences between piping, ductwork, equipment, architectural, electrical, and structural work.

J. Finish necessary offsets in piping and ductwork together with fittings and connections required to properly install the work complete in place

K. Install piping and ducts as close as possible to ceilings, walls, and columns, to utilize a minimum amount of space and to not obstruct any portion of windows, light fixtures, doorways or passages.

L. In case interferences develop, the OWNER will decide which equipment or installation must be relocated regardless of which apparatus was first installed. Such work shall be accomplished at no additional cost.

M. Locate and install valves, thermometers, gauges, fittings, filters, or other equipment or specialties requiring frequent reading, adjustment, inspection, repair, removal, or replacement conveniently and accessibly with reference to the finished building.

N. If necessary, make alterations and/or repairs to mechanical work and/or work specified in other divisions of the specifications because of lack of proper mechanical supervision and/or failure to coordinate work, and/or failure to direct locations of necessary openings, or framing. Pay all costs related to alterations or repair

3.2 EXECUTION

A. No information given on the plans or in the specifications shall relieve the CONTRACTOR of the responsibility or coordination of the work. Each Contractor shall cooperate with the CONTRACTOR and all other Contractors to coordinate their work, avoid interferences and delays, and coordinate all parts of the work in service and appearance with all other parts.

B. Locate equipment which must be serviced, operated or maintained, in fully accessible positions. Equipment includes, but is not limited to, valves, cleanouts, motors, pumps, controllers, switchgear, filters and drain points. Minor deviations from the Drawings may be made to allow for better accessibility; however, changes must be reviewed and accepted by the OWNER prior to installation

- END OF SECTION -

SECTION 43 10 50 - PIPING, GENERAL

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide the piping systems indicated, complete and operable, in accordance with the Contract Documents.

B. The Drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical Drawings are **not** pipe construction or fabrication drawings. Where pipe supports and spacing are indicated on the Drawings and are referenced to a Standard Detail, the CONTRACTOR shall use that Detail. Where pipe supports are not indicated on the Drawings, it is the CONTRACTOR'S responsibility to develop the details necessary to design and construct mechanical piping systems to accommodate the specific equipment provided, and to provide spacers, adapters, and connectors for a complete and functional system.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. **Shop Drawings:** Shop Drawings shall contain the following information:

1. Drawings: Layout drawings including necessary dimensions, details, pipe joints, fittings, specials, bolts and nuts, gaskets, valves, appurtenances, anchors, guides, and material lists. Fabrication drawings shall indicate spacers, adapters, connectors, fittings, and pipe supports to accommodate the equipment and valves in a complete and functional system.

2. Thermoplastic Pipe Joints: Submit solvent cement manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.

3. Gasket Material: Submit gasket manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.

4. Modular Seals for Pipe: Manufacturer's catalog sheet showing materials and installation procedures.

C. **Samples:** Performing and paying for sampling and testing as necessary for certifications are the CONTRACTOR'S responsibility.

D. Certifications

1. Necessary certificates, test reports, and affidavits of compliance shall be obtained by the CONTRACTOR.

2. A certification from the pipe fabricator that each pipe shall be manufactured subject to the fabricator’s or a recognized Quality Control Program. An outline of the program shall be submitted to the OWNER for review prior to the manufacture of any pipe.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Extent of Work:** Pipes, fittings, and appurtenances shall be provided in accordance with the requirements of the applicable Sections of all Divisions within these project specifications and as indicated. Materials in contact with potable water shall be listed as compliant with NSF Standard 61.

B. **Pipe Supports:** Pipes shall be adequately supported, restrained, and anchored in accordance with Section 43 10 52 - Pipe Supports, and as indicated.

C. **Lining:** Application, thickness, and curing of pipe lining shall be in accordance with the applicable Sections for each pipe.

D. **Coating:** Application, thickness, and curing of coating on buried pipe shall be in accordance with the applicable Sections for each pipe, unless otherwise indicated.

E. **Pressure Rating:** Piping systems shall be designed for the maximum expected pressure as indicated on the Piping Schedule or as designated in the applicable Sections for each pipe.

F. **Inspection:** Pipe shall be subject to inspection at the place of manufacture. During the manufacture, the OWNER shall be given access to areas where manufacturing is in progress and shall be permitted to make inspections necessary to confirm compliance with requirements.

G. **Tests:** Except where otherwise indicated, materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as indicated. The CONTRACTOR shall be responsible for performing material tests.

H. **Welding Requirements:** Qualification of welding procedures used to fabricate pipe shall be in accordance with the provisions of AWS D1.1 - Structural Welding Code. Welding procedures shall be submitted for the OWNER‘s review.

I. **Welder Qualifications:** Welding shall be done by skilled welders and welding operators who have adequate experience in the methods and materials to be used. Machines and electrodes similar to those used in the WORK shall be used in qualification tests. Qualification testing of welders and materials used during testing is part of the WORK.

2.2 PIPE FLANGES

A. **General:** Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated. Attachment of the flanges to the pipe shall conform to the applicable requirements of AWWA C207. Flange faces shall be perpendicular to the axis of the adjoining pipe. Flanges for miscellaneous small diameter pipes shall be in accordance with the standards indicated for these pipes.

B. Pressure Ratings

1. 150 psi or less: Flanges shall conform to either AWWA C207 - Steel Pipe Flanges for Waterworks Service--Sizes 4 In. Through 144 In., Class D, or ASME B16.5 - Pipe Flanges and Flanged Fittings, 150 lb class.

2. 150 psi to 275 psi: Flanges shall conform to either AWWA C207 Class E or Class F, or ASME B16.5 150 lb class.

3. 275 psi to 700 psi: Flanges shall conform to ASME B16.5, 300 lb class.

4. Selection based on test pressure: AWWA flanges shall not be exposed to test pressures greater than 125 percent of rated capacity. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected.

C. **Blind Flanges:** Blind flanges shall be in accordance with AWWA C207, or as indicated for miscellaneous small pipes. Blind flanges for pipe sizes 12-inches and greater shall be provided with lifting eyes in the form of welded or screwed eye bolts.

D. **Flange Coating:** Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

E. **Flange Bolts:** Bolts and nuts shall conform to Section 05 50 00 - Miscellaneous Metalwork. All-thread studs shall be used on valve flange connections where space restrictions preclude the use of regular bolts.

F. Flange Gaskets

1. Gaskets for flanged joints used in general water and wastewater service shall be full-faced type, with material and thickness in accordance with AWWA C207, suitable for temperatures to 700 deg F, a pH of one to 11, and pressures to 1000 psig. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted unless otherwise indicated. Flange gaskets shall be as manufactured by **John Crane, Style 2160, Garlock, Style 3000,** or equal**.**

2. Gaskets for flanges for HDPE, PVC and CPVC piping used in general water and wastewater service shall be full faced, 1/8-inch thick, made of ethylene propylene rubber (EPR) having a Type A durometer hardness of 50 to 70 when tested in accordance with ASTM D 2240. When the mating flange has a raised face, provide a flat ring gasket filler between the flange and gasket and the adjacent flange.

3. Gaskets for flanged joints used in chemicals, air, solvents, hydrocarbons, steam, chlorine and other fluids shall be made of materials compatible with the service, pressure, and temperature.

2.3 THREADED INSULATING CONNECTIONS

A. **General:** Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. **Materials:** Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.4 SLEEVE-TYPE COUPLINGS

A. **General:** Sleeve-type couplings shall be provided where indicated. The CONTRACTOR shall not be allowed to substitute a sleeve-split coupling, or any other type in lieu of sleeve coupling unless approved by the OWNER.

B. **Construction:** Sleeve couplings shall be in accordance with AWWA C219 - Standard for Bolted Sleeve-Type Couplings for Plain-End Pipe. Couplings shall be steel with steel bolts, without pipe stop. Couplings shall be of sizes to fit the pipe and fittings indicated. The middle ring shall be not less than 1/4-inch thick or at least the same wall thickness as the pipe to which the coupling is connected. If the strength of the middle ring material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe. The coupling shall be either 5- or 7-inches long for sizes up to and including 30-inches and 10-inches long for sizes greater than 30-inches, for standard steel couplings, and 16-inches long for long-sleeve couplings. The followers shall be single-piece contoured mill sections welded and cold-expanded as required for the middle rings, and of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts shall conform to the requirements of Section 05 50 00. Buried sleeve-type couplings shall be epoxy-coated at the factory as indicated.

C. **Pipe Preparation:** Where indicated, the ends of the pipe shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12-inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

D. Gaskets

1. Gaskets for sleeve-type couplings shall be rubber-compound material that shall not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," Grade 60, or equivalent suitable elastomer. The rubber in the gasket shall meet the following specifications:

   a. Color - Jet Black

   b. Surface - Non-blooming

   c. Durometer Hardness - 74 plus and minus 5

   d. Tensile Strength - 1000 psi minimum

   e. Elongation - 175 percent minimum

2. The gaskets shall be immune to attack by impurities normally found in water or wastewater. Gaskets shall meet the requirements of ASTM D 2000 - Classification System for Rubber Products in Automotive Applications, AA709Z, meeting Suffix B13 Grade 3, except as noted above. Where sleeve couplings are used in water containing chloramine or other fluids which attack rubber materials, gasket material shall be compatible with the piping service and fluid utilized.

E. **Piping Connection to Equipment:** Where piping connects to mechanical equipment such as pumps, compressors, and blowers, the piping shall be brought to the equipment connection aligned and perpendicular to the axis of the flange or fitting for which the piping is to be connected. The piping shall not impose excessive stress to the equipment connection to cause misalignment of the equipment. The CONTRACTOR shall assign the responsibility to the equipment manufacturer to review the piping connection to the equipment and submit any modifications to the OWNER for review.

F. **Restrained Joints:** Sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall be designed by the pipe manufacturer in accordance with AWWA Manual M11, or as indicated. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed. Where harness sets are installed near the suction and discharge of the pump, harness bolts shall have zero elongation to prevent misalignment of the pump imparted by the thrust within the piping system.

G. Manufacturers, or equal

1. **Dresser, Style 38**

2. **Ford Meter Box Co., Inc., Style FC1 or FC3**

3. **Smith-Blair, Style 411**

2.5 FLANGE COUPLING ADAPTERS

A. Flange coupling adapters shall be provided where indicated. The CONTRACTOR shall not be allowed to substitute any other type in lieu of flange coupling adapter unless approved by the OWNER. The coupling shall be rated as indicated.

B. **Construction**: Flange coupling adapter body shall be fabricated from steel ASTM A 512 - Cold-Drawn Buttweld Carbon Steel Mechanical Tubing or A 513 - Electric-Resistance Welded Carbon and Alloy Steel Mechanical Tubing with steel bolts, without pipe stop. Flange shall be in accordance with AWWA C207. Couplings shall be of sizes to fit the pipe and fittings indicated. The body shall be not less than 1/4-inch thick or at least the same wall thickness as the pipe to which the coupling is connected. If the strength of the body material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe. The follower flange shall be fabricated from steel, ASTM A 576 - Steel Bars, Carbon, Hot Wrought, Special Quality or AISI C1012. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Flange coupling adapters installed in piping system rated for positive pressure, the coupling shall be restrained with harness bolts or tie rods. Other means of restraining the coupling such as set screws shall not be acceptable. Bolts and nuts shall conform to the requirements of Section 05 50 00. Buried couplings shall be epoxy-coated at the factory as indicated.

C. Gaskets: Gaskets for flange coupling adapters shall be rubber-compound material that shall not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," Grade 60 NSF approved, or equivalent suitable elastomer.

1. The rubber in the gasket shall meet the following specifications:

a. Color - Jet Black

b. Surface - Non-blooming

c. Durometer Hardness - 74 plus and minus 5

d. Tensile Strength - 1000 psi Minimum

e. Elongation - 175 percent Minimum

2. The gaskets shall be immune to attack by impurities normally found in water or wastewater. Gaskets shall meet the requirements of ASTM D 2000 - Classification System for Rubber Products in Automotive Applications, AA709Z, meeting Suffix B13 Grade 3, except as noted above. Where flange coupling adapters are used in water containing chloramine or other fluids which attack rubber materials, gasket material shall be compatible with the piping service and fluid utilized.

D. **Piping Connection to Equipment:** Where piping connects to mechanical equipment such as pumps, compressors, and blowers, the piping shall be brought to the equipment connection aligned and perpendicular to the axis of the flange or fitting for which the piping is to be connected. The piping shall not impose excessive stress to the equipment connection to cause misalignment of the equipment. The CONTRACTOR shall assign the responsibility to the equipment manufacturer to review the piping connection to the equipment and submit any modifications to the OWNER for review.

E. **Restrained Joints:** Flange coupling adapters on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall be designed by the pipe manufacturer in accordance with AWWA Manual M11, or as indicated. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed. Where harness sets are installed near the suction and discharge of the pump, harness bolts shall have zero elongation to prevent misalignment of the pump imparted by the thrust within the piping system.

F. Manufacturers, or Equal

1. **Smith-Blair, Model 975**

2. **JCM, Model 309**

2.6 EXPANSION JOINTS

A. Piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement without exertion of undue forces to equipment or structures. This may be accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints. Expansion joints shall be flanged end, stainless steel, Monel, rubber, or other materials best suited for each individual service. The CONTRACTOR shall submit detailed calculations and manufacturer's Shop Drawings of proposed expansion joints, piping layouts, and anchors and guides, including information on materials, temperature, and pressure ratings.

2.7 AIR VENT

A. Continuous acting air/vacuum release valves shall be placed at all high points.

2.8 PIPE THREADS

A. Pipe threads shall be in accordance with ASME B1.20.1 - Pipe Threads, General Purpose (inch), and be made up with Teflon tape unless otherwise indicated.

PART 3 -- EXECUTION

3.1 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. Piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact. Defective or damaged materials shall be replaced with new materials.

3.2 GENERAL

A. Piping, fittings, and appurtenances shall be installed in accordance with the requirements of applicable Sections of all Divisions within these project specifications and as indicated. Proprietary manufactured couplings shall be installed in accordance with the coupling manufacturer's recommendation.

B. Care shall be taken to insure that piping flanges, mechanical-type couplings, sleeve-type couplings, flexible connectors, and expansion joints are properly installed as follows:

1. Gasket surfaces shall be carefully cleaned and inspected prior to making up the connection. Each gasket shall be centered properly on the contact surfaces.

2. Connections shall be installed to prevent inducing stress to the piping system or the equipment to which the piping is connected. Contact surfaces for flanges, couplings, and piping ends shall be aligned parallel, concentric, and square to each axis at the piping connections.

3. Bolts shall be initially hand-tightened with the piping connections properly aligned. Bolts shall be tightened with a torque wrench in a staggered sequence to the AISC recommended torque for the bolt material.

4. Groove ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove.

5. After installation, joints shall meet the indicated leakage rate. Flanges shall not be deformed nor cracked.

- END OF SECTION -

SECTION 43 10 52 - PIPE SUPPORTS

PART 1 -- GENERAL

1.1 SUMMARY

A. Provide pipe supports, hangers, guides, and anchors, complete and in place, as indicated in accordance with the Contract Documents.

B. Where pipe support systems are not indicated on the Drawings, the CONTRACTOR shall design and provide the supports in accordance with this Section.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01 33 00 – Contractor Submittals.

B. Submit shop drawings and the manufacturer's descriptive literature on all equipment listed in this specification prior to the product installations and associated fabrications.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Code Compliance

1. Piping systems and pipe connections to equipment shall be properly anchored and supported in order to prevent undue deflection, vibration, and dislocation due to seismic events, line pressures, pipe weight, fluid weight, liquid movement, thermal changes, vibration, probable forces applied during construction, and stresses on piping, equipment, and structures.

2. Supports for plumbing piping shall be in accordance with the latest edition of the applicable plumbing code or local administration requirements.

B. Structural Members

1. Wherever possible, pipes shall be supported from structural members.

2. Where it is necessary to frame structural members between existing members, such supplementary members shall be provided by the CONTRACTOR.

3. Supplementary members shall be in accordance with the requirements of the Building Code and the American Institute of Steel Construction, and shall be as acceptable to the OWNER.

C. Pipe Hangers

1. Pipe hangers shall be capable of supporting the pipe in operation, allowing free expansion and contraction of the piping and preventing excessive stress on equipment.

2. Hangers shall have a means of vertical adjustment after erection.

3. Hangers shall be designed to prevent becoming disengaged by any movement of the supported pipe.

4. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves shall include hydraulic shock suppressors.

5. Hanger rods shall be subjected to vertical loading only.

D. Hangers Subject to Horizontal Movements

1. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit such movement.

2. Where horizontal pipe movement is greater than 1/2 inch, or where the hanger rod deflection from the vertical is greater than 4 degrees from the cold-to-hot position of the pipe, the hanger rod and structural attachment shall be offset in such a manner that the rod is vertical in the hot position.

E. Thermal Expansion

1. Wherever expansion and contraction of piping is expected, a sufficient number of expansion loops or expansion joints shall be provided, together with the necessary rolling or sliding supports, anchors, guides, pivots, and restraints permitting the piping to expand and contract freely away from the anchored points.

2. Components shall be structurally suitable to withstand the imposed loads.

F. Heat Transmission

1. Supports, hangers, anchors, and guides shall be designed and insulated such that excessive heat shall not be transmitted to the structure or to other equipment.

G. Riser Supports

1. Where practical, risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.

H. Freestanding Piping

1. Freestanding pipe connections to equipment such as chemical feeders and pumps shall be firmly attached to steel frames fabricated from angles, channels, or I-beams anchored to the structure.

2. Exterior, freestanding overhead piping shall be supported on fabricated pipe stands consisting of pipe columns anchored to concrete footings, or with horizontal, welded steel angles, and U-bolts or clamps securing the pipes.

I. Materials of Construction

1. Pipe support assemblies, including framing, hardware, and anchors, shall be of steel construction, galvanized after fabrication, unless otherwise indicated.

2. Submerged supports, as well as piping, conduits, and equipment in hydraulic structures within 24 inches of the water level, shall be supported with support

assemblies, including framing, hardware, and anchors constructed of Type 316 stainless steel, unless otherwise indicated.

J. Point Loads

1. Meters, valves, heavy equipment, and other point loads on PVC, FRP, or other plastic pipes, shall be supported on both sides, according to manufacturer's recommendations, in order to avoid undue pipe stresses and failures.

2. In order to avoid point loads, the supports on PVC, FRP, or other plastic piping shall be equipped with extra wide pipe saddles or galvanized steel shields.

K. Concrete Anchors

1. Anchors shall be in accordance with the requirements of Section 05 50 00 – Miscellaneous Metalwork.

2.2 SUPPORT SPACING

A. Supports for piping with the longitudinal axis in approximately a horizontal position shall be spaced to prevent excessive sag, bending, and shear stresses in the piping, with special consideration given where components such as flanges and valves impose concentrated loads.

B. Pipe support spacing shall be in accordance with the pipe manufacturer’s recommendations.

C. Vertical supports shall be provided to prevent the pipe from being overstressed from the combination of loading effects.

2.3 MANUFACTURED SUPPORTS

A. Stock Parts

1. Where not specifically indicated, designs that are generally accepted as exemplifying good engineering practice and using stock or production parts shall be utilized wherever possible.

2. Such parts shall be locally available, new, of best commercial quality, and designed and rated for the intended purpose.

2.4 COATING

A. Galvanizing

PART 3 -- EXECUTION

3.1 INSTALLATION

A. General

1. Pipe supports, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions.

2. Concrete inserts for pipe hangers and supports shall be coordinated with the formwork.

B. Appearance

1. Pipe supports and hangers shall be positioned in order to produce an orderly, neat piping system.

2. Hanger rods shall be vertical, without offsets.

3. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, and without interference with other WORK.

3.2 FABRICATION

A. Quality Control

1. Pipe hangers and supports shall be fabricated and installed by experienced welders and fitters, using the best welding procedures available.

2. Fabricated supports shall be neat in appearance without sharp corners, burrs, or edges.

- END OF SECTION -

SECTION 43 10 61 – POLY VINYL CHLORIDE (PVC) PRESSURE PIPE
(ASTM D 1785, MODIFIED)

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide polyvinyl chloride (PVC) pressure pipe, complete and in place, in accordance with the Contract Documents.

B. The requirements of Section 43 10 50 - Piping, General, apply to the WORK of this Section.

C. This Section includes PVC pressure pipe with solvent-welded, flanged, or screwed joints.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01 33 00 – Contractor Submittals.

B. Submit shop drawings and the manufacturer's descriptive literature on all equipment listed in this specification prior to the product installations and associated fabrications.

PART 2 -- PRODUCTS

2.1 PIPE MATERIAL

A. PVC pipe shall be made from new rigid unplasticized polyvinyl chloride and shall be normal impact Type 1, Grade 1, class 12454, Schedule 40, listed as compliant with NSF Standard 61, unless otherwise indicated, in accordance with ASTM D 1785-Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

B. PVC pipe shall be manufactured by CertainTeed, Diamond Plastics, J-M Manufacturing, Scepter, or approved equal.

2.2 PIPE JOINTS

A. Pipe joints shall be screw type and shall be made up with appropriate thread sealant tape.

B. Screwed joints that are necessary to match up to threaded valves or fittings shall be made up with appropriate thread sealant tape.

C. Flanged joints shall be made with solvent-welded PVC flanges, drilled to ASME B 16.5 - Pipe Flanges and Flanged Fittings, Class 150, unless otherwise indicated. Gaskets shall be ANSI 150 lb. full face, 1/8-inch thick Neoprene for water or wastewater service. Gasket material for chemicals shall be suitable for the chemical service.

2.3 FITTINGS

A. **Solvent Welded and Threaded Fittings:** Solvent-welded and threaded fittings shall be Schedule 40 PVC fittings in accordance with ASTM D 2466 - Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

B. **Flanged Fittings:** Flanged fittings shall be Schedule 40 fabricated PVC fittings with 150 lb. flanges to ASME B 16.5.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **General:** PVC pipe shall be installed in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the Site to avoid interferences with structural members, architectural features, openings, and equipment. Exposed pipe shall afford maximum headroom and access to equipment, and where necessary, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points. It is recommended that the CONTRACTOR obtain the assistance of the pipe manufacturer's field representative to instruct the pipefitters in the correct installation and support of PVC piping.

B. **Supports and Anchors:** Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 43 10 52 - Pipe Supports. Where necessary to avoid stress on equipment or structural members, the pipe shall be anchored or harnessed. Expansion joints and guides shall compensate for pipe expansion due to temperature changes.

C. **Valves and Unions:** Unless otherwise indicated, connections to fixtures, groups of fixtures, and equipment shall be provided with a shutoff valve and union, unless the valve has flanged ends. Unions shall be provided at threaded valves, equipment, and other devices requiring occasional removal or disconnection. Valves and flanges attached to PVC pipe shall be provided with adequate supports.

3.2 PIPE PREPARATION

A. Prior to installation, each pipe length shall be carefully inspected, flushed clean of any debris or dust, and be straightened, if not true. Ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly.

3.3 PIPE JOINTS

A. **Threaded Joints:** Pipe threads shall conform to ASTM F 1498 - Taper Pipe Threads 60 Degrees for Thermoplastic Pipe and Fittings, and shall be full and cleanly cut with sharp dies or molded. Joints shall be made with Teflon tape or thread sealant.

B. **Solvent-Welded Joints:** Solvent-welded joints shall be made with fresh primer and solvent cement on clean, dry pipe ends. The primer and cement cans shall be kept closed at all times and the joints shall be made up at the recommended ambient temperatures, to the pipe or cement manufacturer's written recommendations. Pipe ends shall be inserted to the full depth of the socket.

C. **Flange Joints:** Flanged joints shall be made with gaskets and Type 316 stainless steel bolts and nuts. Care shall be taken not to over-torque the bolts, in accordance with the manufacturer's written recommendations.

3.4 INSPECTION AND FIELD TESTING

A. **Inspection:** Finished installations shall be carefully inspected for proper joints and sufficient supports, anchoring, interferences, and damage to pipe, fittings, and coating. Defective WORK shall be repaired.

B. **Field Testing:** The CONTRACTOR shall allow adequate time for the solvent cement joints to cure. Curing time shall be per the solvent cement manufacturer's recommendation. Prior to enclosure or burying, piping systems shall be pressure tested as required in the Piping Schedule, for a period of not less than one hour, without exceeding the tolerances listed in the Piping Schedule. Caution - Do not use air or gas for testing PVC pipe. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. The CONTRACTOR shall furnish test equipment, labor, materials, and devices.

C. Leakage shall be determined by loss of pressure. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.

D. Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.

- END OF SECTION -

SECTION 43 10 82 – HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide high density polyethylene (HDPE) pipe, complete and in place, in accordance with the Contract Documents.

B. The requirements of Section 43 10 50 - Piping, General, apply to the WORK of this Section.

C. This Section covers requirements for AWWA PE 3608 High Density polyethylene pipe and fittings for drinking water lines and fittings.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01 33 00 – Contractor Submittals.

B. Submit shop drawings and the manufacturer's descriptive literature and certifications on all equipment listed in this specification prior to the product installations and associated fabrications.

1.3 REFERENCED STANDARDS

A. All standards and specifications referenced shall be the latest edition and version thereof. This includes AWWA, ASTM, ANSI, NSF and Federal specifications and standards.

ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulation Materials
ASTM D1238	Standard Test Method for Melt Flow Rates of Thermoplastics by extrusion Plastometer
ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D2239	Standard Specification for Polyethylene (PE) Plastic Pipe (S.I.D.R.-PR) Based on Controlled Inside Diameter
ASTM D2657	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
ASTM D2737	Standard Specification for Polyethylene (PE) Plastic Tubing

ASTM D2774	Standard Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D3035	Standard Specifications for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3261	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D3350	Standard Specification for Polyethylene Plastic Pipe and Fittings Material
ASTM F412	Standard Terminology Relating to Plastic Piping Systems
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (S.D.R.-PR) Based on Outside Diameter
ASTM F1473	Standard Test Method for Notch Tensile to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins
AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 63 in., For Water Distribution and Transmission
NSF Standard 014	Plastics Piping System Components and Related Materials
NSF Standard 061	Drinking Water System Components - Health Effects

1.4 WARRANTY

A. Materials and workmanship shall have a one-year warranty to be free from defects in workmanship and materials. The warranty will be from the date of completion of construction. If deficiencies are discovered during the warranty period, the CONTRACTOR shall be required to correct these deficiencies without additional charge to the OWNER.

PART 2 -- PRODUCTS

2.1 PIPE MATERIAL

A. The HDPE pipe shall be manufactured in a plant capable of providing continuous quality control through inspection. The facility shall have the necessary testing equipment to verify that the pipe meets the requirements of AWWA C901 or C906, NSF Standard #61 and ASTM standards.

B. Polyethylene pipe and fittings shall be made from resin meeting the requirements of the Plastic Pipe Institute as PE 3608. The resin shall meet the requirements of ASTM D3350.

C. Pipe shall have a manufacturing standard of ASTM F-714. Pipe shall be DR 17 (130psi WPR) unless otherwise specified on the plans. The pipe shall contain no recycled

compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, listed as NSF 61 and per AWWA C906 Pressure Class (PC) 100 have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe.

D. HDPE shall be flexible, non-toxic and black. The pipe shall have a minimum wall thickness corresponding to the DR designation shown on the Drawings or as in this Section if not designated on the Drawings. Pipe shall be accordance with ASTM F714.

E. The material shall be of virgin quality.

F. Pipe diameters shown on the Drawings shall be **minimum inside diameter** of pipe.

G. High-density polyethylene pipe and fittings are to be supplied by one manufacturer and meet ASTM D3350.

2.2 FITTINGS

A. Butt Fusion Fittings. HDPE fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02, and approved for AWWA use. Butt fusion fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the Quality Control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

B. The manufacturing facility shall have the necessary testing equipment to verify that the fittings meet the requirements of AWWA C901 for sizes ½” to 2” and AWWA C906 for sizes 3” through 54”.

C. Polyethylene pipe and fittings shall be made from resin meeting the requirements of the Plastic Pipe Institute as PE 3608. The resin shall meet the requirements of ASTM D3350. High-density polyethylene pipe and fittings are to be supplied by one manufacturer.

D. Fittings shall be the same material, thickness, and joint type as pipe to which it is connected and in accordance with ASTM D3261.

E. All internal weld beads shall be smooth and shall protrude into the pipe no more than 1/8 inch

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All pipe shall be installed in strict accordance with manufacturer's recommendations, drawings and/or specifications and in the best commercial trade practice.

B. Pipe and fittings shall be packaged in a manner suitable for shipment by a commercial carrier. Upon receipt at job site, a receiving inspection shall be prepared. The quantity

shall be verified and any shipping damage shall be reported to the supplier within 7 days.

C. Trenches shall be excavated in accordance with the plans and specifications. OSHA standards or Owner safety policies regarding safety shall be followed regarding trench safety. If groundwater is encountered, it shall be removed by the Contractor. Shoring of the trench, where required is the responsibility of the contractor.

D. Flanges/MJ adapters shall be attached to pipe and fittings using butt fusion. The flanges/MJ adapters shall be aligned and centered relative to the pipe. Flanges/MJ adapters should be square with the valve or other flange before tightening of bolts. Bolts should not be used to draw flanges into alignment. Bolt threads shall be lubricated, and flat washers shall be used under flange nuts. Bolts shall be tightened using a “star tightening pattern”. See manufacturers recommendations. Twenty-four hours after first tightening the flange bolts, they must be re-tightened using the same “star tightening pattern used above. The final tightening torque shall be as indicated by the manufacturer.

E. Wherever a pipe passes from concrete to earth, a flanged connection, mechanical seal or a flexible joint shall be installed as shown or required. Particular care shall be taken to ensure a full support of the pipe in the earth between and beyond the joints. Pipe passing through concrete wall shall have integrally cast or welded on water stop ring cast into wall.

F. Where pipes pass through walls and floors, extreme care shall be exercised to ensure joints are watertight. The pipe shall be free of all dirt and grease to secure a tight bond with the concrete.

G. Plain end pipe and fittings shall be made using butt fusion. The butt fusion procedures shall be in accordance with the manufacturer or the PPI. The fusion equipment operator shall receive training using the recommended procedure. The Contractor shall be responsible to verify that the fusion equipment is in good operating condition and that the operator has been trained within the past twelve months. The fusion equipment shall be equipped with a Datalogger. Records of the welds (heater temperature, fusion pressure, and a graph of the fusion cycle) shall be maintained for five (5) years and supplied to the OWNER upon request. Fusion beads shall not be removed.

H. Heat Fusion Training. The supplier of the pipe and fittings shall provide a person certified by the pipe manufacturer and the fusion equipment manufacturer to train contractor fusion equipment operators and inspectors representing the Owner.

I. Mechanical Joining. Polyethylene pipe and fittings shall be joined together using Flanges or Mechanical Joint (MJ) adapters. These fittings shall be made from PE 3608 HDPE, with a Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and MJ adapters shall have a manufacturing standard of ASTM D3261. They shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

3.2 INSPECTION AND FIELD TESTING

A. Inspection: Finished installations shall be carefully inspected for proper joints and sufficient supports, anchoring, interferences, and damage to pipe, fittings, and coating. Defective WORK shall be repaired.

B. Leakage shall be determined by loss of pressure. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.

C. Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.

- END OF SECTION -

SECTION 43 30 00 - VALVES, GENERAL

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide valves, actuators, and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to valves and valve actuators except where otherwise indicated. Valves and actuators in particular locations may require a combination of units, sensors, limit switches, and controls indicated in other Sections of the Specifications.

C. **Unit Responsibility:** A single manufacturer shall be made responsible for coordination of design, assembly, testing, and furnishing each valve; however, the CONTRACTOR shall be responsible to the OWNER for compliance with the requirements of each valve section. Unless indicated otherwise, the responsible manufacturer shall be the manufacturer of the valve.

D. **Single Manufacturer:** Where 2 or more valves of the same type and size are required, the valves shall be furnished by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. **Shop Drawings:** Shop Drawings shall contain the following information:

1. Valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number.

2. Complete information on valve actuator, including size, manufacturer, model number, limit switches, and mounting.

3. Cavitation limits for control valves.

4. Assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, handwheels, position indicators, limit switches, integral control systems, needle valves, and control systems.

5. Complete wiring diagrams and control system schematics.

C. **Technical Manual:** The Technical Manual shall contain the required information for each valve.

D. **Spare Parts List:** A Spare Parts List shall contain the required information for each valve assembly, where indicated.

E. **Factory Test Data:** Where indicated, signed, dated, and certified factory test data for each valve requiring certification shall be submitted before shipment of the valve. The data shall also include certification of quality and test results for factory-applied coatings.

PART 2 -- PRODUCTS

2.1 PRODUCTS

A. **General:** Valves and gates shall be new and of current manufacture. Shut-off valves 6-inches and larger shall have actuators with position indicators. Gate valves 18-inches and larger or where chain wheel is required, shall be furnished with spur gear and hand wheel. Buried valves shall be provided with valve boxes and covers containing position indicators and valve extensions. Manual shut-off valves mounted higher than 7-feet above working level shall be provided with chain actuators.

B. **Valve Actuators:** Unless otherwise indicated, actuators shall be in accordance with Section 43 30 12 - Valve and Gate Actuators.

C. **Protective Coating:** The exterior surfaces of valves and the wet interior surfaces of ferrous valves of sizes 4-inches and larger shall be coated with an OWNER approved manufacturer applied coating. The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications. Flange faces of valves shall not be epoxy coated.

D. **Valve Labeling:** Except when such requirement is waived by the OWNER in writing, a label shall be provided on shut-off valves and control valves except for hose bibbs and chlorine cylinder valves. The label shall be of 1/16-inch plastic or stainless steel, minimum 2-inches by 4-inches in size and shall be permanently attached to the valve or on the wall adjacent to the valve as directed by the OWNER.

E. **Valve Testing:** As a minimum, unless otherwise indicated or recommended by the reference standards, valves 3-inches in diameter and smaller shall be tested in accordance with manufacturer's standard and 4-inches in diameter and larger shall be factory tested as follows:

1. **Hydrostatic Testing:** Valve bodies shall be subjected to internal hydrostatic pressure equivalent to twice the water rated pressure of the valve. Metallic valve rating pressures shall be at 100 degrees F and plastic valves shall be 73 degrees, or at higher temperature according to type of material. During the hydrostatic test, there shall be no leakage through the valve body, end joints, or shaft seals, nor shall any part of the valve be permanently deformed. The duration shall be sufficient time to allow visual examination for leakage. Test duration shall be at least 10 minutes.

2. **Seat Testing:** Valves shall be tested for leaks in the closed position with the pressure differential across the seat equal to the water rated pressure of the valve. The duration of test shall be sufficient time to allow visual examination for leakage. Test duration shall be at least 10 minutes. Leakage past the closed valve shall not exceed 1 fluid ounce per hour per inch diameter for metal seated valves. Resilient-seated valves shall be drop-tight.

3. **Performance Testing:** Valves shall be shop-operated from fully closed to fully open position and reverse under no-flow conditions in order to demonstrate the valve assembly operates properly.

F. **Certification:** Prior to shipment, the CONTRACTOR shall submit for valves over 12-inches in size, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, or ASTM.

G. **Valve Marking:** Valve bodies shall be permanently marked in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.2 MATERIALS

A. **General:** Materials shall be suitable for the intended application. Materials in contact with potable water shall be listed as compliant with NSF Standard 61. Materials not indicated shall be high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended. Unless otherwise indicated, valve and actuator bodies shall conform to the following requirements:

1. **Cast Iron:** Close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. **Ductile Iron:** ASTM A 536 - Ductile Iron Castings, or to ASTM A 395 - Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

3. **Steel:** ASTM A 216 - Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service, or to ASTM A 515 - Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service.

4. **Stainless Steel:** Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel.

5. **PVC:** Poly vinyl chloride materials for valve body, flanges, and cover shall conform to Cell Classification 12454.

6. **CPVC:** Chlorinated poly vinyl chloride materials for valve body, flanges, and cover shall conform to Cell Classification 23447.

7. **NSF Standard 14:** Materials shall be listed for use in contact with potable water.

2.3 VALVE CONSTRUCTION

A. **Bodies:** Valve bodies shall be cast, molded (in the case of plastic valves), forged, or welded of the materials indicated, with smooth interior passages. Wall thicknesses shall be uniform in agreement with the applicable standards for each type of valve, without casting defects, pinholes, or other defects that could weaken the body. Welds on welded bodies shall be done by certified welders and shall be ground smooth. Valve ends shall be as indicated, and be rated for the maximum temperature and pressure to which the valve shall be subjected.

B. **Valve End Connections:** Unless otherwise indicated, valves 2-1/2 inches diameter and smaller may be provided with threaded end connections. Valves 3-inches and larger shall have flanged end connections.

C. **Bonnets:** Valve bonnets shall be clamped, screwed, or flanged to the body and shall be of the same material, temperature, and pressure rating as the body. The bonnets shall have provision for the stem seal with the necessary glands, packing nuts, or yokes.

D. **Stems:** Valve stems shall be of the materials indicated, or, if not indicated, of the best commercial material for the specific service, with adjustable stem packing, O-rings, Chevron V-type packing, or other suitable seal.

E. **Stem Guides:** Stem guides shall be provided, spaced 10-feet on centers unless the manufacturer can demonstrate by calculation that a different spacing is acceptable. Submerged stem guides shall be 304 stainless steel.

F. **Internal Parts:** Internal parts and valve trim shall be as indicated for each individual valve. Where not indicated, valve trim shall be of Type 316 stainless steel or other best suited material.

G. **Nuts and Bolts:** Nuts and bolts on valve flanges and supports shall be in accordance with Section 05 50 00 - Miscellaneous Metalwork.

2.4 VALVE ACCESSORIES

A. Valves shall be furnished complete with the accessories required to provide a functional system.

2.5 SPARE PARTS

A. The CONTRACTOR shall furnish the required spare parts suitably packaged and labeled with the valve name, location, and identification number. The CONTRACTOR shall also furnish the name, address, and telephone number of the nearest distributor for the spare parts of each valve. Spare parts are intended for use by the OWNER, after expiration of the correction of defects period.

2.6 MANUFACTURERS

A. **Manufacturer's Qualifications:** Valve manufacturers shall have a successful record of not less than 5 years in the manufacture of the valves indicated.

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION

A. **General:** Valves, actuating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as indicated. Gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. **Access:** Valves shall be installed with easy access for actuation, removal, and maintenance and to avoid interference between valve actuators and structural members, handrails, or other equipment.

C. **Valve Accessories:** Where combinations of valves, sensors, switches, and controls are indicated, the CONTRACTOR shall properly assemble and install such items so that systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on Shop Drawing submittals.

- END OF SECTION -

SECTION 43 30 12 - VALVE AND GATE ACTUATORS

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide valve and gate actuators and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to valves and gates except where otherwise indicated in the Contract Documents.

C. **Unit Responsibility:** The valve or gate manufacturer shall be made responsible for coordination of design, assembly, testing, and installation of actuators on the valves and gates; however, the CONTRACTOR shall be responsible to the OWNER for compliance of the valves, gates, and actuators with the Contract Documents.

D. **Single Manufacturer:** Where 2 or more valve or gate actuators of the same type or size are required, the actuators shall be produced by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals and Section 43 30 00 - Valves, General.

B. **Shop Drawings:** Shop Drawing information for actuators shall be submitted together with the valve and gate submittals as a complete package.

C. **Calculations:** Selection calculations showing dynamic seating and unseating torques versus output torque of actuator.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Unless otherwise indicated, shut-off and throttling valves and externally actuated valves and gates shall be provided with manual or power actuators. The CONTRACTOR shall furnish actuators complete and operable with mounting hardware, motors, gears, controls, wiring, solenoids, handwheels, levers, chains, and extensions, as applicable. Actuators shall have the torque ratings equal to or greater than required for valve seating and dynamic torques, whichever is greater, and shall be capable of holding the valve in any intermediate position between fully-open and fully-closed without creeping or fluttering. Actuator torque ratings for butterfly valves shall be determined in accordance with AWWA C504 - Rubber-Seated Butterfly Valves. Wires of motor-driven actuators shall be identified by unique numbers.

B. **Manufacturers:** Valves and gates shall be provided with actuators manufactured by the valve or gate manufacturer.

C. **Materials:** Actuators shall be current models of the best commercial quality materials and be liberally-sized for the required torque. Materials shall be suitable for the environment in which the valve or gate is to be installed.

D. **Actuator Mounting and Position Indicators:** Actuators shall be securely mounted by means of brackets or hardware specially designed and sized for this purpose and be of ample strength. The word "open" shall be cast on each valve or actuator with an arrow indicating the direction to open in the counter-clockwise direction. Gear and power actuators shall be equipped with position indicators. Where possible, manual actuators shall be located between 48- and 60-inches above the floor or the permanent working platform.

E. **Standard:** Unless otherwise indicated and where applicable, actuators shall be manually operated with removable hand wheels that connect to the actuator by a 2” square nut drive.

F. Fasteners shall be in accordance with Section 05 50 00 - Miscellaneous Metalwork.

G. Protective coatings shall be for potable water systems and applied by the manufacturer and approved by the OWNER.

2.2 MANUAL ACTUATORS

A. **General:** Unless otherwise indicated, valves and gates shall be furnished with manual actuators. Valves in sizes up to and including 3-inches shall have direct acting lever or handwheel actuators of the manufacturer's best standard design. Larger valves and gates shall have gear-assisted manual actuators, with an operating pull of maximum 60 pounds on the rim of the handwheel. Buried and submerged gear-assisted valves, gates, gear-assisted valves for pressures higher than 250 psi, valves 30-inches in diameter and larger, and where so indicated, shall have worm gear actuators, hermetically-sealed water-tight and grease-packed. Other valves 6-inches to 24-inches in diameter may have traveling nut actuators, worm gear actuators, spur or bevel gear actuators, as appropriate for each valve.

B. **Buried Valves:** Unless otherwise indicated, buried valves shall have extension stems to grade, with 2” square nuts or floor stands, position indicators, and cast-iron or steel pipe extensions with valve boxes, covers, and operating keys. Where so indicated, buried valves shall be in cast-iron, concrete, or similar valve boxes with covers of ample size to allow operation of the valve actuators. Covers of valve boxes shall be permanently labeled as required by the OWNER. Wrench nuts shall comply with AWWA C 500 - Metal - Seated Gate Valves for Water Supply Service.

C. **Floor Boxes:** Hot dip galvanized cast iron or steel floor boxes and covers to fit the slab thickness shall be provided for operating nuts in or below concrete slabs.

For operating nuts in the concrete slab, the cover shall be lockable with a dull finish.

D. **Tee Wrenches:** Buried valves with floor boxes shall be furnished with 2 operating keys or 1 key per 10 valves, whichever is greater. Tee wrenches sized so that the tee handle will be 2 to 4 feet above ground, shall fit the operating nuts.

E. **Traveling-Nut Actuator:** The actuator shall consist of a traveling-nut with screw (Scotch yoke) contained in a weatherproof cast iron or steel housing with spur gear and minimum 12-inch diameter handwheel. The screw shall run in 2 end bearings, and the actuator shall be self-locking to maintain the valve position under any flow condition. The screw and gear shall be of hardened alloy steel or stainless steel, and the nut and bushings shall be of alloy bronze. The bearings and gear shall be grease-lubricated by means of nipples. Gearing shall be designed for a 100 percent overload.

PART 3 -- EXECUTION

3.1 SERVICES OF MANUFACTURER

A. **Field Adjustments:** Field representatives of manufacturers of valves or gates with pneumatic or electric actuators shall adjust actuator controls and limit-switches in the field for the required function.

3.2 INSTALLATION

A. Valve and gate actuators and accessories shall be installed in accordance with Section 43 30 00 - Valves, General. Actuators shall be located to be readily accessible for operation and maintenance without obstructing walkways. Actuators shall not be mounted where shock or vibrations will impair their operation, nor shall the support systems be attached to handrails, process piping, or mechanical equipment.

- END OF SECTION -

SECTION 43 30 14 - BUTTERFLY VALVES

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide butterfly valves and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 43 30 00 - Valves, General apply to this Section.

C. The requirements of Section 43 30 12 - Valve Actuators apply to this Section.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 and Section 43 30 00.

B. Shop Drawings

1. Complete Shop Drawings of butterfly valves and actuators.

2. Drawings showing valve port diameter complete with dimensions, part numbers, and materials of construction.

3. Certified statement of proof-of-design tests from the valve manufacturer. Valve manufacturer shall state that the valves proposed for this project shall be manufactured with identical basic type of seat design and materials of construction to the prototype evaluated under the proof of design testing.

4. Manufacturer's certification that the valve complies with applicable provisions of AWWA C504 – Rubber-Seated Butterfly Valves.

1.3 QUALITY ASSURANCE

A. Valves shall be subjected to performance, leakage, and hydrostatic tests in accordance with procedures and acceptance criteria established by AWWA C504.

PART 2 -- PRODUCTS

2.1 RUBBER SEATED BUTTERFLY VALVES 25 TO 150 PSI (AWWA)

A. **General:** Butterfly valves for steady-state water working pressures and steady-state differential pressure up to 150 psi and for fresh water service having a pH range from 6 to 10 and temperature range from 33 to 125 degrees F shall conform to AWWA C504 and be as indicated. Valves subjected to steady state working pressures and steady state differential pressures from 25 to 150 psi in sizes 3-inches through 24-inches shall be rated for Class 150B with actuator sized for Class 150B. Valves 30 inches through 72-inches shall be of the class indicated. Valves larger than 72-inches shall be of the class indicated, designed in accordance with the intent of AWWA C504. If the operating conditions such as flow, velocity, and differential pressures are not indicated, the valve body and shaft shall be sized for the pressure class rating of the valve.

B. Valves shall be of the body type, pressure class, end joint, and actuator indicated.

C. **Construction:** Unless otherwise indicated, materials of construction shall be in accordance with AWWA C504, suitable for the service. Seats shall be positively clamped or bonded into the disc or body of the valve, but cartridge-type seats that rely on a high coefficient of friction for retention shall not be acceptable. Seat material shall be guaranteed to last for at least 75 percent of the number of cycles in the AWWA C504 proof-of-design test without premature damage.

Description	Material Standards
Valve bodies	Gray iron, ASTM A 48, Class 40 or Ductile iron, ASTM A 536, grade 65-45-12
End flanges	Same material as valve bodies
Valve shafts	Stainless steel ASTM A 240 or A 276, Type 316
Valve discs	Same material as valve bodies.
Resilient seats	Buna-N, Hycar or EPDM
Seat mating surfaces	Stainless steel, ASTM A 240 or A 276, Type 316
Clamps and retaining rings	Type 316 retaining rings and cap screws.
Valve bearings	Self lubricating materials per AWWA C504
Shaft seals	Resilient non-metallic materials suitable for service
Painting and coating	Applied by manufacturer and approved by Owner for potable water systems.

D. **Manual Actuators:** Unless otherwise indicated, manually-actuated butterfly valves shall be equipped with a hand wheel and 2-inch square actuating nut and position indicator. Screw-type (traveling nut) actuators shall not be permitted for valves 30-inches in diameter and larger.

E. **Worm Gear Actuators**: Valves 30-inches and larger, as well as submerged and buried valves, shall be equipped with worm-gear actuators, lubricated and sealed to prevent entry of dirt or water into the housing.

F. Manufacturers, or Equal

1. **DeZURIK Water Controls, Corporation**

2. **Kennedy Valve**

3. **M & H Valve Company**

4. **Mueller Company**

5. **Henry Pratt Company**

6. **Rodney Hunt Company** (24-inches and larger)

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator. Installation shall be in accordance with Section 43 30 00.

- END OF SECTION -

SECTION 43 30 18 - BALL VALVES

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide ball valves and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 43 30 00 - Valves, General apply to this Section.

C. The requirements of Section 43 30 12 - Valve and Gate Actuators apply to this Section.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 and Section 43 30 00.

PART 2 -- PRODUCTS

2.1 PLASTIC BALL VALVES

A. **General:** Plastic ball valves for corrosive fluids shall be made of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polypropylene (PP), or polyvinylidene fluoride (PVDF), as recommended by the manufacturer for the specific application. Valves shall have manual actuators in accordance with Section 43 30 12 - Valve and Gate Actuators, unless otherwise indicated.

B. **Construction:** Plastic ball valves shall have union ends or flanged ends to mate with ANSI B 16.5, class 150 flanges for easy removal. The balls shall have full size ports and teflon seats. Body seals, union O-ring seals, and stem seals shall be in accordance with the corrosion resistance requirements of Section 43 10 61. External (without entering into the wetted area) seat packing adjustment is preferred. Metal reinforced stems to prevent accidental breakage are preferred. The valves shall be suitable for a maximum working non-shock pressure of 150 psi at 73 degrees F for PVC and CPVC, with decreasing ratings for higher temperatures and other plastics.

C. Manufacturers, or Equal

1. **ASAHI-America**

2. **George Fischer, Inc.**

3. **NIBCO Inc., (Chemtrol)**

4. **Plast-O-Matic Valves, Inc.**

5. **Spears Mfg. Co.**

6. **Watts Regulator**

PART 3 -- EXECUTION

3.1 GENERAL

A. Valves shall be installed in accordance with Section 43 30 00. Care shall be taken that valves in plastic lines are well supported at each end of the valve.

- END OF SECTION -

SECTION 43 30 56 - HYDRAULIC GATES, GENERAL

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide hydraulic gates with appurtenances, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to flap gates, slide gates, stop gates, cast iron slide gates, canal gates, and shear gates, except where otherwise indicated in the Contract Documents.

C. The requirements of Section 43 30 12 – Valve and Gate Actuators apply to this Section.

D. Single Manufacturer

1. The CONTRACTOR shall assign to a single manufacturer responsibility for the furnishing and functional operation of the hydraulic gates, including operators and accessories.

2. The designated single manufacturer, however, need not manufacture more than one part of the units, but shall coordinate the design, assembly, testing, and installation of the units.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

AWWA C560	Cast Iron Slide Gates
AWWA C561	Stainless Steel Slide Gates
AWWA C562	Aluminum Slide Gates
AWWA C563	Composite Slide Gates
AWWA C 513	Open Channel Fabricated Metal Slide Gates
ASTM A 276	Stainless Steel Bars and Shapes
ASTM B 21	Naval Brass Rod, Bar, and Shapes
ASTM B 584	Copper Alloy Sand Castings for General Applications

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Shop Drawings

1. Submit Shop Drawings of hydraulic gates as indicated in their respective Section.

C. Technical Manuals

1. Submit complete technical manuals, including printed instructions for proper maintenance, lubrication, and complete parts list indicating the various parts by name, number, and exploded view where necessary.

2. A list of recommended spare parts for the OWNER to store at the facility shall be included.

D. Certification

1. The CONTRACTOR shall obtain written certification from the designated single manufacturer, addressed to the OWNER, stating that the equipment shall efficiently and thoroughly perform the required functions in accordance with these Contract Documents, and that the designated single manufacturer accepts the CONTRACTOR's assignment of responsibility for coordination of gate equipment, including operators, controls, and services required for proper installation and operation.

E. Field Procedures

1. Prior to installation of the gates, provide instructions for field procedures for installation, adjustments, inspection, and testing.

1.4 QUALITY ASSURANCE

A. Equipment Field Testing

1. The CONTRACTOR shall be responsible for the coordination of the tests of each hydraulic gate in the presence of the manufacturer's factory service representative.

2. Excessive leaks shall be corrected and the equipment retested until found to be satisfactory.

1.5 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Installation and Startup Assistance

1. Service and testing assistance by the manufacturer's engineering representative for each gate and valve shall be furnished by the CONTRACTOR during installation and startup.

B. Instruction of OWNER's Personnel

1. The CONTRACTOR shall arrange for the services of a factory service representative to instruct the OWNER's personnel in the operation and maintenance of the equipment.

1.6 SPECIAL WARRANTY REQUIREMENT

A. The CONTRACTOR shall furnish the manufacturer's written guarantee that the hydraulic gates comply with the indicated requirements.

B. The CONTRACTOR shall furnish the manufacturer's warranties as published in its literature.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Equipment provided under this Section shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products and which have had previous experience in such manufacture.

B. Combinations of manufactured equipment which are provided under these Specifications shall be entirely compatible, and the CONTRACTOR and the manufacturer shall be responsible for the compatible and successful operation of the various components of the units.

C. Indicated and necessary mountings and appurtenances shall be included.

2.2 MATERIALS

A. Materials employed in the manufacture and installation of the hydraulic gates and operators shall be suitable for the intended application. Material not specifically called for shall be high-grade, standard commercial quality, free from defects and imperfection that might affect the serviceability of the product for the purpose for which it is intended.

1. All gates shall be made of aluminum according to AWWA C562

2.3 HARDWARE

A. Bolts and nuts shall comply with the requirements of Section 05 50 00 – Miscellaneous Metalwork.

2.4 TOOLS AND SPARE PARTS

A. Tools

1. Furnish special tools that are necessary for maintenance and repair of the gates.

2. Such tools shall be suitably stored in metal toolboxes and identified with the equipment number by means of stainless steel or solid plastic nametags attached to the box.

B. Spare Parts

1. Furnish the following spare parts in a box as described above for tools, for air- or hydraulic-actuated gates for each type and size of gate:

a. one set of directional valves, solenoid or pilot actuated

b. one set of cylinder actuator seals

c. one set of filters

d. One repair kit for the hydraulic pump, containing seals or packing, gaskets, and O-rings.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Slide, canal, and shear gates shall be installed in strict accordance with the manufacturer's printed recommendations and the indicated requirements.

B. Operators shall be located as to avoid interference with handrails and structural members.

C. Gates with Wall Thimbles

1. Shortly before setting each gate, apply a 1/8-inch-thick layer of mastic grade polysulfide elastomeric sealant to the back of the gate frame.

2. After setting the gate, the nuts shall be turned down on the anchor bolts far enough only to make them snug and to cause the rubber sealant to begin to ooze out, but not far enough to produce any significant stress to the frame.

3. Excess sealant at the edges shall be removed.

4. The sealant shall be allowed to cure for at least 7 Days, after which the anchor bolt nuts shall be tightened to their final positions.

5. If gaskets are being used, they shall be installed over the studs in one piece, or dovetailed and cemented with a liquid-type gasket material.

D. Damage to surface coatings incurred during shipment or installation shall be repaired.

- END OF SECTION -