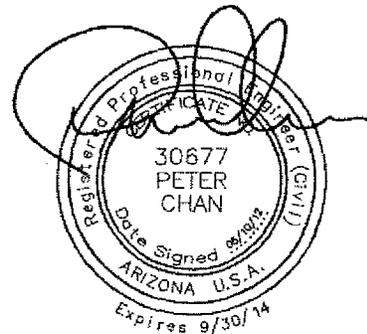


# EXHIBIT B

## PROJECT SPECIFICATIONS

PROJECT 3204461  
LARGE VALVE REPLACEMENT AND WATERLINE  
BORING AT RAILROAD CROSSING  
VOLUME 1 OF 1  
May 2012

CITY OF TEMPE  
ENGINEERING DEPARTMENT  
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**CITY OF TEMPE, ARIZONA**

**LARGE VALVE REPLACEMENT AND WATERLINE BORING AT RAILROAD  
CROSSING  
PROJECT NUMBER 8311019**

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SECTION 01010  
SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. Project Description

Project will be owned and operated by the City and is located in five different vicinities throughout the Tempe city limits. The Project consists of the following principal features:

1. Valve replacements, 5 total.
2. Concrete Manhole.
3. Site work, piping and appurtenances.
4. Jack and Bore waterline installation.

Work to include all piping, valves, structures, earthwork and other elements required for the successful completion of the project as designed.

Job Conditions:

1. Construction of the new valve vaults is as shown on the drawings.
2. CONTRACTOR is encouraged to visit job site(s) prior to bidding.
3. Confined space entry safety program: The City and ENGINEER hereby notifies the CONTRACTOR that manholes and other structures might constitute permit-required confined spaces as defined in Title 29 of the Code of Federal Regulations (CFR) Part 1910.146, including Appendices A, B, C, D and E. The CONTRACTOR is required to notify all workers of the potential confined spaces. The CONTRACTOR shall maintain a confined space entry safety program in compliance with 29 CFR Part 1910.146 at all times when entering any confined spaces.

B. Submittals

1. Project schedule.
2. Construction sequencing plan.
3. Staging area plan.

C. Form of Specifications

1. Term "provide" or "provided" shall mean "CONTRACTOR shall furnish and install in-place". Unless explicitly noted, all items and/or services listed in these specifications are to be provided by CONTRACTOR.
2. In the event of conflict between these specifications, the Maricopa Association of Governments (MAG), and City standard details and specifications, the latter shall prevail, followed by MAG, and these technical specifications, respectively.

D. Contracts

1. Work is to be performed under a lump sum contract.
2. Contractor shall be required to provide a schedule of values before the schedule pre-construction conference.
3. Perform all work specified in this contract.

4. Restore project site and all work areas to original condition. Re-landscape disturbed areas.
- E. Work by Others
1. Utility services
    - a. CONTRACTOR shall be required to coordinate with City prior to potable water shut down.
    - b. CONTRACTOR shall be required to coordinate with utility companies and other contractor's in the vicinity of the project area.
- F. Work Coordination
1. Schedule construction operations with minimum down time periods. All down time shall be coordinated with the ENGINEER and/or City at least 48 hours before scheduled down time.
  2. Order equipment with long lead times as early as possible. ENGINEER shall provide expedited submittal review for such items.
  3. Order equipment and materials required for early phases of the project as quickly as possible. ENGINEER shall provide expedited review for such items.
  4. CONTRACTOR shall not modify or interfere with existing facility operation and controls.
- G. Construction Sequence

CONTRACTOR shall review the following construction sequencing and incorporate sequencing into project schedule for review by ENGINEER. Minimize down time periods. CONTRACTOR shall have final responsibility with respect to coordination with his subcontractors. Sequence is generally described as follows:

1. Erect temporary fencing.
2. Provide temporary bank stability procedure for review by ENGINEER.
3. Excavate and provide embankment stability measures.
4. Uncover and locate underground utilities and pipelines.
5. Coordinate shutdown and interconnection with City staff.
6. Complete new valve assembly and obtain accurate field measurements.
7. Completion dates of these tasks shall be shown on CONTRACTORS project schedule. Project schedule shall be submitted to the ENGINEER prior to pre-construction conference.
8. All work shall be performed within the guidelines of all governing agencies such as, but not limited to, health department, OSHA, NFPA, Corps of Engineers, City, County, State and Federal regulatory agencies.

Interferences:

1. Minimize time interval and/or frequency that any critical operation is out of service.
2. Notify ENGINEER of all interferences.
3. Provide all labor and materials necessary to shutdown, bypass, and startup. This may include power generators, piping and other means to support and maintain CITY's operation.
4. 24 hour, 7 days a week operation is required until normal service is restored.
5. Disruption of service shall be done during off peak hours, such as nighttime, or weekends.
6. Notify CITY of all planned shutdowns or disruption of service at least 48 hours before scheduled downtime.

H. Partial City Occupancy

1. CITY may occupy the site during entire period of construction for conducting normal maintenance and operation work.
2. CITY will have rights to enter project site at all times.
3. CONTRACTOR shall conduct all work to ensure least inconveniences to CITY and general public.
4. CITY reserves right to occupy and to place and install equipment in completed areas, prior to substantial completion provided that such occupancy does not interfere with completion of work. Such placing of equipment and partial occupancy shall not constitute acceptance of total work.

I. Contractor's Use of Premises

1. CONTRACTOR shall have use of project site for execution of work.
2. Confine work to areas within limits.
3. Keep driveways and all areas accessible to the CITY.
4. Use of the site will be under the sole direction of the ENGINEER.
5. Obtain and pay for use of additional storage or work areas needed for operations at no additional costs to the CITY.
6. Submit construction staging plans for approval by ENGINEER. Show location of alternate or off-site staging/storage areas.

1.02 FUTURE WORK

- A. No future expansion is planned at these sites.

1.03 CITY PRE-ORDERED EQUIPMENT OR MATERIAL

- A. CITY will not be providing any pre-ordered equipment or material for this project.

1.04 CITY-FURNISHED EQUIPMENT OR MATERIAL

- A. CITY will not provide any equipment or material for this project.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Perform all work in compliance with all federal, state and local codes.
- B. CITY will perform and execute quality program. CONTRACTOR shall assist CITY in collecting samples and other testing required by the CITY.
- C. ENGINEER will perform quality assurance testing whenever necessary.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

\*\*\* END OF SECTION \*\*\*

SECTION 01060  
SPECIAL CONDITIONS

PART 1 GENERAL

1.01 DOCUMENTS FOR CONTRACTOR USE

- A. CONTRACTOR shall pick up "no-charge" documents within 10 days from date of Notice of Award. The following are "no-charge" documents:
1. Up to 10 sets of full size plans.
  2. Up to 10 sets of specifications.
  3. 1 copy of Permit to Construct.
  4. Sample of Submittal forms, hardcopy and computer format.

1.02 SITE MAINTENANCE

- A. Keep site clean of debris, rubble and trash. Minimum weekly maintenance work is required.
- B. Paint and maintain temporary structures, fencing, barricades and other items.
- C. Dust control shall be required at all times.
- D. Provide temporary fencing, approximately 8 feet high. Fence shall be in accordance to MAG detail 160. Remove fencing material at the end of construction.
- E. Post "No Trespassing" signs as necessary.

1.03 SPECIAL CONSIDERATIONS

- A. CONTRACTOR shall maintain a clean and orderly work area at all times.
- B. Provide trash collection and arrange for pickup at appropriate intervals or as necessary. No trash overflow will be allowed.
- C. Repair all damaged roadways at no additional costs to the OWNER. Maintain conditions of access road to site such that access is not hindered or creates public inconveniences as a result of construction related deterioration. Normal deterioration due to construction shall be repaired by CONTRACTOR at no cost to the OWNER.
- D. CONTRACTOR shall make own arrangements for electric power, telephone, water and other utilities required for this project. Pay for all application and monthly costs.
- E. Provide temporary sanitary facilities, and coordinate to ensure facilities are out of view of residents. All temporary sanitary facilities shall be maintained at regular intervals or as necessary. Meet all health department codes.
- F. Existing equipment and any other appurtenant equipment shall be maintained and operated by City staff only. Except in emergency cases, CONTRACTOR shall be allowed to operate OWNER's equipment to minimize damage. Inform OWNER within 1 hour.
- G. CONTRACTOR shall keep a log of all personnel and delivery truck drivers which are within the project site. CONTRACTOR shall also enforce travel speed of trucks and other vehicles along

roadways leading to and from project site. School zones and other speed control signage shall be adhered to.

- H. CONTRACTOR shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site.

#### 1.04 PERMITS

- A. CONTRACTOR shall obtain and pay for all permits, except for the Approval to Construct and the Approval of Construction permits.
- B. Project is located in Maricopa County, City of Tempe, and within ADOT right-of-way.

#### 1.05 HISTORICAL AND ARCHAEOLOGICAL

- A. If during the course of construction, evidence of deposits of historical or archaeological interest is found, the CONTRACTOR shall cease operations affecting the find and shall notify the OWNER immediately. No further disturbance of the deposits shall ensue until the CONTRACTOR has been notified by the OWNER that CONTRACTOR may resume work. A written notice to proceed shall be issued after OWNER has completely surveyed the area. Compensation to the CONTRACTOR, if any, for lost time or changes in construction resulting from the find, shall be determined in accordance with changed or extra work provisions of the Contract Documents.

#### 1.06 Construction Site Safety

- A. The CONTRACTOR shall be solely responsible for all health and safety issues on the construction site related to the construction project. The CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. He/ she will take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to all employees on the project including those of Subcontractors, State, County, City, OWNER and all other persons who may be affected thereby.

#### 1.07 Site Restoration per Master Spec

- A. CONTRACTOR shall restore landscaping and grading to the original pre-construction condition, unless noted otherwise.

### PART 2 PRODUCTS

(Not Used)

### PART 3 EXECUTION

(Not Used)

\*\*\* END OF SECTION \*\*\*

SECTION 01270  
MEASUREMENTS AND PAYMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. This Section identifies methods of payment and measurement.
- B. Provide labor, materials, equipment, supervision, and other cost and services to construct each Bid Item as required by Contract Documents. Lump sum amounts shall include CONTRACTOR overheads, personnel training, education, safety programs, and other specialized training required by CONTRACTOR to complete the construction of this project.
- C. Payments are based on lump sum bids. Payments and measurements will be made in accordance with the General Conditions and in Section 01295 - Schedule of Values.

1.02 DESCRIPTION OF BID ITEMS -GENERAL

- A. Tempe Valve Replacement and Waterline Boring (Lump Sum).
  - 1. Tasks are described in Section 01295 - Schedule of Values.
  - 2. Include cost of, but not limited to:
    - a. All sizes of pipelines and materials used in the project.
    - b. All sizes of valves, fittings and appurtenances.
    - c. Reinforced concrete and manholes.
    - d. Construction surveying and replacement of survey movements.
  - 3. Do not include cost of:
    - a. Soils and materials testing paid for by OWNER as part of the OWNER's quality assurance program.
    - b. Work included in other Bid items.
  - 4. Measurement for Payment:
    - a. Measurements will be percentages of completion in accordance with the Schedule of Values of these Specifications.
  - 5. Payment:
    - a. Include costs for tasks appearing in the Schedule of Values in the lump sum price bid. Costs shall be based on monthly percentages of completion as approved by the ENGINEER. Payment shall be made to the CONTRACTOR with retainage specified in the General Conditions.
- B. Valve Replacement and Waterline Boring
  - 1. Materials include the following:
    - a. Site work.
    - b. Testing.
    - c. Trenching, backfilling and compaction.

- d. Rock excavation.
- e. Pipe material, fittings, and valves as shown on the drawings.
- f. Manhole and valve vault as shown on drawings.
- g. Waterline casing
- h. Other appurtenant and incidental work.

2. Include cost of the following items:

- a. Replacement of paving, sidewalk, curb and gutter, and sawcutting.
- b. Excavation and disposal of surplus materials.
- c. Imported materials for bedding and backfill.
- d. Supports for other underground utilities.
- e. Protection of other above and below ground structures and utilities.
- f. Sheeting, shoring and bracing.
- g. Dewatering if necessary.
- h. Pipe materials, cost of storage and installation.
- i. Placement of backfill and compaction.
- j. Fittings and appurtenances such as mechanical joints, flanges, valves, reducers, bends, tees, etc.
- k. By-pass pumping, if required.
- l. Removal of abandoned structures and/or pipes.
- m. Removal or abandonment of thrust blocks and/or bulkheads.
- n. Casing, flexible joints, and collars.
- o. Geotextile, if required.
- p. Testing for leakage.
- q. Temporary aggregate driveway for affected property owners.
- r. Provide steel plate.
- s. Clean up and restoration.
- t. Landscaping.
- u. Repipe or re-route utility conflicts.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

\*\*\* END OF SECTION \*\*\*

SECTION 01295  
SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

- A. The schedule of values applies only to the lump sum bids. The Valve Replacement and Waterline Boring project will be bid as a lump sum and is covered under this Section of the specifications.
- B. Submit Schedule of Values allocated to lump sum portion of the work under this contract.
- C. Upon request of the ENGINEER, support values with data substantiating their correctness.
- D. Provide itemized list that establishes the value or cost of each major part of the work and the division of work and cost between CONTRACTOR and sub-contractors.
- E. Include values for all work shown on the plans and specifications.
- F. Provide a detailed and itemized schedule of values that shows the value or cost of each part of work.
- G. Schedule of values may be used as a basis for preparing progress payments and may be used as a basis for negotiations for additional work or credits.
- H. Include unit, unit prices and quantities. Quantities will not be used to establish correctness of CONTRACTOR's bid.

1.02 SUBMITTALS:

- A. Preliminary Schedule of Values, 5 copies.
- B. Final Schedule of Values, 5 copies.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Type schedule on 8-1/2 in. by 11 in. white paper; CONTRACTOR's standard forms and computer printout will be considered for approval by ENGINEER upon CONTRACTOR's request. Identify schedule with the following.
  - 1. Project title and location.
  - 2. OWNER and OWNER's Project number.
  - 3. ENGINEER and ENGINEER's Project number.
  - 4. Name, telephone and address of CONTRACTOR.
  - 5. Date of printout.
  - 6. Contact and name of person in-charge of preparing the schedule.
- B. Identify installed value of component parts of Work in sufficient detail to serve as basis for computing values for progress payments and change orders during construction.
- C. Schedule of values shall be formatted on computer spreadsheets (Excel) and include the following columns.
  - 1. Line number.

2. Description (eg. Ductile iron pipe, PVC Schedule 40, etc.).
3. Size.
4. Unit (eg. LF, SF, CY, etc.).
5. Unit price (\$/unit).
6. Labor and overhead. Overhead cost shall include taxes, permit fees, shipping, insurances, administration, etc.
7. Profit.
8. Total cost per unit (\$/unit).
9. Comments/notes.

D. For Various Portions of Work:

1. Each item shall include directly proportional amount of CONTRACTOR's overhead and profit.
2. There shall be no payment claims for excess, uninstalled materials and equipment.

E. Sum of values listed in schedule shall equal total Contract sum.

F. CONTRACTOR may include an item for bond, insurances and temporary facilities.

G. Use table of contents of these specifications as a basis for the Schedule of Values. List sub-items if necessary.

H. CONTRACTOR shall be required to substantiate all values listed based on normal market price.

I. Show breakdown of labor, materials, equipment and other costs.

J. CONTRACTOR shall submit a preliminary Schedule of Values 5 working days before pre-construction meeting.

K. Submit a final Schedule of Values 5 days after review by ENGINEER.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

\*\*\* END OF SECTION \*\*\*

SECTION 01300  
PROJECT COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Project Coordination Procedures.
2. CONTRACTOR responsibilities.
3. Closeout responsibilities.

1.02 COORDINATION

A. CONTRACTOR shall coordinate work of any subcontractors employed by the prime contractor for this Project.

B. CONTRACTOR shall:

1. Coordinate Work of own employees and subcontractors.
2. Expedite Work to ensure compliance with schedules.
3. Coordinate with OWNER, through the ENGINEER, at all times.
4. Coordinate interconnection sequencing with ENGINEER and OWNER.
5. No extra compensation will be allowed to cover cost of removing subcontractors' work due to lack of coordination between CONTRACTOR and subcontractor(s).
6. CONTRACTOR shall be responsible for all work done under this project, including work done by all CONTRACTOR's subcontractor.

1.03 SUBMITTALS:

- A. Communication plan, with contact person's name, telephone number, cellular phone, and facsimile number.
- B. Include mailing address and email address.
- C. Include title, roles and responsibility.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.01 CONSTRUCTION ORGANIZATION AND STARTUP

A. CONTRACTOR shall establish on-site lines of authority and communications for his/her firm and that of his/her subcontractor. Submit a communication plan to the ENGINEER. Communications from sub-contractor shall be directly to the CONTRACTOR. Communications from the CONTRACTOR shall be directed to the ENGINEER. ENGINEER will communicate with OWNER. CONTRACTOR shall provide a plan for the following:

1. Schedule and conduct progress meetings.
2. Establish procedures for intra-Project communications.

- a. Submittals.
  - b. Reports and records.
  - c. Recommendations.
  - d. Coordination drawings.
  - e. Schedules.
  - f. Resolution of conflicts.
3. Interpret Contract Documents.
- a. Consult with design ENGINEER to obtain interpretation.
  - b. Assist in resolution of questions or conflicts which may arise.
  - c. Forward written interpretations to other sub-contractors, and to other concerned parties.
4. Assist in obtaining permits and approvals.
- a. Building permits and special permits required for Work or temporary facilities.
  - b. Verify subcontractors have obtained inspections for Work and temporary facilities.
  - c. Ensure that all permits are current and up-to-date.
  - d. Application of permits shall be the CONTRACTOR's responsibility.
  - e. CONTRACTOR will pay all normal and customary permit fees.
5. Control use of site.
- a. Supervise field engineering and site layout.
  - b. Allocate space for each subcontractor's use for field offices, sheds, and Work and storage areas.
  - c. Allocate field office and storage space, and Work and storage areas, for use of each subcontractor.
  - d. Establish access, traffic, and parking allocations and regulations. Do not disturb vegetation in the project area unless approved by the ENGINEER.
  - e. Monitor use of site during construction. Provide security to ensure that site is safe against theft and vandalism.

### 3.02 GENERAL CONTRACTOR CONSTRUCTION DUTIES

#### A. Construction Schedules:

- 1. Coordinate schedules of subcontractors.

#### B. Review coordination drawings prepared by other subcontractors.

#### C. Prepare coordination drawings as required to resolve conflicts and to ensure coordination affected by mechanical or electrical trades, or by special equipment requirements.

- 1. Reproduce and distribute copies to concerned parties and submit to ENGINEER for approval.

#### D. Inspection and Testing:

- 1. Inspect Work to ensure performance in accordance with requirements of Contract Documents.
- 2. Recommend special testing and inspections of suspect Work.
- 3. Coordinate testing laboratory services.

- a. Verify required laboratory personnel are present.
  - b. Verify tests are made in accordance with specified standards.
  - c. Review test reports for compliance with specified criteria.
  - d. Recommend and administer required retesting.
  - e. Laboratory shall be licensed to operate in the State of Arizona. All results shall be stamped by a licensed Professional Engineer in the State of Arizona.
- E. Monitor use of temporary utilities.
- 1. Verify that adequate services are provided and maintained.
  - 2. Coordinate use of OWNER's facilities and site.
- F. Monitor other subcontractors' periodic cleaning.
- 1. Enforce compliance with Specifications.
  - 2. Resolve conflicts.
- G. Implement procedures for review and processing of subcontractors' applications for progress and final payments.
- 1. Review each application for payment, submit recommendations to ENGINEER.
- H. Maintain reports and records at job site, available to ENGINEER and OWNER.
- 1. Daily log of progress of Work of each subcontractor.
  - 2. Records.
    - a. Contracts.
    - b. Purchase orders.
    - c. Materials and equipment.
    - d. Record drawings (As-Builts).
  - 3. Obtain information from other subcontractors and maintain file of record documents.
  - 4. Assemble documentation for handling of claims and disputes.
  - 5. At end of Project, prior to final completion, turn over Record Documents to ENGINEER.

### 3.03 GENERAL CONTRACTOR CLOSEOUT DUTIES

- A. Equipment Startup:
- 1. Coordinate checkout of utilities and equipment.
  - 2. Assist in testing and provide chemicals for testing.
  - 3. Record dates of start of operation of systems and equipment.
  - 4. Submit to OWNER written notice of beginning of warranty period and length of warranty period for equipment accepted by OWNER and put into service.
- B. At completion of Work of each Contract, conduct inspection ensuring following.
- 1. Specified cleaning accomplished.
  - 2. Temporary facilities removed from site.
- C. Substantial Completion:

1. Conduct inspection confirming or supplementing subcontractors' list of Work to be completed or corrected.
2. Assist ENGINEER in inspection.
3. Supervise correction and completion of Work as established in Certificate of Substantial Completion.

D. Final Completion:

1. When each subcontractor determines Work is finally complete, conduct inspection to verify completion of Work.
2. Assist ENGINEER in inspection.

E. Administration of Contract Closeout:

1. Receive and review sub-contractors' final submittals.
2. Transmit to ENGINEER with recommendations for action.
3. Assemble record drawings from other sub-contractors and forward to ENGINEER.
4. Assist ENGINEER in assembling O&M data for compilation of operations manuals.

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\*\*\* END OF SECTION \*\*\*

SECTION 01315  
PROJECT MEETINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Design ENGINEER and Construction Administration Resident ENGINEER will schedule and conduct preconstruction conference. ENGINEER will notify CONTRACTOR as to the date and time of the meeting 10 working days prior to the conference. As a guide, preconstruction conference will be held within 20 days after effective notice of award.
- B. CONTRACTOR shall schedule and administer progress meetings, construction foreman's meetings, and specially called meetings throughout progress of Work. CONTRACTOR shall:
  - 1. Prepare agenda for meetings.
  - 2. Distribute written notice of specially called meetings minimum of 1 working day(s) in advance of meeting date.
  - 3. Make physical arrangements for meetings.
  - 4. Preside at meetings.
  - 5. Record minutes; include significant proceedings and decisions.
  - 6. Maintain an action item log.
  - 7. Prepare formal minutes and distribute within 3 working days after each meeting:
    - a. To meeting participants.
    - b. To parties affected by decisions made at meeting.
    - c. Furnish both ENGINEER and OWNER with copies of minutes and transmit an electronic file (Word or WordPerfect) of the minutes and action items log via email.
- C. Representatives of CONTRACTOR, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of entity each represents.
- D. OWNER and ENGINEER shall be invited to attend meetings.

1.02 PRECONSTRUCTION CONFERENCE

- A. Within 20 days after Effective Date of Award, but before CONTRACTOR starts Work at site.
- B. Location: to be determined
- C. Attendance (at a minimum should include):
  - 1. CONTRACTOR's Project Manager.
  - 2. CONTRACTOR's Resident Superintendent.
  - 3. CONTRACTOR's "hands-on" person designated by CONTRACTOR to submit Shop Drawings to ENGINEER.
  - 4. Subcontractors' or suppliers' representatives CONTRACTOR may desire to invite or ENGINEER may request.
  - 5. Design and resident ENGINEERS' representatives.
  - 6. OWNER's representatives.
  - 7. Local utility representatives, if applicable.
- D. Suggested format includes, but not be limited to the following:

1. Project Safety.
2. Presentation of preliminary progress schedule and preliminary schedule of Shop Drawing and sample submissions.
3. Check of required bonds and insurance policies prior to Notice to Proceed.
4. Liquidated damages.
5. Procedures for handling submittals such as substitutions and Shop Drawings.
6. O&M submittal procedures.
7. Direction of correspondence, and coordinating responsibility.
8. Weekly and monthly progress meetings.
9. Equal opportunity requirements.
10. Laboratory and field testing requirements.
11. Provisions for inventory of material stored on-site or off-site if off-site storage is authorized.
12. Schedule of values, application for progress payment, and progress payment procedures.
13. Change Order procedures.
14. Posting of Project Signage.

E. Partnership Meeting:

1. A partnership meeting will be sponsored by the OWNER and will be required for this project.
2. Attendees should include:
  - a. CONTRACTOR's representatives.
  - b. OWNER's representatives.
  - c. Design and Resident ENGINEERS.

1.03 MONTHLY PROGRESS MEETINGS

A. Schedule monthly meetings.

B. Location: CONTRACTOR's field office or a location acceptable to the OWNER.

C. Attendance:

1. CONTRACTOR's Project Manager.
2. CONTRACTOR's Resident Superintendent.
3. Electrical, plumbing, mechanical, earth work, and other affected subcontractors. ENGINEER and OWNER shall be invited to the meeting.

D. Suggested Agenda:

1. Review minutes of previous meeting.
2. Review Work progress since previous meeting.
3. Project safety concerns.
4. Field observations, problems, conflicts. CONTRACTOR shall maintain a copy of record drawings.
5. Problems impeding Construction Schedule.
6. Review of off-site fabrication, delivery schedules.
7. Corrective measures and procedures to regain conformance with projected Construction Progress Schedule.
8. Revisions to Construction Progress Schedule.
9. Issues raised by OWNER and ENGINEER.
10. Progress and schedule for succeeding Work period.

11. Coordination of schedules.
  12. Review and update submittal schedules.
  13. Maintenance of quality standards.
  14. Pending changes and substitutions.
  15. Review proposed changes for:
    - a. Effect on Construction Progress Schedule and completion date.
    - b. Effect on other contracts of Project.
  16. Other business.
- E. Agenda containing specific subjects to be discussed shall be provided to each attendee and to OWNER and ENGINEER at least 7 days before meeting.
- 1.04 CONSTRUCTION FOREMAN'S MEETING
- A. Contractor shall schedule weekly meetings.
  - B. Location: CONTRACTOR's field office.
  - C. Attendance:
    1. Resident superintendent.
    2. Subcontractor's foremen.
  - D. Suggested Agenda:
    1. Review agenda of Work progress since previous meeting.
    2. Proposed progress and schedule for succeeding Work period.
    3. Field observations, problems, conflicts.
    4. Problems which effect construction schedule.
- 1.05 MEETING NOTES and MINUTES
- A. Email an electronic file of the minutes/notes via email to the ENGINEER.
- 1.06 ENGINEER'S MEETING
- A. ENGINEER, whenever necessary, shall call an emergency meeting to resolve project issues.
    1. Attendees:
      - a. CONTRACTOR's representative.
      - b. OWNER's representatives.
    2. Suggested agenda.
      - a. Emergency issues.
      - b. Resolution of conflicts.
      - c. Change order request.
      - d. Negotiations.
      - e. Clarification of design intent.
      - f. Project schedule.
    3. 48-hour notice shall be given to attendees.

4. Location: Site office or OWNER's office.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

\*\*\* END OF SECTION \*\*\*

SECTION 01316  
ENGINEER'S STATUS DURING CONSTRUCTION

PART 1 GENERAL

1.01 OWNER'S REPRESENTATIVE

- A. Project has been designed by GHD, Inc. 7600 North 16<sup>th</sup> Street, Suite 205, Phoenix, Arizona 85020, (602) 216-7200, hereinafter called ENGINEER, and who is to act as OWNER's representative in the interpretation of design intent, assume duties and responsibilities and have rights and authority assigned to ENGINEER in Contract Documents in connection with completion of Work in accordance with Contract Documents, and shall not be extended without written consent of OWNER and ENGINEER.

1.02 DEFINITIONS

A. ENGINEER:

1. As used in the Specifications and on Drawings, refers to GHD Inc. and/or associated sub-consulting companies.
2. As used in other documents is as defined in General Specifications.
3. Resident ENGINEER with the responsibility of day-to-day construction administration activities.

B. OWNER:

1. As used in Specifications and on Drawings, is as defined in Agreement.

1.03 VISITS TO SITE

- A. Resident ENGINEER and the ENGINEER's subconsultants will be at the site at intervals appropriate to the various stages of construction as ENGINEER deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work.
- B. Based on information obtained during such visits and observations, ENGINEER will endeavor for the benefit of OWNER to determine, in general, if the Work is proceeding in accordance with the Contract Documents and in line with the intentions of the design ENGINEER.
- C. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents.
- D. On the basis of such visits and on-site observations, ENGINEER will keep OWNER informed on the progress of the Work, accuracy, quality, and will endeavor to guard OWNER against defective Work. ENGINEER will coordinate Work with other pipeline CONTRACTOR and work with OWNER assigned representative.
- E. Resident ENGINEER will furnish Resident Project Representative (RPR), assistants, and other field staff to assist ENGINEER in observing performance of Work of CONTRACTOR.

Through more extensive on-site observations of Work in progress and field checks of materials and equipment by RPR and assistants, ENGINEER shall endeavor to provide further protection

for OWNER against defects and deficiencies in Work; but, furnishing of such services will not make ENGINEER responsible for or give ENGINEER control over construction means, methods, techniques, sequences or procedures or for safety precautions or programs, or responsibility for CONTRACTOR'S failure to perform Work in accordance with Contract Documents.

F. RPR'S duties and responsibilities limited to those of ENGINEER in ENGINEER'S agreement with OWNER and in Contract Documents, and further limited and described as follows.

1. General: RPR is ENGINEER'S agent on-site, will act as directed by and under supervision of Resident ENGINEER, and will confer with ENGINEER regarding RPR'S actions. RPR'S dealings in matters pertaining to on-site Work shall, in general, be with ENGINEER and CONTRACTOR keeping OWNER advised as necessary. RPR'S dealings with Subcontractors through or with full knowledge and approval of CONTRACTOR. RPR shall generally communicate with OWNER with knowledge of and under direction of ENGINEER.

2. Duties and Responsibilities of RPR Representative:

- a. Attend preconstruction conference with OWNER, Contractors, utilities, and other appropriate parties affected by Project. This meeting will allow parties to Project an opportunity to develop specific guidelines of involvement, establish schedule of events, and define Project requirements.
- b. Provide direction for assistants and coordinate observation activities. Make field notes as necessary.
- c. Direct visiting inspectors representing public or other agencies having jurisdiction over Project and other visitors, to OWNER or CONTRACTOR as appropriate.
- d. Administer required written amendments as Project proceeds.
- e. Reject Work observed to be "defective." Require special inspection or testing of Work when deemed necessary.
- f. Review testing of equipment furnished by CONTRACTOR and assess compliance with Contract Documents.

3. Duties and Responsibilities of RPR'S Assistant(s):

- a. Assistant(s) shall function under direction and supervision of RPR.
- b. Observe Work activities as directed and report observations to RPR. Observed variance in Work activities from intent of Contract Documents will be reported to RPR.
- c. Inform RPR when situations develop such that change in Contract Documents would serve to improve final product received by OWNER. Gather and maintain information required for pay estimate review by RPR and Resident ENGINEER.
- d. Perform other duties as directed by RPR/Resident ENGINEER.
- e. Assistant(s) will have limitations on responsibilities and authority. Assistant(s) will:
  - 1) Not be authorized to modify or otherwise change Contract Documents.
  - 2) Not have authorization necessary to accept any Work on behalf of OWNER.
  - 3) Not be authorized to order any additional Work.
  - 4) Not, through his/ her efforts, relieve CONTRACTOR of CONTRACTOR'S ultimate responsibility for quality of Work.

#### 1.04 CLARIFICATIONS AND INTERPRETATIONS

A. Resident ENGINEER will issue with reasonable promptness such written clarifications or interpretations of requirements of Contract Documents (in form of Drawings or otherwise) as Resident ENGINEER may determine necessary, which shall be consistent with or reasonably

inferable from Contract Documents. Resident ENGINEER may consult with the design ENGINEER regarding clarifications and interpretation. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER or CONTRACTOR believes written clarification or interpretation justifies an adjustment in Contract Price or Contract Times and parties are unable to agree to amount or extent thereof, if any, OWNER or CONTRACTOR might make a written claim as provided in General Conditions.

#### 1.05 AUTHORIZED VARIATIONS IN WORK

- A. Resident ENGINEER, through consultation with the design ENGINEER, may authorize minor variations in Work from requirements of Contract Documents which do not involve adjustment in Contract Price or Contract Times and are compatible with the design concept of the completed project as a functioning whole as indicated by the Contract Documents. These may be accomplished by Field Order and will be binding on OWNER and also on CONTRACTOR who shall perform Work involved promptly. If OWNER or CONTRACTOR believes that Field Order justifies an adjustment in Contract Price or Contract Time and parties are unable to agree as to amount or extent thereof, OWNER or CONTRACTOR may make claim therefore as provided in General Conditions.

#### 1.06 REJECTING DEFECTIVE WORK

- A. Resident ENGINEER will have authority to disapprove or reject Work which Resident ENGINEER believes to be defective or that Resident ENGINEER, through consultation with design ENGINEER, believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Resident ENGINEER will also have authority to require special inspection or testing of Work whether or not Work is fabricated, installed or completed.

#### 1.07 DECISIONS ON DISPUTES

- A. Resident ENGINEER will be initial interpreter of requirements of Contract Documents and judge of acceptability of Work thereunder. Resident ENGINEER will consult and confirm interpretation with design ENGINEER. Claims, disputes, and other matters relating to acceptability of Work or interpretation of requirements of Contract Documents pertaining to performance and furnishing of Work and claims under the General Conditions in respect of changes in Contract Price or Contract Times will be referred initially to Resident ENGINEER in writing with request for formal decision in accordance with this paragraph. Written notice of each such claim, dispute, or other matter will be delivered by claimant to Resident ENGINEER and other party to Agreement promptly (but in no event later than 30 days) after start of occurrence or event giving rise thereto, and written supporting data will be submitted to Resident ENGINEER and other party within 60 days after start of such occurrence unless Resident ENGINEER allows additional period of time for the submission of additional or more accurate data in support of such claim, dispute or other matter. The opposing party shall submit any response to Resident ENGINEER and the claimant within thirty days after receipt of the claimant's last submittal (unless Resident ENGINEER allows additional time). Resident ENGINEER will render a formal decision in writing within thirty days after receipt of the opposing party's submittal, if any, in accordance with this paragraph. Resident ENGINEER's written decision on such claim, dispute or other matter will be final and binding upon OWNER and CONTRACTOR.
- B. When functioning as interpreter and judge under above Paragraph, Resident ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with interpretation or decision rendered in good faith in such capacity. Rendering of decision by Resident ENGINEER pursuant to above Paragraph, with respect to any such claim, dispute or other matter (except any which have been waived by making or acceptance of final payment)

will be condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under Contract Documents or by Laws or Regulations in respect to any such claim, dispute or other matter.

#### 1.08 SHOP DRAWINGS AND SAMPLES

- A. Design ENGINEER will review and approve Shop Drawings and Samples, but, design ENGINEER's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER's review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where specific means, method, technique, sequence or procedure of construction is specifically and expressly called for by Contract Documents) or to safety precautions or programs incident thereto. Review and approval of separate item as such will not indicate approval of assembly in which item functions. CONTRACTOR shall make corrections required by ENGINEER, and return required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than corrections called for by ENGINEER on previous submittals.
- B. ENGINEER's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for variation from requirements of Contract Documents unless CONTRACTOR has, in writing, called ENGINEER's attention to each such variation at time of submission and ENGINEER has given written approval of each such variation by specific written notation incorporated in or accompanying Shop Drawing or Sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in Shop Drawings or from responsibility for having complied with provisions of General Condition.
- C. Where Shop Drawing or Sample is required by Contract Documents, related Work performed prior to ENGINEER's review and approval of pertinent submittal will be at CONTRACTOR's sole expense and responsibility.

#### 1.09 SUBSTITUTIONS

- A. ENGINEER will be allowed reasonable time within which to evaluate each proposed substitute. ENGINEER will be sole judge of acceptability, and no substitute will be ordered, installed or utilized without ENGINEER's prior written acceptance which will be evidenced by Change Order or approved Shop Drawing. OWNER may require CONTRACTOR to furnish, at CONTRACTOR's expense, special performance guarantee or other surety with respect to substitute in form of Special Performance Guarantee and Surety Bond.
- B. All substitutions shall be evaluated by design ENGINEER within the time limits set forth by the OWNER.

#### 1.10 LIMITATIONS ON ENGINEER'S RESPONSIBILITIES

- A. Neither ENGINEER's authority to act under this section or Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority or responsibility or undertaking, exercise or performance of any authority or responsibility by ENGINEER shall create, impose, or give rise to any duty owned by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for employee or agent of any of them.

- B. Whenever in Contract Documents terms "as ordered", "as directed", "as required", "as allowed", "as approved" or terms of like effect or import are used, or adjectives "reasonable", "suitable", "acceptable," "proper" or "satisfactory" or adjectives of like effect or import are used to describe requirement, direction, review or judgment of ENGINEER as to Work, it is intended that such requirement, direction, review or judgement will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in Contract Documents and conformance with design concept of completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is specific statement indicating otherwise). Use of any such term or adjective shall not be effective to assign ENGINEER any duty or authority to supervise or direct furnishing or performance of Work for any duty or authority to undertake responsibility contrary to provisions of this article.
- C. ENGINEER will not supervise, direct, control or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or safety precautions and programs incidental thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations and ENGINEER is not responsible for CONTRACTOR's failure to perform or furnish Work in accordance with Contract Documents.
- D. ENGINEER will not be responsible for acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of Work.
- E. ENGINEER is not responsible for project site safety. The CONTRACTOR shall maintain a site specific safety plan.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

\*\*\* END OF SECTION \*\*\*

SECTION 01321  
CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide construction record photographs during the course of the project.

1.02 SUBMITTALS

- A. Deliver prints and digital files as soon as processed, not more than 7 calendar days after picture is taken.

PART 2 PRODUCTS

2.01 PHOTOGRAPHS

- A. Digital Cameras and Video Equipment:
  - 1. Digital cameras should be used in lieu of film photography whenever possible. CONTRACTOR shall provide prints in digital format. Provide CD to the OWNER and ENGINEER.
  - 2. Video recordings will be required in addition to still photography for all areas.

PART 3 EXECUTION

3.01 RECORD REQUIREMENTS

- A. Take photographs and video before these major stages of construction. CONTRACTOR shall be required to take additional photographs as necessary. Avoid using flash, whenever possible.
  - 1. Before commencement of construction. Show project site, onsite storage and staging areas, adjacent roadway and any areas covered by traffic control.
  - 2. After cleanup and restoration. Photos should cover all areas shown in initial pre-construction records as well as any areas where additional work was performed.

3.02 VIEWS REQUIRED

- A. Photograph from locations to adequately illustrate condition of construction and state of Project.
  - 1. At each specified time, photograph project from 3 different views, as approved by OWNER / ENGINEER.
  - 2. Avoid harsh shadows. Use fill-in flash, if required.
  - 3. Show all valves and manholes.
  - 4. Use a reference size object, such as coins, scale or objects of known size for all close up photography.

\* \* \* END OF SECTION \* \* \*

SECTION 01325  
CONSTRUCTION PROGRESS SCHEDULES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide a preliminary schedule 7 calendar days before pre-construction meeting. Prepare and submit to ENGINEER for review.
- B. No Work shall be performed between 6:00 p.m. and 7:00 a.m., nor on Saturdays, Sundays or legal holidays without written permission of OWNER. Emergency work may be performed without prior permission. CONTRACTOR shall notify ENGINEER within 8 hours.
- C. Night work may be established by CONTRACTOR as regular procedure with written permission of OWNER. Such permission may be revoked at any time by OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for proper execution and control of Work at night.
- D. CONTRACTOR shall prepare and coordinate schedule with subcontractor(s).
- E. Information for preparation of Construction Progress Schedule is as follows.
  - 1. CONTRACTOR shall obtain all information from subcontractor 5 working days before updating project schedules.

1.02 FORM OF SCHEDULE

- A. Prepare schedule in form of horizontal-bar-chart type (Gantt chart). Time-scaled logic diagrams may be used.
  - 1. Provide separate horizontal time bar for each task, trade, activity or operation.
  - 2. Provide continuous vertical line to identify first working day of each week and a solid line for each month.
  - 3. Scale and space to allow for notations and future revisions.
  - 4. Schedule each activity in construction sequence or as required by ENGINEER.
  - 5. Schedule shall also include target and actual schedule, represented by horizontal bars.
  - 6. Show task description, duration, percent complete and float on the left margin.
- B. Format of Listings: Chronological order of start of each activity or operation for use in a Gantt chart format. If time-scaled diagram is used, sort by early start date or actual start date.

1.03 CONTENT OF SCHEDULE

- A. Construction Progress Schedule:
  - 1. Show complete sequence of construction by task, activity or operation. Provide "hammock" to group subtasks together.
  - 2. Coordinate Construction Progress Schedule with Submittals. Show submittals of critical path items.
  - 3. Show dates for beginning and completion of each activity or operation during construction and installation dates for major items of equipment. Activities and operations shall include, but not be limited to the following:

- a. Material and equipment submittal, submittal approval deadline, order, manufacturer delivery, installation, and checkout, including allowance items.
- b. Performance tests and supervisory services activity.
- c. Piping, duct work, conduit and wiring installation.
- d. Construction of various structures and facilities.
- e. Concrete pour sequence and formwork removals.
- f. Structural steel erection.
- g. Precast concrete erection.
- h. Backfilling, grading, seeding, sodding, landscaping, fence construction, and paving.
- i. Electrical work activity.
- j. Heating, ventilating, and air conditioning work activity.
- k. Plumbing work activity.
- l. Sewer installation.
- m. Equipment installation.
- n. Connection to existing sewers.
- o. Water main installation.
- p. Subcontractor's items of Work.
- q. Alterations work.
- r. Allowance for inclement weather.
- s. Demolition, abandonment, delivery and storage.
- t. Miscellaneous concrete pours or placement.
- u. System startup and punchlist management
- v. Instructional training and final cleanup.
- w. O&M data submittal.

- 4. Show projected percentage of completion for each item as of first day of each month or a same time every month as determined by ENGINEER.

#### 1.04 SCHEDULE REVISIONS

- A. Every calendar month, revise Construction Progress Schedule to reflect changes in progress of Work. Show actual vs. target.
- B. Indicate progress of each activity or operation at date of schedule revision.
- C. Show changes occurring since previous revised submittal.
  - 1. Major changes in scope which affects cost and time.
  - 2. Activities modified since previous submittal.
  - 3. Revised projections of progress and completion.
  - 4. Other identifiable changes.
  - 5. Show effects on total time.
  - 6. Show critical path activities on separate printout or in red color on project schedule.
- D. Every week, provide narrative report defining following.
  - 1. Problem areas, anticipated delays, and impact on schedule. Provide critical path schedule during weekly meetings.
  - 2. Corrective action recommended and its effect.
  - 3. Effect of changes on schedules of other subcontractors. Also show project milestones as established by ENGINEER or shown in the work sequencing plan.
- E. Submit to ENGINEER for review.

#### 1.05 DELAYS AND RECOVERY

- A. If, at any time during Project, CONTRACTOR fails to complete activity by its latest scheduled completion date, CONTRACTOR shall, within 3 working days, submit to ENGINEER written statement as to how and when Work force will be reorganized to return Contract to current target construction schedule. The original target schedule and all subsequent approved revised schedules shall be kept as part of the record documents.
- B. When it becomes apparent from progress evaluation and updated schedule data that milestone completion or Contract completion dates will not be met, CONTRACTOR shall take some or all of following actions.
  - 1. Increase construction staffing in such quantities and crafts as shall substantially eliminate backlog of Work.
  - 2. Increase number of working hours per shift, shifts per Work day, Work days per week, or amount of construction equipment, or combination of foregoing sufficient to substantially eliminate backlog of Work. Work hours shall be approved by the OWNER and consider impacts on adjacent property owners.
  - 3. Reschedule Work items to achieve concurrency of accomplishment.
  - 4. Work to be done to meet project milestones shall be done at no additional costs to the OWNER.
- C. Addition of equipment or construction forces, increasing working hours or other method, manner or procedure to return to current Construction Progress Schedule will not be considered justification for amending Contract Documents or treated as acceleration.
- D. CONTRACTOR shall accept risk for delays caused by rate of progress of Work to be performed under other Contracts. If CONTRACTOR is delayed in prosecution and completion of Work because of such conditions, CONTRACTOR shall have no claim for damages other than extension of time and waiving of liquidated damages during period of time occasioned by delay.

#### 1.06 SUBMITTAL REQUIREMENTS

- A. For initial submittal of Construction Progress Schedule and subsequent revisions thereof, submit 6 copies of schedule to ENGINEER. Failure to submit schedule on timely basis as previously noted shall be considered cause for withholding progress payments otherwise due under this Contract.
- B. Submit on 24" x 36" printouts or 11" x 17" printouts. Any other size printout shall be approved by the ENGINEER.
- C. CONTRACTOR shall develop and update project schedules on Primavera Project Planner or Microsoft Project. Spreadsheet with shaded cells and other database improvisations will not be allowed. Use of any other proprietary software or database will not be allowed for this project.
- D. Provide monthly pure logic diagrams.
- E. Show lags and floats.

#### PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

\*\*\* END OF SECTION \*\*\*

SECTION 01330  
SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Procedural requirements for Project-related submittals including Construction Progress Schedules, piping layout, Shop Drawings, product data, samples, operation and maintenance (O&M) data, construction photographs, design data, test reports, manufacturer's instructions, pre-fab drawings, schedule of values and other miscellaneous Work-related submittals.
2. Submittal requirements per items listed in Part 1, of all Sections in these specifications.
3. Items requiring ENGINEER's approval in these specifications.
4. Items shown on drawings which require approval by ENGINEER.

1.02 DEFINITIONS

A. Submittal for Review or Approval:

1. Submit for ENGINEER's review in accordance with requirements of Contract Documents.

B. Submittal for Record:

1. Submit for inclusion into OWNER's records prior to Substantial Completion. Submittal will not be reviewed by ENGINEER.

1.03 CONSTRUCTION PROGRESS SCHEDULES

- A. Provide monthly/weekly project schedule as specified.

1.04 SHOP DRAWINGS AND PRODUCT DATA

A. Scheduling:

1. Provide submittal schedule for items of materials and equipment for which submittals are required by Specifications or requiring approval of the ENGINEER as shown on the plans. Adjust submission schedule to reflect revisions to Construction Progress Schedule and submit to ENGINEER.
2. Prepare and transmit each submittal sufficiently in advance of scheduled performance of Work and other applicable activities.

B. CONTRACTOR's Responsibilities:

1. Review Shop Drawings and product data prior to submittal. CONTRACTOR shall verify correctness and completeness of all submittals prior to forwarding same to ENGINEER for review. CONTRACTOR shall provide approval/review stamp, signature and date. Identify deviations in the submittal from the plans and specifications.
2. Determine and verify following:
  - a. Field measurements.
  - b. Field construction criteria.

- c. Catalog numbers and similar data.
  - d. Conformance with Specifications.
  - e. Delete (Strike out) items NOT used in suppliers brochure and highlight the model/make of equipment used specifically for the project.
3. Coordinate each submittal with requirements of Work and Contract Documents.
  4. Notify ENGINEER in writing, at time of submittal, of deviations in submittals from requirements of Contract Documents.
  5. Begin no fabrication or Work requiring submittals until return of submittals with ENGINEER approval.
  6. Designate in Construction Progress Schedule, dates for submittal and receipt of reviewed shop drawings and samples.
  7. Submittals received but not requested in Specifications shall be returned without review.

C. Submittals shall contain:

1. Date of submittal and dates of previous submittals.
2. Project title and number.
3. Contract identification.
4. Names, telephone, and fax numbers of:
  - a. CONTRACTOR.
  - b. Supplier.
  - c. Manufacturer and Manufacturer Technical Department or Staff.
  - d. Local/Regional representative(s).
5. Identification of product, with identification numbers, and Drawing and Specification section numbers. CONTRACTOR shall be required to bind submittals by each section number shown in these specifications. When a section contains more than one type of equipment, CONTRACTOR shall provide tabs and a table of contents. Submittals can be made one section at a time within the time frame shown on the project schedule. Submittals with portions of each section will not be allowed, unless approved by ENGINEER.
6. Field dimensions, clearly identified.
7. Identify details required on Drawings and in Specifications.
8. Show manufacturer and model number, give dimensions, and provide clearances and tolerances.
9. Relation to adjacent or critical features of Work or materials.
10. Applicable standards, such as ASTM or Federal Specification numbers. Identification of deviations from Contract Documents.
11. Identification of revisions on resubmittals.
12. 8 in. by 3 in. blank space for CONTRACTOR and ENGINEER review stamps.
13. CONTRACTOR's stamp, signed, certifying to review of submittal, verification of products, field measurement, field construction criteria, and coordination of information within submittal with requirements of Work and Contract Documents.
14. Product related data. Refer to O&M submittal requirements by ENGINEER.
15. Samples, actual, color charts or cutouts.
16. Personnel qualifications.
17. Training plans.
18. Installation requirements and procedures.
19. Performance test requirements and procedures.
20. Material certification.
21. Warranties and guarantees.
22. Tools and parts list. Include current price lists.

D. Resubmittal Requirements:

1. Comply with submittal requirements.
2. Make corrections or changes in submittals required by ENGINEER. Resubmittals required until approved.
3. Identify on transmittal form that submittal is a resubmission.
4. Shop Drawings and Product Data:
  - a. Revise initial drawings or data and resubmit as specified for initial submittal.
  - b. Indicate changes made other than those requested by ENGINEER.

E. Distribute reproductions of Shop Drawings and copies of product data which carry ENGINEER'S stamp approval to following:

1. Jobsite file.
2. Record documents file.
3. Other affected Contractors.
4. Subcontractors.
5. Supplier or fabricator.
6. Submit a minimum of six (6) copies of submittals for review by ENGINEER.
7. Furnish additional copies for use by CONTRACTOR.

F. ENGINEER'S Duties:

1. Review submittals in accordance with schedule.
2. Indicate requirements for resubmittal or approval of submittal.
3. Return submittals to CONTRACTOR for distribution or for resubmittal.

1.05 TEST RESULTS REPORTS AND CERTIFICATIONS

- A. Submit test results, reports, and certifications as required.
- B. Submit test results upon completion of test or submittal of results from testing laboratory.
- C. Test results and certifications are submitted for review of conformance with specified requirements and information.

1.06 CONSTRUCTION PHOTOGRAPHS

- A. Taken at regular intervals during course of the project. Refer to Construction Photographs section of these specifications.

1.07 GUARANTEE, WARRANTIES, MAINTENANCE AGREEMENTS AND WORKMANSHIP BONDS

- A. Refer to Specification sections for requirements. Submittal considered final when submittal is returned by ENGINEER, marked "Approved" or "Approved as Noted."
- B. In addition to copies desired for CONTRACTOR's use, furnish 6 executed copies to ENGINEER.

1.08 OPERATION AND MAINTENANCE (O&M) DATA

- A. Compile product data and related information appropriate for OWNER's maintenance and operation of products. All manufacturer's data for all products installed for this project shall be compiled on a single CD/DVD and two copies shall be submitted.

1.09 ACTION ON SUBMITTALS

A. ENGINEER'S Action:

1. General:

- a. Except for submittals for record and similar purposes, where action and return on submittals required or requested, ENGINEER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, ENGINEER will so advise CONTRACTOR without delay.
- b. ENGINEER will stamp each submittal with action stamp, appropriately marked with submittal action.

2. Notification of Insufficient Information:

- a. If information submitted is not sufficient to complete review of submittal, ENGINEER will send transmittal to CONTRACTOR notifying CONTRACTOR that additional information is required.
- b. Submittal will not be returned. Submittal will be placed in an "on hold" status until CONTRACTOR provides additional information.

B. Action Stamp:

1. Marking: Approved.

- a. Final Unrestricted Release: Where submittals are marked as "Approved," Work covered by submittal may proceed provided it complies with Contract Documents. Acceptance of Work depends on that compliance.

2. Marking: Approved As Noted.

- a. Final-But-Restricted Release: When submittals are marked as "Approved With Noted Exceptions," Work covered by submittal may proceed provided it complies with ENGINEER'S notations or corrections on submittal and with Contract Documents. Acceptance of Work depends on that compliance. Resubmittal is not required.

3. Marking: Not Approved.

- a. Submittal Not Accepted: When submittals are marked as "Not Approved," do not proceed with Work covered by submittal. Work covered by submittal does not comply with Contract Documents.
- b. Prepare new submittal for different material or equipment supplier or different product line or material of same supplier complying with Contract Documents.

4. Marking: Revise and Resubmit.

- a. Returned for Resubmittal: When submittals are marked as "Revise and Resubmit," do not proceed with Work covered by submittal. Do not permit Work covered by submittals to be used at Project site or elsewhere where Work is in progress.
- b. Revise submittal or prepare new submittal in accordance with ENGINEER'S notations. Resubmit without delay. Repeat if required to obtain different action marking.

## 1.10 SUBSTITUTIONS

### A. Substitute Items of Materials and Equipment

1. Contract requirements contain references to material and equipment by manufacturer, trade name, make, model or catalog number. Such references establish the standard of quality, type, finish, appearance or performance required. If an item is not sole source, the CONTRACTOR may submit material or equipment of other suppliers as proposed equals. CONTRACTOR must submit sufficient information to permit Project Manager/ENGINEER to determine whether or not the material or equipment proposed is equal to that named and that it has been used successfully elsewhere under similar conditions. The Project Manager/ENGINEER will consider quality, type, materials of construction, finish, appearance, specific design details, and performance when evaluating "or equal material and equipment." However, the Project Manager/ENGINEER will not eliminate from evaluation an "or equal" or "or approved equal" proposed by the CONTRACTOR because of a specific design feature or criteria listed in the specifications unless the specific design feature or criteria is material and essential to the project needs. In all cases, the burden of proof that the material or equipment offered is equal or superior to that described in the specifications shall rest upon the CONTRACTOR. Project Manager/ENGINEER shall make the final determination on whether or not the material or equipment is equal.
2. Whenever equipment is proposed that differs substantially from that shown on the Drawings, or which will require modifications, structures, piping controls and other related design items, the CONTRACTOR is to include in his/ her Bid on such equipment:
  - a. The cost of redesign of any mechanical, electrical controls or structural changes necessary to make the proposed equipment comply with the ratings, loadings, etc., contained in the Contract Requirements; and
  - b. Any increase or reduction in cost of structures, piping, electrical controls, and mechanical appurtenances involved by the proposed equipment. The OWNER shall receive all benefit of any reduction in cost that results directly or indirectly from acceptance or any substitute item of material or equipment after bid time.

## 1.11 SPARE PARTS

- A. The manufacturer's spare parts shall be defined as that recommended list of spare parts that has been developed and made part of the Operations and Maintenance Manual for the product in addition to those specifically identified in the Detailed Specifications. The spare parts shall be transmitted to the Owner in a Form submitted, acceptable to the OWNER and delivered to a location point within the Plant designated by the OWNER. The Submittal Form shall contain as a minimum, a description of the Spare Parts, Catalogue Number, quantities involved, Manufacturer's name, address and telephone number and actual cost.

## PART 2 PRODUCTS

(Not Used)

## PART 3 EXECUTION

### 3.01 SUBMITTAL REQUIREMENTS

- A. Provide complete copies of required submittals as follows.

1. Construction Progress Schedule:
  - a. 6 copies of initial schedule.
  - b. 3 copies of each revision.
2. Shop Drawings and Product Data: 6 copies.
3. Test Results: 6 copies.
4. Construction Photos: 2 CD/DVDs containing all photos and video.
5. Operation and Maintenance Manuals: 2 CD/DVDs with all equipment cut sheets.
6. Other Submittals:
  - a. 6 copies if required for review and all 6 copies shall be retained by the ENGINEER.
  - b. CONTRACTOR shall furnish extra copies in addition to the six for CONTRACTOR's use.
7. CONTRACTOR shall furnish a minimum of 6 copies of submittal. Copies shall be distributed by ENGINEER as required.

\*\*\* END OF SECTION \*\*\*

SECTION 01400  
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Quality control and control of installation.
- B. Allowable Tolerances.
- C. Standards and references.
- D. Testing and inspection services.
- E. Manufacturers' field services.
- F. Examination.
- G. Preparation.

1.02 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents or with CONTRACTOR's installation procedures, request clarification from ENGINEER before proceeding. CONTRACTOR shall be required to provide written clarification from manufacturer upon request by the ENGINEER.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer or ENGINEER.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement. CONTRACTOR shall provide manufacturer's calculations for each pump to determine that vibration and load factors are taken into consideration.

1.03 ALLOWABLE TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate. Use proper measurement techniques.
- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from ENGINEER before proceeding.

- C. Adjust products to appropriate dimensions; position before securing products in place. Proper anchors, straps or other methods of positioning shall withstand impact loading caused by concrete pours and other movements, such as vibration, shifting, etc.

#### 1.04 STANDARDS AND REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Obtain copies of standards where required by product specification sections. Provide photocopy to ENGINEER for record purposes.
- C. When specified reference standards conflict with Contract Documents, request clarification from ENGINEER before proceeding.
- D. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of ENGINEER shall be altered from Contract Documents by mention or inference otherwise in reference documents.

#### 1.05 TESTING AND INSPECTION SERVICES

- A. Owner will employ and pay for specified services of an independent firm to perform OWNER's or ENGINEER's own quality assurance testing and inspection program. CONTRACTOR shall pay for all project required testing in accordance with City and MAG requirements.
- B. Laboratory used by CONTRACTOR shall be approved by the ENGINEER. No out-of-state laboratory will be allowed. The following criteria shall be met:
  - 1. Laboratory: Authorized to operate in the State of Arizona.
  - 2. Laboratory Staff: Maintain full time staff Professional Engineer, registered in the State of Arizona, for reviewing services.
  - 3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by the ENGINEER.
- D. Reports will be submitted by independent firm to ENGINEER, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
  - 1. Notify ENGINEER and independent firm 24 hours prior to expected time for operations requiring services.
  - 2. Make arrangements with independent firm and pay for additional samples and tests required for the use of the CONTRACTOR.
- F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

- G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Payment.
- H. OWNER will pay for independent firm testing if results are in concurrence with CONTRACTOR values and will be made a part of OWNER's Quality Assurance program.

#### 1.06 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, equipment start-ups as applicable. Initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- C. Refer to Section 01330 - SUBMITTAL PROCEDURES.
- D. Manufacturer's field services shall be made part of CONTRACTOR's work at no additional cost to the OWNER. Field services will be required by the OWNER prior to final completion of the project.

#### PART 2 PRODUCTS

(Not Used)

#### PART 3 EXECUTION

##### 3.01 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify utility services are available, of correct characteristics, and in correct locations.

\*\*\* END OF SECTION \*\*\*

SECTION 01500  
TEMPORARY CONSTRUCTION FACILITIES AND UTILITIES

PART 1 GENERAL

1.01 QUALITY ASSURANCE

- A. This section covers temporary construction facilities and utilities, such as electrical power, water, lighting, telephone, fire protection, fencing, and other temporary items required for this project. Items provided under this section shall be listed or labeled by UL (Underwriters' Laboratory) or other Nationally Recognized Testing Laboratory (NRTL).
1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
  2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- B. Regulatory Requirements:
1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.
  2. Meet all applicable City and County codes for temporary structures.
- C. Comply with federal, state, county and local codes and regulations, and with utility company requirements.

PART 2 PRODUCTS

2.01 TEMPORARY ELECTRICITY AND LIGHTING

- A. General:
1. Temporary lighting shall be sufficient to enable CONTRACTOR and Subcontractors to complete Work and enable ENGINEER to observe Work as it is being performed. Illumination shall meet or exceed state code requirements.
  2. CONTRACTOR shall contact the utility company and make all arrangements for temporary power to the project site. CONTRACTOR shall pay for all application fees and usage directly to the utility company.
- B. Responsibilities:
1. Provide, maintain, and remove temporary electric service facilities. CONTRACTOR shall pay for all fees and costs of all utilities used during the construction period up to final acceptance. CONTRACTOR shall be required to apply for electrical services and make all necessary arrangements for bringing electrical service to the project site for the exclusive use by the CONTRACTOR, subcontractor, and ENGINEER.
  2. Facilities exposed to weather shall be weatherproof type and electrical equipment enclosure locked to prevent access by unauthorized personnel.
  3. Pay for installation of temporary services including poles, transformer charges, conduits, conductors, and metering.
  4. Arrange with local electric utility for temporary electric service subject to their requirements and approval.
  5. Register temporary meter in CONTRACTOR'S name. Pay for all services.
  6. Provide and maintain lamps, wiring, switches, sockets, and similar equipment required for temporary lighting and small power tools.

7. Pay for electrical energy consumed for construction purposes including operation of ventilating equipment for buildings, and for testing and operating of equipment after permanent wiring has been installed, until final acceptance by ENGINEER or until final acceptance and occupancy by OWNER.
8. Provide and pay for services to temporary offices, if required.
9. CONTRACTOR, upon approval of the ENGINEER, may use diesel generator to generate temporary power for lighting, and tools.
10. Provide temporary heat or cooling for chemicals prone to freezing or combustion or any equipment requiring constant temperature storage.

#### 2.02 TEMPORARY TELEPHONE SERVICE

- A. Phone service is not required. Contractor shall provide 4-hour courier service if fax service is not available.

#### 2.03 WATER FOR CONSTRUCTION

- A. Make arrangements and pay costs for water used during the construction period. Obtain all necessary permits and pay for all initial and monthly costs. Provide approved backflow preventers to meet City codes. If hydrants are used, CONTRACTOR shall operate hydrants according to procedures. Line breaks caused by abruptly shutting down hydrants shall be repaired immediately by the CONTRACTOR at no cost to the OWNER. Make hydrants accessible to Fire Department at all times. Report valve/hydrant malfunction to Fire Department immediately, and then to ENGINEER.
- B. Provide temporary piping per City codes. Obtain water meter(s) from the City to measure all flows.
- C. Disinfect temporary potable water lines, if required for potable use.
- D. Water for testing pipes shall be provided by the CONTRACTOR, prior to acceptance of Work.

#### 2.04 SANITARY FACILITIES

- A. Provide temporary sanitary toilet facilities conforming to state and local health and sanitation regulations, in sufficient number for use of CONTRACTOR'S and Subcontractor's employees.
- B. Maintain in sanitary condition and properly supplied with toilet paper.
- C. Arrange for portable toilet units and holding tanks. All wastes from trailer offices shall be piped to a holding tank.
- D. Arrange for routine vac services and maintenance.
- E. Proper sanitary, vector and odor control shall be required and maintained at all times.

#### 2.05 TEMPORARY FIRE PROTECTION

- A. CONTRACTOR shall be required to contact local fire department and meet all necessary fire codes at the project site.
- B. CONTRACTOR shall make arrangements for fire department audits, 30 days after Notice to Proceed.
- C. Make roadways accessible to fire trucks.

- D. Provide, and maintain in working order, a minimum of one fire extinguisher in each trailer, or as required by code.

#### 2.06 TEMPORARY SITE AND OTHER ROADS

- A. Construct and maintain temporary site roadways in drivable condition necessary to carry out construction operations.
- B. Maintain OWNER'S existing roads and public roads used during construction free from accumulations of dirt, mud and construction debris resulting from construction operations. Roads shall be considered "maintained" when material has been removed by a mechanical sweeper.
- C. Paved roads damaged during routine and normal construction shall be repaved at CONTRACTOR'S costs per City paving requirements.
- D. Provide photographs of road conditions before start of project.

#### 2.07 SECURITY

- A. Security will not be provided by OWNER.
- B. CONTRACTOR shall be responsible for loss or injury to persons or property where Work is involved, and shall provide security and take precautionary measures to protect CONTRACTOR'S and OWNER'S interests.
- C. CONTRACTOR shall provide insurance against loss of materials, trailer(s) contents, equipment and other property at the project site and trailer(s), including contents belonging to ENGINEER and OWNER.

#### 2.08 TEMPORARY PARKING

- A. Temporary parking areas shall be provided by the CONTRACTOR at no additional cost. Project area may not have adequate parking areas for all workers. Off-site parking may be necessary. CONTRACTOR shall make arrangements for additional parking without additional costs to the OWNER. OWNER and ENGINEER will require parking for 5 vehicles.
- B. Maintain parking area with 1-inch decomposed granite or other suitable material.
- C. No heavy machinery shall be allowed on OWNER'S parking area.

#### 2.09 TEMPORARY FENCING

- A. Provide temporary fencing sufficient to prevent trespass by CONTRACTOR'S employees and suppliers onto private property and by public onto construction site. Provide fencing that is sufficiently secure against trespass of children and other stray animals. Follow requirements of MAG and City codes.
- B. Materials shall be sufficiently durable to be effective for duration of construction period.
- C. Fencing around the project site will be removed and new fence will be constructed in place.

#### 2.10 PROJECT IDENTIFICATION

- A. Provide signs suitably supported and erected on Project site to indicate all construction areas. Locate signs where designated by ENGINEER on behalf of OWNER.

#### 2.11 OWNER'S USE

- A. Upon acceptance of Work, or portion of Work defined and certified as Substantially Completed by ENGINEER, and OWNER commences full-time successful operation of facility or portion thereof, OWNER will pay cost for utilities used for OWNER'S operation. CONTRACTOR shall continue to pay for utilities used until final acceptance of Work, except as provided herein.

### PART 3 EXECUTION

#### 3.01 GENERAL

- A. Comply with applicable requirements of this specifications.
- B. Maintain and operate systems to ensure continuous service.
- C. Modify, move and/or extend systems as Work progress requires.

#### 3.02 REMOVAL AND RESTORATION

- A. Completely remove temporary materials, equipment, signs, and structures when no longer required.
- B. In unfinished areas, clean and repair damage caused by temporary installations or use of temporary facilities, restore drainage, and evenly grade, seed or plant as necessary to provide appearance equal to or better than original.
- C. In finished areas, restore existing or permanent facilities used for temporary services to specified, or original condition.

#### 3.03 DAMAGE TO EXISTING PROPERTY

- A. CONTRACTOR is responsible for replacing or repairing damage to existing buildings, structures, sidewalks, roads, parking lot surfacing, and other existing assets.
- B. CONTRACTOR shall have option of having OWNER contract for such Work and have cost deducted from Contract price. OWNER's cost may be considerably higher than market price.

\*\*\* END OF SECTION \*\*\*

SECTION 01550  
TRAFFIC REGULATION

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes:
  - 1. Traffic Regulation.
- B. Traffic regulation shall conform to all City and ADOT requirements.
- C. Do not disturb natural vegetation and drainage washes outside limits of construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All materials used for traffic regulation shall conform to all City and ADOT requirements

PART 3 EXECUTION

3.01 EXECUTION

- A. Comply with MAG and City requirements.
- B. Follow traffic controls at all times.
- C. Follow speed control signage.
- D. Provide ingress and egress for affected residents.
- E. Inform residents of construction schedule. Provide a copy of all information distributed to the ENGINEER and a distribution listing.

\*\*\* END OF SECTION \*\*\*

## SECTION 01560

### PROTECTION OF ENVIRONMENT

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This project is designed with efforts by the ENGINEER and OWNER on protection of the environment by using environmentally friendly products. CONTRACTOR, in executing Work, shall maintain on-site and off-site work areas free from environmental pollution that would be in violation of federal, state, county, or local regulations.
- B. Submit temporary drainage plan for approval by ENGINEER. Submit contamination containment plans to the ENGINEER.
- C. CONTRACTOR shall comply with all requirements of the OWNER's Permit. A copy of the permit is available for review in the ENGINEER's office. Do not encroach on to the limits of the jurisdictional water of the United States.

##### 1.02 PROTECTION OF STORM AND SANITARY SEWERS

- A. Prevent construction material, pavement, concrete, earth or other debris from entering existing storm sewer, irrigation channels, washes, or sewer system. All culverts shall be kept clean at all times. Prevent accumulation of trash and debris.

##### 1.03 PROTECTION OF WATERWAYS AND CANALS

- A. Observe rules and regulations of State of Arizona, Department of Environmental Quality, City of Tempe, Maricopa County, Corps of Engineers and other agencies prohibiting pollution and contamination.
- B. Disposal of materials shall conform to all requirements of the State of Arizona and local ordinances.
  - 1. Permits and disposal fee, if required, are to be obtained by the CONTRACTOR at CONTRACTOR'S cost.
- C. Provide holding ponds or approved method which will divert flows, including storm flows and flows created by construction activity, to prevent flood damage and inconvenience to adjacent property.

##### 1.04 DISPOSAL OF EXCESS EXCAVATED AND OTHER WASTE MATERIALS

- A. Excess excavated material not required or not suitable for backfill and other waste material shall be disposed of in accordance with local regulatory requirements.
- B. Provide watertight conveyance for liquid, semi-liquid or saturated solids which tend to bleed during transport. Liquid loss from transported materials is not permitted, whether being delivered to construction site or hauled away for disposal. Fluid materials hauled for disposal must be specifically acceptable at selected disposal site.

##### 1.05 PROTECTION OF AIR QUALITY

- A. Minimize air pollution by requiring use of properly operating combustion emission control devices on construction vehicles and equipment and encourage shutdown of motorized equipment not in use.
- B. Do not burn trash on construction site.

#### 1.06 USE OF CHEMICALS

- A. Chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall be approved by U.S. EPA or U.S. Department of Agriculture or any other applicable regulatory agency.
- B. Use and disposal of chemicals and residues shall comply manufacturer's instructions.
- C. MSDS shall be accessible at all times.
- D. Chemicals shall conform to the emission regulations for Volatile Organic Compounds (VOC).

#### 1.07 NOISE CONTROL

- A. Conduct operations to cause least annoyance to residents in vicinity of Work, and comply with applicable local ordinances.
- B. Equip compressors, hoists, and other apparatus with mechanical devices necessary to minimize noise and dust. Equip compressors with silencers on intake lines.
- C. Equip gasoline or oil-operated equipment with silencers or mufflers on intake and exhaust lines.
- D. Line storage bins and hoppers with material that will deaden sounds.
- E. Conduct operation of dumping rock and of carrying rock away in trucks so as to cause minimum of noise and dust.
- F. Route vehicles carrying rock, concrete or other material over such streets as will cause least annoyance to public and do not operate on public streets between hours of 6:00 p.m. and 7:00 a.m., or on Saturdays, Sundays or legal holidays unless approved by OWNER.

#### 1.08 DUST CONTROL

- A. Due to close geographic location of Project to other facilities, take special care in providing and maintaining temporary site roadways, OWNER'S existing roads, and public roads used during construction operations in clean, dust free condition.
- B. Comply with local environmental regulations for dust control. If CONTRACTOR'S dust control measures are considered inadequate by OWNER, OWNER may require CONTRACTOR to take additional dust control measures, including the use of mechanical sweeper.

#### 1.09 FUELS AND LUBRICANTS

- A. Comply with local, county, state, and federal regulations concerning transportation and storage of fuels and lubricants.
- B. Fuel storage area and fuel equipment shall be approved by OWNER prior to installation. Submit containment provisions to OWNER for approval.

- C. Report spills or leaks from fueling equipment or construction equipment to OWNER and cleanup as required at CONTRACTOR'S expense.
- D. OWNER may require CONTRACTOR to remove damaged or leaking equipment from Project site at CONTRACTOR'S expense.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

\*\*\* END OF SECTION \*\*\*

SECTION 01724  
CONSTRUCTION SURVEYING

PART 1 GENERAL

1.01 SUMMARY

- A. The ENGINEER will provide horizontal and vertical control at the Project site as shown on the drawings. Work will be staked by CONTRACTOR at no expense to OWNER.
- B. Construction surveys shall conform to the City's and MAG standard specifications and based on datum shown on the drawings.
- C. CONTRACTOR shall furnish all materials, personnel, and equipment necessary to perform all surveying, staking, laying out of control lines and verifications of accuracy of all existing control points that are delineated in the Contract Documents. The work shall be done under the direction of a Registered Land Surveyor licensed to practice in the State of Arizona.
- D. Field Books: CONTRACTOR shall furnish field books to be used for recording survey data and field notes. These books shall be available for inspection by the City at any time and shall become the property of the City upon completion of the work.
- E. Staking Outline: Prior to beginning any survey operations, CONTRACTOR shall furnish to the City on-site representative, for approval, a written outline detailing the method of staking, interval of stakes, marking of stakes, grade control for various courses of materials, referencing, structure control, and any other procedures and controls necessary for survey completion. A part of this outline shall also be a schedule that will show the sequencing of the survey and layout work, throughout the course of the contract, listing a percentage of completion for each month.

1.02 CONTROL POINTS

- A. Bench marks provided by OWNER to establish primary vertical control for Work are indicated on Drawings. Coordinates and elevations are referenced to a datum.
- B. Preserve and maintain primary control monuments.
- C. Control Points (horizontal and vertical) - The existence and location of all survey monuments, bench marks and control points shall be verified prior to demolition or construction activity. Immediately notify the City on-site representative when location discrepancies greater than two-hundredths (0.02) foot horizontal or one-hundredth (0.01) foot vertical are found.
- D. Construction control lines with grade breaks, transition points, horizontal and vertical curves, etc., shall be established and referenced prior to construction. Temporary benchmarks shall be established and referenced at this time.
- E. Pre-Construction Location Survey: All existing features which are located prior to construction shall be referenced to survey monuments along control lines by stationing in accordance with the construction documents and by offset distance from the control lines. All features shall be relocatable after construction. Distances measured shall be within one-hundredth (0.01) foot.
- F. Water and Sewer line appurtenances - Water and sewer line surface appurtenances such as manholes, valves and cleanouts that lie within the construction area shall be located by the CONTRACTOR.

- G. Match Points and Removals - Verify the location (horizontal and vertical) of existing facilities to which the project connects. Immediately notify the ENGINEER when location discrepancies of connecting facilities greater than one-tenth (0.10) foot horizontal or two-hundredths (0.02) foot vertical are found.

### 1.03 CONSTRUCTION SURVEYING

- A. On the bases of primary control points, the CONTRACTOR shall provide all elements of construction survey including, but not limited to:
  - 1. Rectangular coordinates for all structures.
  - 2. Elevations for all above and underground structures.
  - 3. Finish grade elevations.
  - 4. Pipeline elevations.
  - 5. Rectangular coordinates for all piping systems at fittings, appurtenances and valves.
  - 6. Invert elevations for all piping systems.
- B. Construction Stakes: CONTRACTOR shall set construction stakes and marks establishing lines and grades for structures, buildings, centerlines for utilities and necessary appurtenances and other work as indicated in the Contract Documents and shall be responsible for their conformance with the plans and specifications.
- C. The construction stakes shall be established in accordance with the following guidelines that represent the minimum standard and CONTRACTOR shall provide additional stakes and controls necessary to perform the work. CONTRACTOR shall be held responsible for the preservation of all stakes and marks and will replace, at no additional cost to the City, any construction stakes or marks that have been carelessly or willfully destroyed by any party.
- D. Curbs, Curb and Gutter, Valley Gutter:
  - 1. Curbing will be used as shown on the drawings. Replace curbs as necessary.
  - 2. Install curb, paving and gutter per MAG and/or City specifications.
- E. Roadway:
  - 1. Roadway repairs shall be constructed per City specifications.
- F. Sanitary Sewer: All cuts will be to the invert of the pipe, given to the nearest one-hundredth (0.01) of a foot.
- G. Storm Sewer and Drainage: All cuts will be to the invert of the pipe, given to the nearest one-hundredth (0.01) of a foot.
- H. Water: All cuts will be to the invert of the pipe, given to the nearest one-tenth (0.10) of a foot.
- I. Striping: No surveying is required.
- J. Landscaping: CONTRACTOR shall delineate the procedures and controls to be utilized in the Staking Outline.

### 1.04 CONTROL POINT PROTECTION

- A. Protect control points established by the ENGINEER in the Project area.

- B. Survey monuments - All survey monuments that lie within the construction area that may be disturbed shall be referenced to a specific point on at least four (4) stable objects by distance measurement. Reference objects shall be located no greater than three-hundred (300) feet from the survey monument being referenced.
- C. Monument locations will be marked with "straddlers" (four (4) nails with metal "shiners") driven into the pavement, placed in pairs approximately six feet apart and opposite to each other. Lines connecting opposing pairs shall form a ninety (90) degree cross with three-foot legs. The center of the cross will signify the exact location of the center of the monument to be set. Monuments will be drilled or punched after they have been set.
- D. Inspection and Acceptance of Work: The City reserves the right to make inspections and random checks of any portion of the staking and layout work. If, in the City's opinion, the work is not being performed in a manner that will assure proper control and accuracy of the work, the City will order any or all of the staking and layout work redone at no additional cost.
- E. Manhole, valve box and cleanout locations within the Project site shall be painted on the pavement.
- F. If such control points and monuments are damaged by CONTRACTOR, they shall be replaced by an Arizona Registered Land Surveyor at CONTRACTOR'S expense.

## PART 2 PRODUCTS

(Not Used)

## PART 3 EXECUTION

### 3.01 STANDARDS

- A. All construction surveys shall be performed in accordance with the MAG Standards, City Standards, and the conventions of normal professional practice.
- B. Verify corners of footing prior to placement of concrete for all structures.

\*\*\* END OF SECTION \*\*\*

SECTION 01740  
CLEANING

PART 1 GENERAL

1.01 SUMMARY

- A. Clean project site regularly throughout duration of project and a thorough clean up at completion of Work.
- B. Refer to specification sections for specific cleaning for Products or Work.

1.02 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with all codes, ordinances, regulations, and anti-pollution laws. No on-site disposal will be allowed.
- B. No trash burning is allowed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Use only those cleaning materials, which will not create hazards to property and persons or damage surfaces of material to be cleaned. Provide MSDS shall be available on site at all times, when requested by ENGINEER.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

- A. Keep premises and adjacent properties free from accumulations of waste materials, rubbish, and other debris resulting from construction operations.
- B. Provide on-site containers for collection and removal of waste materials, debris, and rubbish in accordance with applicable regulations.

3.02 CLEANING

- A. Complete following cleaning before requesting inspection for certification of substantial and final completion of entire Project or portion of Project.
  - 1. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight exposed interior and exterior surfaces.
  - 2. Wash all areas.
  - 3. Clean valves and exposed piping.
  - 4. Ventilating Systems:
    - a. Not used
  - 5. Clean haul roads and streets used as haul roads during construction of accumulated material. Clean paved streets with water and mechanical sweeper.

- B. Prior to substantial completion or OWNER occupancy, CONTRACTOR with ENGINEER, shall conduct inspection of sight-exposed interior and exterior surfaces and work areas to verify Work and site is clean.

\*\*\* END OF SECTION \*\*\*

SECTION 01788  
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Maintain at site one record copy of:

1. Drawings and Specifications.
2. Project Manual and ENGINEER's design information.
3. Addenda.
4. Change orders, written amendments, Work change directives, and other modifications to Contract.
5. ENGINEER field orders, written instructions, or clarifications.
6. Approved submittals.
7. Field test records.
8. Construction photographs.
9. Associated permits.
10. Certificates of inspection and approvals.
11. Conformed drawings.
12. Project Schedule.
13. Contact person and emergency telephone number.

1.02 SUBMITTALS

A. At Substantial Completion:

1. Prepare one certified reproducible "As-Built" set of drawings. Submit for review in accordance with Section 01330 – Submittals.

B. Accompany submittals with transmittal letter containing following.

1. Date.
2. Project title and number.
3. CONTRACTOR'S name and address.
4. Title of record document.
5. Company seal and signature of CONTRACTOR or authorized representative.

C. At Final Completion:

1. Submit Project Record Documents in suitable storage containers to the ENGINEER at a location identified by the ENGINEER.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.01 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in CONTRACTOR'S field office or at designated location apart from documents used for construction. Designated location office shall be less than 30 miles from project site.
  - 1. Provide files and racks for storage of documents.
  - 2. Provide secure storage space for storage of samples.
- B. Maintain documents in clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- C. Make documents and samples available for inspection by ENGINEER at the site office.
- D. Failure to properly maintain record documents concurrently with the construction may be reason to delay a portion of progress payments until records comply with Contract Documents.

### 3.02 RECORD DOCUMENTS

- A. Label each document "PROJECT RECORD" in neat, large printed letters.
- B. Maintain record set of Drawings and Specifications legibly annotated to show all changes made during construction.
  - 1. Graphically depict changes by modifying or adding to plans, details, sections, elevations, specifications, or schedules.
  - 2. Make changes on each sheet affected by changes.
- C. Record information concurrently with construction progress.
  - 1. Do not conceal Work until required information is recorded and verified by ENGINEER.
  - 2. Record changes made by Written Amendment, Field Order, Change Order, Work Directive Change, or addition by others and/or OWNER.
- D. Drawings:
  - 1. General:
    - a. Depths of various elements in relation to manhole rim.
    - b. Horizontal and vertical locations of underground utilities, corners, and appurtenances, referenced to permanent surface improvements.
    - c. Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
    - d. Field changes.
    - e. Details not on original Drawings.
    - f. Location and identification of exposed interior piping, including those shown schematically on Drawings.
    - g. Size of equipment and location including connections.
  - 2. Specifications:
    - a. Mark Specification sections to show substantial variations in actual Work performed in comparison with test of Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation.
    - b. Note related record drawing information and Product Data.

3. Electrical and Instrumentation:

- a. Horizontal and vertical locations and size of underground cable and conduit run dimensioned from established building lines or permanent above ground structures.
- b. Plan location and size of interior concealed and exposed elements.
- c. Size and location of access panels.
- d. Departures from original Drawings and electrical work revisions.

\*\*\* END OF SECTION \*\*\*

SECTION 02220  
DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Demolition:

1. Include in base Bid, cost of all demolition work.
2. CONTRACTOR shall review drawings and field conditions prior to bidding. Bid price shall include all labor, materials, equipment, and incidentals as shown on the drawings.
3. Include in base Bid, cost of removal and disposal of unsuitable material, disposal fees and materials required for backfilling and restoration.

1.2 SUBMITTALS

A. Shop Drawings:

1. Submit proposed demolition method, equipment to be used and demolition sequence. Submittal should include, but not be limited to, the name of contact person(s), and coordination for shut-off protocols, capping, discontinuation of utility services, testing requirements (i.e., lead paint), etc.
2. Submit in accordance with Specification Section 01330.

B. Test Results:

1. Provide all sampling and analytical test reports required for this project.
2. Submit in accordance with Specification Section 01330.

C. Miscellaneous Submittals:

1. All applicable items as necessary.

1.3 QUALITY ASSURANCE

A. Testing:

1. Testing shall be provided by CONTRACTOR.
2. CONTRACTOR shall provide all necessary supervision for the proper disposal of excavated materials and demolition materials.

B. Regulatory Requirements:

1. Work shall be in accordance with all applicable codes and regulations.

1.4 PROJECT/SITE CONDITIONS

B. Do not block or obstruct roads and driveways with materials, except as authorized by ENGINEER and Local Agency Roadway Authority.

C. Immediately repair damage to facilities to remain, or to any property belonging to adjacent property owners or utilities. Carry out demolition without interference to OWNER's operations.

- D. Notify ENGINEER 48 hours prior to start of demolition work. OWNER will mark for identification those items which are to remain the property of OWNER. Do not start demolition until authorized to do so in writing. Deliver items marked for OWNER to locations identified by OWNER for item storage.
- E. No explosives are permitted on this project.

## PART 2 PRODUCTS

### 2.1 STRUCTURAL FILL (if required)

- A. Well-graded sand, well-graded sand and gravel, well graded crushed stone or gravel, or other approved granular material, of 2 in. maximum size, free from organic and deleterious materials. Classified as GW, GP, SW, or SP in Unified Soil Classification System.
- B. Plasticity Index: ASTM D4318, 6 or less. Plasticity Index shall be performed on fraction of material that passes the No. 40 sieve.
- C. Maximum Fines: ASTM D422, percentage passing No. 200 sieve shall be determined by field engineer.
- D. Uniformity Coefficient: 5 or greater.
- E. Provide minimum 95% compaction, or greater as required.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Notify corporations, companies, individuals or authorities owning above or below ground conduits, wires, pipes or other utilities running to and within the property. All utilities required to be demolished must be disconnected prior to start of demolition.
- B. Cap or remove services in accordance with instructions by owners of said services.
- C. Protect, support, and maintain conduits, wires, pipes or other utilities that are to remain in accordance with requirements of owners of said services.
- D. Provide adequate dust control.

### 3.2 OWNERSHIP OF MATERIALS

- A. All materials marked for demolition and disposal shall become the property of CONTRACTOR, except for those which are marked for salvage. All materials shall be disposed in conformance with all applicable laws and regulations.

### 3.3 DEMOLITION REQUIREMENTS

- A. Remove all foundations.
- B. Mechanical removals shall consist of dismantling and removing of existing equipment, piping, valves and appurtenances. Work shall include capping, cutting, and plugging as required.
- C. Do not contaminate potable water system.

D. Coordinate removals of any transformers, conduits, direct bury cables, lighting, panels, and other electrical equipment.

E. Any required structural welding shall conform to AWS D12.1.

### 3.4 INFLUENCE ZONES

A. Do not excavate within influence zone of existing footings or foundations, without prior approval of ENGINEER.

### 3.5 CLEAN UP

A. Roadways shall be swept clean as often as needed and no less than once per day.

B. CONTRACTOR shall remove all demolition debris and excess excavated materials from the project site. Premises shall be left clean, neat and orderly.

END OF SECTION

SECTION 02310  
JACK AND BORE

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes materials, performance and installation standards, and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to install, complete required boring and jacking installations, or other trenchless methods for pipelines, as shown on the Drawings and as specified herein.
- B. The provision of this section shall be the minimum standards for the installation of casing pipe by the boring and jacking method.
- C. All work related to the installation of the casing shall comply with the requirements of the Union Pacific Railroad Company.
- D. Comply with requirements of MAG Section 602.
- E. Submit per MAG Section 602.4

PART 2 PRODUCTS

2.01 CASING PIPE MATERIALS AND INSTALLATION

- A. Casings shall be steel pipe conforming to the requirements of ASTM Designation A-139. The minimum casing pipe size shall be 30" and wall thickness shall be 1/2". Casing pipe shall be a minimum of 12-inches larger than the largest outside diameter of the carrier pipe.

2.02 CARRIER PIPES

- A. A Ductile Iron Pipe to be installed within the specified casings shall be equipped with restrained joint connections.

2.03 CASING INSULATORS

- A. Non-corrosive casing insulators shall be used. The casing runner height shall be large enough so that it does not interfere with the pipe restrained joints. Stainless steel nuts and bolts shall be used. Installation and spacing of casing insulators shall be as required by the manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Casing pipes crossing under railroads shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures, with a minimum 54-inch depth of cover between the top of the casing pipe and the bottom of the railroad ties. For casing pipe crossings under railroads, the Contractor shall comply with the regulations of said authority in regard to design, specifications, and construction.
- B. The boring and jacking operations shall be done simultaneously, with hours of installation to be approved by Owner. Correct line and grade shall be carefully maintained. Add on sections of casing pipe shall be full-ring welded to the preceding length, developing watertight, total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement, or distortion of the existing roadbed/railroad or other facilities. Following placement of the carrier pipe within the steel casing, end link seals are to be installed at each open end.

Said end link seals shall be suitable for restraining the external earth load, while allowing internal drainage.

- C. Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The distance between the leading end of the first auger section and the leading end of the casing shall be as necessary to maintain a solid plug of spoil material inside the forward portion of the casing.
- D. The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressures. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage. Should the casing pipe be damaged, such damaged portion not in the hole, shall be replaced; however, if installed, the encasement pipe shall be abandoned in place, grouted full, and suitably plugged, and an alternate installation made. An alternate installation will also be required if the casing alignment or elevation substantially deviates from the plan locations, and results in the installation being unusable, as determined by the ENGINEER.
- E. Required boring and jacking pits or shafts shall be excavated and maintained to the minimum dimensions necessary to perform the operation. Said excavations shall be adequately barricaded, sheeted, braced and dewatered, as required.

\* \* END OF SECTION \* \*

SECTION 02316  
TRENCHING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.01 DESCRIPTION

A. Description of Work

1. The work to be performed in accordance with this section includes the excavation, trenching, backfilling and surface repair for all pipelines, pipe culverts, box culverts, accessories and lines connected thereto, complete including sheeting and shoring, dewatering, grading and cleanup.

Excavation for appurtenant structures such as manholes, inlets, transition structures, junction structures, vaults, valve boxes, catch basins, etc. shall be included in this section.

The work shall include the furnishing of all labor, tools, equipment, materials and performing all operations to provide a complete item in accordance with the project plans and these specifications.

2. This section is used to supplement any Local Agency or County specifications, including but not limited to:
  - a. MAG Standard Specifications Section 601.
  - b. Tempe Standard Supplement to MAG T-450

B. Definitions

1. Trench: An excavation in which the depth is greater than the width of the bottom of the trench.
2. Foundation: Material on which bedding is to be directly placed.
3. Bedding: Granular material on which pipe or structure is to be directly placed. The bedding extends from 6 inches below the pipe to 12 inches above the top of the pipe.
4. Select Backfill: Material placed from top of the bedding to finished subgrade.

1.02 QUALITY ASSURANCE

A. Reference Test Standards and Specifications

1. ASTM C94, Ready Mix Concrete.
2. ASTM C117, Standard Test Method for Materials Finer than No. 200 Sieve by Washing.
3. ASTM C131, Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
4. ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregate.
5. ASTM D1556, Density of Soil in Place by the Sand-Cone Method.
6. ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
7. ASTM D2922, Density of Soil and Soil-Aggregate in Place by Nuclear Methods.
8. ASTM D3017, Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods.
9. ASTM D4215, Standard Specification for Cold Mixed, Cold Laid Bituminous Paving Mixture.
10. ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
11. Rock Correction Procedure for Maximum Density Determination, ARIZ 227.

B. Frequency of Testing

1. Maximum Dry Density and Optimum Moisture Content, ASTM D698.
  - a. One test for each different class or type of material shall be provided by the

CONTRACTOR.

- b. CONTRACTOR shall provide additional test when previous test is suspect, due to subtle changes in the material, as determined by the OWNER.

2. Density of Soil In-Place by Sand Cone or by Nuclear Methods

- a. OWNER will perform a minimum of one test per lift per 500 linear feet of trench for each type of material.
- b. OWNER will perform additional tests as required to ensure proper compaction.

C. Testing Tolerances

- 1. Percent Relative Compaction: Not less than as specified on plans or in these specifications.
- 2. In-Place Moisture Content: As required to achieve specified percent relative compaction.
- 3. Soft or Yielding Surfaces: Regardless of percent relative compaction obtained by test, areas which are soft and yield under the load of construction equipment are to be removed and replaced at no additional cost.

1.03 SUBMITTALS

A. Materials Test Reports

- 1. Report on maximum dry density and optimum moisture content prior to beginning of construction.
- 2. Report on bedding and backfill materials compliance tests as required.

B. Spoil Disposal Area

- 1. Provide location and written approval for area to dispose of spoil from operation.

C. Shoring Plan

- 1. Provide plans, details and calculations by a professional ENGINEER registered in the appropriate jurisdiction if shoring or sheeting is required.

D. Dewatering Plan

- 1. Not required.

1.04 JOB CONDITIONS

A. Dewatering

- 1. It is the CONTRACTOR's responsibility to dewater if groundwater is encountered.

B. Protection of Existing Utilities

- 1. Maintain all utilities both underground and overhead in continuous service throughout the contract period. Liability for damages to or interruption of services caused by the construction shall be borne by the CONTRACTOR.

PART 2 MATERIALS

2.01 SOIL AND SOIL AGGREGATE MATERIALS

A. Unsuitable materials not to be incorporated in the work include:

1. Organic matter such as peat, mulch, organic silt or sod.
2. Soils containing expansive clays.
3. Material containing excessive moisture.
4. Poorly graded coarse material.
5. Particle size in excess of 6-inches.
6. Material which will not achieve density and/or bearing requirements.
7. Material containing asphalt concrete or Portland cement concrete.

**B. Bedding**

Bedding for all water, sewer, storm drain lines, and manholes shall be sand. Concrete culverts shall be bedded on aggregate base.

1. Bedding Sand: Sandy material, non-plastic and shall conform to the following:

SIEVE SIZES	PERCENTAGE BY WEIGHT PASSING SIEVE
3/8"	100
No. 4	90-100
No. 50	10-40
No. 100	3-20
No. 200	0-15

2. Aggregate Base: Crushed aggregate or processed natural material, clean, hard, sound and free of any detrimental quantity of soft, friable elongated or laminated pieces, organic matter or other deleterious substances. Properties of which shall meet the following requirement:

- a. Grading, ASTM C136 and ASTM C117.

Sieve Size	Percent by Weight Passing
1 1/8"	100
No. 4	38-65
No. 8	25-60
No. 30	10-40
No. 200	3-12

- b. Percentage of Wear, ASTM C131, maximum percentage of wear of 40 after 500 revolutions.
- c. Plasticity Index and Liquid Limit, ASTM D4318, maximum plasticity index of 5, maximum liquid limit of 25 percent.

**C. Select Backfill**

1. Native excavated granular material or approved import material free from unsuitable materials

defined herein. Aggregate base may be used as backfill material.

D. Granular Backfill

1. Native excavated or approved import granular material, free draining and free of unsuitable materials defined herein. Granular backfill shall be non-plastic, well graded and meet the following gradation:

Sieve Size	Percent by Weight Passing
1 1/2 inches	100%
No. 200	0-15

2.02 PORTLAND CEMENT CONCRETE

- A. ASTM C94 and Specification Section 03300.

2.03 ASPHALT CEMENT CONCRETE

- A. As required in MAG standard specifications.

2.04 COLD MIX, COLD LAID BITUMINOUS PAVING MIXTURE

- A. ASTM D4215.

2.05 BURIED WARNING AND IDENTIFICATION TAPE

- A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for locating, warning, and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, color coded as stated below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing is to be permanent, unaffected by moisture or soil.

WARNING TAPE COLOR CODES	
RED	ELECTRIC
YELLOW	GAS, OIL, DANGEROUS MATERIALS
ORANGE	TELEPHONE AND OTHER COMMUNICATIONS
BLUE	WATER SYSTEMS
GREEN	SEWER SYSTEMS
WHITE	STEAM SYSTEMS
PURPLE	RECLAIMED WATER SYSTEM

B. Warning Tape for Metallic Piping

1. Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing

requirements indicated above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise with a maximum 350 percent elongation.

C. Detectable Warning Tape for Non-Metallic Piping

1. Polyethylene plastic tape to the width, color, and printing requirements indicated above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise.

PART 3 EXECUTION

3.01 PRELIMINARY INVESTIGATION OF THE WORK

- A. Verify that all of the preliminary work including construction staking has been performed in accordance with the plans and specifications prior to trenching and backfill operations.

3.02 TRENCHING IN FILL AREAS

- A. Grade fill areas to within 1 foot of the finish grade prior to trenching and placement of the pipeline.

3.03 EXCAVATION

A. General

1. Perform all excavations of every description and of whatever substances encountered to the depths indicated on the plans and including excavation ordered by the OWNER of compacted fill for the purpose of performing tests. Use open cut excavation methods unless otherwise indicated on the plans or approved by the OWNER.

B. Trench Widths

1. Excavate trenches for pipe to the following dimensions:

SIZE OF PIPE (I.D.)	MAXIMUM WIDTH AT TOP OF PIPE GREATER THAN O.D. OF PIPE	MINIMUM WIDTH AT SPRINGLINE EACH SIDE OF PIPE
Less than 18"	16"	6"
18" to 24" inclusive	19"	7 ½"
27" to 39" inclusive	22"	9"
42" to 60" inclusive	½ O.D.	12"
over 60"	36"	12"

2. Maintain trench walls as vertical as possible except as required by safety standards and as required for sheeting and shoring.
3. If the maximum trench width is exceeded at the top of the pipe, the CONTRACTOR shall provide necessary additional load bearing capacity by means approved by the OWNER at no additional cost to the OWNER.

C. Over-excavation

1. Unauthorized Over-excavation
    - a. Fill and compact unauthorized excavation beyond the specified grade line, at the CONTRACTOR'S expense, with bedding material, compact to 95 percent of the maximum density. No payment will be made for unauthorized over-excavation.
  2. Rock
    - a. Over-excavate rock encountered in the trench to provide a minimum of six inches of bedding below the pipe and the minimum width at the springline.
  3. Unsuitable Material
    - a. Over-excavate unsuitable material to the depth necessary to provide the required support as determined by the OWNER. Backfill the over-excavation with bedding material and compact to at least 95 percent of the maximum density.
- D. Excavation for Manholes, Valves, Inlets, Catch Basins and Other Accessories
1. Provided the excavated surfaces are firm and unyielding, the CONTRACTOR may elect to cast concrete for the structure directly against excavated surfaces. Over-excavate to provide bedding where shown on the plans.
  2. Excavation for valve replacements shall be compacted to 100 percent of maximum density or backfilled with slurry to invert of replacement piping to prevent differential settlement below replacement assembly.
- E. Pavement and Concrete Cutting and Removal
1. Saw-cut, remove and dispose of existing pavements and concrete per Specification Section 2100.
- F. Grading and Stockpiling
1. Grading
    - a. Grade in the vicinity of the trench to prevent surface water from flowing into the trench. Remove any water accumulated in the trench by pumping or by other approved methods. Stockpile excavated material in an orderly manner a sufficient distance back from the edges of the trench to avoid overloading and to prevent slides or cave-ins.
  2. Topsoil
    - a. Excavate topsoil and stockpile separately. Replace topsoil upon completion of backfill and grade to the elevations indicated on the plans.
- G. Shoring and Sheeting
1. Shore, sheet and brace excavations as set forth in the rules, orders and regulations of the United States Department of Labor Occupational Health and Safety Administration (OSHA). Provide detailed plan and calculations as prepared by a registered professional ENGINEER for excavations 20 feet in depth or greater or when shoring, sheeting or bracing deviates from OSHA standards. Place and remove shoring, sheeting and bracing so as not to damage adjacent improvements, utilities or utility being placed. Costs for shoring, sheeting and bracing to be incidental to the pipe item.

H. Open Trench

1. Maximum Length

- a. The maximum length of open trench at any one location is not to exceed 500 feet, provided that all proper barricades and safety procedures have been addressed. The trench is considered to be open until backfill is completed to adjacent finish grade elevation.

2. Street Crossing

- a. Complete backfill of trench across streets at the end of each work day. Use temporary patch material (cold mix asphalt concrete) or steel plates as required.

3. Temporary Provisions

- a. Furnish and install trench bracing and steel plating required to provide safe and convenient vehicular and pedestrian passage across trenches where required. Maintain access to and from emergency facilities at all times.

3.04 FOUNDATION, BEDDING, BACKFILLING AND COMPACTION

A. Foundation

- 1. Excavate trench bottom to the depth and width as shown. Remove all loose, disturbed material from the bottom of the trench such that the bedding shall rest on firm, undisturbed soil.

B. Bedding

- 1. Moisture condition and place bedding material to required thickness. Compact bedding material to the specified density.

C. Fine Grading

- 1. Accurately grade the bottom of the trench to provide uniform bearing and support for each section of pipe at every point along its entire length, except where it is necessary to excavate for joints.

D. Moisture Conditioning

- 1. Moisture condition all bedding and backfill materials by aerating or wetting to obtain the moisture content required to achieve specified percent relative compaction. Completely mix the material until the moisture content is uniform throughout the lift.

E. Lift Thickness

- 1. The following table applies when using mechanical compaction:

LIFT DESCRIPTION	MAXIMUM LOOSE LIFT THICKNESS, INCHES
Initial Bedding	8

Bedding	1/3 Pipe Diameter, or 8 inches, whichever is less
Backfill	8
Aggregate Base Surfacing	6

2. Lift thickness may be increased if CONTRACTOR can prove, through a series of density tests, that minimum density is achieved throughout the lift thickness.
3. Where water jetting is used, bedding for conduits, 24 inches or less in I.D., may be placed in one lift. For larger conduits the first lift shall not exceed the springline of the pipe. Backfill will be placed in lifts as required in the following table prior to settlement.

TRENCH WIDTH	BACKFILL LIFTS
18" to 24"	Not to exceed 4'
25" to 36"	Not to exceed 6'
Over 36"	Not to exceed 8'

F. Compaction

1. Compaction Methods
  - a. Construction shall be accomplished by water jetting or mechanical methods. Rubber tire wheel rolling will not be allowed.
2. Pipe Haunch
  - a. When using mechanical methods, hand compact initial backfill in pipe haunch with a pipe haunch compactor (J-bar) or mechanical vibrator sized to fit the narrow width between the pipe and the trench. Give special attention to provide proper compactive effort in the pipe haunch zone.
3. Water Jetting
  - a. Water consolidation by jetting shall be accomplished with a 1-1/2" pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi. All jetting shall be accomplished transversely across the trench at intervals of not more than 6 feet with the jetting locations on one side of the trench offset to the jetting locations on the other side of the trench. The entire lift shall be leveled and completely saturated working from the top to the bottom.

The CONTRACTOR shall be entirely responsible for establishing each lift depth so as to avoid floating the conduit being placed and shall make any repair or replacement at no cost to the OWNER. However, for conduit larger than 24 inches I.D., the first lift shall not exceed the springline of the conduit.

Flooding is not acceptable as a water consolidation method unless authorized in the specification or by a written change order. It will consist of the inundation of the entire lift with water and then puddled with poles or bars to ensure saturation of the entire lift.

Where jetting or flooding is utilized and the surrounding material is such that it does not permit proper drainage, the CONTRACTOR shall provide, at his expense a sump and a pump at the downstream end to remove the accumulated water.

The use of water consolidation does not relieve the CONTRACTOR from the responsibility to make his own determination that such methods will not result in damage to existing improvements. The CONTRACTOR shall be responsible for any damage incurred.

Where water consolidation is not permitted or does not result in adequate compaction, the backfill material shall be compacted with hand and/or mechanical work methods using equipment such as rollers, pneumatic tamps, hydro-hammers or other approved devices which secure uniform and required density without injury to the pipe or related structures.

Water consolidation will not be permitted for non-granular material.

4. Compaction Densities

- a. Thoroughly compact trench bedding and backfill to not less than the percent relative compaction as presented in the following table, unless more stringent requirements are called for on the plans.

PERCENT RELATIVE COMPACTION MINIMUM DENSITY REQUIRED				
Backfill Type	Location	From Subgrade Surface To 2' Below Surface	From 2' Below Surface To 1' Above Top of Pipe	From 1' Above Top of Pipe To Bottom of Trench
I	Under any existing or proposed pavement, curb, gutter, sidewalk, or such construction included in the contract or when any part of the trench excavation is within 2' of the above.	100% for granular  95% for non-granular	95%	95%
II	On any utility easement, street, road or alley right-of-way out-side of (I).	95%	95%	95%
III	Around any structures or exposed utilities.	95% in all cases		
IV	Excavation below valve replacements.	100% or slurry fill from bottom of excavation to invert of pipe.		

3.05 BURIED WARNING AND IDENTIFICATION TAPE

- A. Place warning and identification tape to the depths specified by the ENGINEER.

3.06 BACKFILL FOR MANHOLES, VALVES, INLETS, CATCH BASINS AND OTHER ACCESSORIES

- A. Backfill appurtenances and structures including bedding, backfill, lift thicknesses and compaction as indicated in the adjacent trench detail.

3.07 PAVEMENT REPLACEMENT AND SURFACE RESTORATION

A. Finish Grading

1. Finish fill, excavated areas, and other disturbed areas to uniform grade and section normally obtainable with blade grader.
2. Allowable template tolerances: +0.10'.
3. Finish grade to neat appearance and to provide positive drainage.

B. Surface Restoration

1. Restore all streets, alleys, driveways, sidewalks, curbs or other surfaces which were broken into or damaged by the installation of the new work to a condition as good as or better than originally encountered in accordance with these specifications, accepted standards and as acceptable to the property OWNER.

C. Landscape

1. Replace landscape rock, sod, shrubs, trees, grass, sprinkler systems as required to a condition as good as or better than originally encountered in accordance with these specifications, accepted standards and as acceptable to the property OWNER.

D. Temporary Pavement

1. Place cold mix, cold laid bituminous paving mixture in accordance with ASTM D4215 immediately following backfilling and compaction of trenches through existing pavement. Maintain pavement in safe and smooth condition until final pavement can be placed. Place final pavement within seven (7) days after original pavement was removed.

E. Pavement Replacement

1. Replace permanent asphalt cement, concrete pavement per the requirements of \*MAG or other Local Agency jurisdiction.

F. Clean Up

1. Remove all excess soil, concrete, etc. from the premises. Leave job site in a neat and clean condition.

END OF SECTION

SECTION 02510  
DISINFECTION OF POTABLE WATER FACILITIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
1. Disinfection of potable water storage tank.
  2. Disinfection of potable water distribution systems.
  3. Reporting results.

1.02 REFERENCES

- A. MAG (Maricopa Association of Governments) – 611; AWWA C652 – Disinfection of Water-Storage Facilities and ADEQ Bulletin No. 8 - Disinfection of Water Systems (1978).

1.03 SUBMITTALS

- A. Submit results in accordance with Specification Section 01330.
- B. Test Reports: Indicate results comparative to specified requirements.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with MAG Standard Specification 611, AWWA C652, and ADEQ Bulletin 8.
- B. Test Firm: Company specializing in testing potable water systems, certified by State of Arizona.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify piping system has been cleaned, pressure tested and inspected.
- B. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.02 PREPARATION

- A. Before disinfection of tank, remove debris and material not part of structure or operating facility of the tank.
- B. Clean using high-pressure water jet or other equally effective means to remove dirt and foreign material.
- C. Remove water dirt and foreign material and dispose of it properly.

3.03 INSTALLATION

(Not Used)

3.04 DISINFECTION

- A. After pressure testing and before placing in service, all potable water piping, pump suction piping, pump suction barrels, booster pumps and discharge heads shall be cleaned and disinfected according to requirements of MAG Standard Specification Section 611.
- B. Notify ENGINEER prior to disinfecting.
- C. Provide test reports in accordance with Section 01330.

END OF SECTION

SECTION 03300  
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUBMITTALS

A. Shop Drawings:

1. Reinforcing steel drawings conforming to ACI SP-66 showing bending diagrams, assembly diagrams, location diagrams, splicing and laps of bars, shapes, dimensions, and details for bar reinforcing and stirrup spacing, accessories, and openings.
2. Construction Joints: Sequence of placing concrete and location and details of joints, openings, and embedded items not shown on Drawings. Submit at time of reinforcing submittals.

B. Product Data:

1. Water stop sample and manufacturer's literature.
2. Miscellaneous materials manufacturer's literature.

C. Test Results:

1. Concrete test Results.
2. Provide with each load of concrete delivered, duplicate delivery tickets one for CONTRACTOR and one for ENGINEER with following information.
  - a. Date and serial number of ticket.
  - b. Name of ready mixed concrete plant, operator, and job location.
  - c. Type of cement, admixtures, if any, and brand name.
  - d. Cement content, in bags/cu yd of concrete, and mix design.
  - e. Truck number, time loaded, and name of dispatcher.
  - f. Amount of concrete in load, in cu yds, delivered.
  - g. Maximum size aggregate.
  - h. Gal of water added at job, if any, and slump of concrete after water was added.
  - i. Temperature of concrete at delivery.
  - j. Number of revolutions of mixer.

D. Miscellaneous Submittals:

1. Statement by ready mix supplier giving source and material certificates, and proportions by weight of cement, fine and coarse aggregates, and admixtures.

E. Submit in accordance with Section 01330.

1.02 QUALITY ASSURANCE

A. Testing:

1. Sampling and testing will be performed by independent testing laboratory and paid for by CONTRACTOR.
2. Perform slump tests (ASTM C143), air-entrainment tests (ASTM C231), and compressive strength tests (ASTM C31 and C39) daily for each class of concrete poured.

B. Tolerances:

1. Conform to requirements of ACI 117.
2. Concrete shall be within 3/16 in. of 10 ft straightedge in all directions except where slabs are dished for drains. Deviations from elevation indicated shall not exceed 3/4 in.

### 1.03 PROJECT SITE CONDITIONS

#### A. Hot Weather:

1. Comply with ACI 305R Hot weather Concreting and ACI 305.1 Specification for Hot weather Concreting.
2. Concrete temperature shall not exceed 90 degrees F.
3. At air temperatures of 80 degrees F or above, keep concrete as cool as possible during placement and curing. Cool forms by water wash.
4. When concrete temperatures exceed 80 degrees F, water reducing, set retarding admixtures shall be used in accordance with manufacturer's recommendations.

## PART 2 PRODUCTS

### 2.01 MATERIALS

#### A. Portland Cement:

1. ASTM C150, Type II.

#### B. Aggregates:

1. ASTM C33, free of foreign materials.
2. Fine Aggregate: Natural sand.
3. Coarse Aggregate: Crushed stone, crushed gravel or gravel. Size 67 (3/4 in. maximum).

#### C. Admixtures for Concrete:

1. Air-Entraining: ASTM C260, vinsol resin or vinsol rosin based.
2. Chemical Admixtures: Optional, ASTM C494.
  - a. Water Reducing: Type A.
  - b. Retarding: Type B.
  - c. Water Reducing and Retarding: Type D.

#### D. Water: Potable:

#### E. Steel Reinforcing Bars:

1. Deformed bars conforming to ASTM A615, grade 60.
2. Deformed weldable conforming ASTM A706,

#### F. Welded Wire Fabric (WWF): ASTM A185.

1. Unless other size noted, whenever welded wire fabric is called for, fabric shall be 6 x 6 - W2.9 x W2.9.
2. Provide welded wire fabric in flat sheets.

#### G. Pre-molded Joint Filler: Cork type, ASTM D1752 or bituminous type, ASTM D1751.

H. Waterstops:

1. Virgin PVC meeting requirements of CRD C572.
2. 6 in. wide by 3/8 in. thick at center, dumbbell on serrated type, unless otherwise noted.
3. Provide factory made prefabricated tees, crosses, and other configurations as required. Splice in accordance with manufacturer's written instructions.

I. Membrane Forming Curing Compound:

1. Manufacturers:
  - a. Cure and Seal J-20 by Dayton Superior.
  - b. Dress and Seal 18 by L&M Construction Materials, Inc.
  - c. Kure-N-Seal by Sonneborn Building Products, Inc.
  - d. Floor Treet by Forrer Chemical Company.
  - e. Master Seal by Master Builders.
  - f. Euco Floor Coat by Euclid Chemical Company.
  - g. Cure & Seal by Symons.
2. ASTM C309, Type 1-D and compatible with scheduled finishes and coatings.
3. Nontoxic and taste and odorfree.

J. Floor Sealer:

1. Manufacturers:
  - a. Sika-Gard Cure/Hard, by Sika Corporation.
  - b. Kure-N-Seal by Sonneborn.
  - c. Cure & Seal by Symons.
  - d. Dress and Seal 18 by L&M Construction Materials, Inc.
  - e. Tuf-Seal J-35 by Dayton Superior.

K. Finishing Grout:

1. Manufacturers:
  - a. Thoroseal with Acryl 60, by Thoro.
  - b. Concrete Finisher with AKKRO-7T, by Tamms Industries Company.

L. Epoxy Bonding Compound: Joining new to existing concrete.

1. Manufacturers:
  - a. Sikadur Hi-Mod by Sika Corporation.
  - b. Epoxitite 2362 by A.C. Horn.
  - c. Euco Epoxy 452mv or 620 by Euclid Chemical Company.
  - d. Fresh Concrete Bonder R649 by Rescon.

M. Non-Epoxy Bonding Compound: Joining new to existing concrete where bonding compound cannot be placed immediately prior to pouring of new concrete.

1. Manufacturers:
  - a. Weld-Crete, by Larsen Products Corporation.

- b. Everbond by L&M Construction Materials, Inc.

N. Preformed Control Joint Strips:

1. Manufacturers:

- a. Kold-Seal Zip-Per Strip, by Kold-Seal Vinylex Corporation.
- b. Stresslock, by H. Compton Company.
- c. Quick Strip, by Schlegel Corporation.

- 2. Plastic joint former with locking tabs.
- 3. Depth shall be 1/4 of slab thickness.

2.02 CONCRETE MIX DESIGN

A. Concrete Mix: Measure and combine cement, aggregates, water, and admixtures in accordance with ASTM C94.

1. Class A:

- a. Minimum Cement Content: 564 lbs/cu yd.
- b. Minimum 28-Day Strength: 4,000 psi.
- c. Air Content: 6% ± 1%.
- d. Maximum Slump: 4 in.
- e. Maximum Water/Cement Ratio: 0.45

2. Class B:

- a. Minimum Cement Content: 517lbs/cu yd.
- b. Minimum 28-Day Strength: 3,000 psi.
- c. Air Content: 6% ± 1%.
- d. Maximum Slump: 4 in.
- e. Maximum Water/Cement Ratio: 0.55

- 3. A substitution by weight, of the portland cement by fly ash, so that the total tricalcium aluminate content of the resulting cement plus fly ash is not greater than eight percent, will be considered. However, the fly ash shall not exceed 20 percent by weight of the cement plus fly ash

B. Concrete Usage:

- 1. Class A: Locations except where Class B specified.
- 2. Class B: where noted.

2.03 MIXING AND DELIVERY

A. Furnish and deliver concrete in conformance with ASTM C94.

B. Deliver and complete discharge within 1-1/2 hrs of commencing mixing or before 300 revolutions of drum or blades, whichever comes first. Includes revolutions required by transit mix trucks. Limitations may be waived by ENGINEER if concrete is of such slump after 1-1/2 hrs or 300 revolution limit, if it can be placed without addition of water.

C. Do not add water on job unless authorized by ENGINEER.

## PART 3 EXECUTION

### 3.01 SUBGRADE PREPARATION

- A. Subgrade and Bedding: Compacted and free of frost. If placement allowed at temperatures below freezing, provide temporary heat and protection as required to remove frost.
- B. Provide mud slabs where necessary and when required by ENGINEER to obtain dry and stable working platform for placement of slabs on grade.
- C. Where vapor barrier is not noted, at CONTRACTOR'S option, provide vapor barrier or soak subgrade evening before placement and sprinkle ahead of placement of concrete.
- D. Remove standing water, mud, and foreign matter before concrete is deposited.

### 3.02 FORMS

- A. Workmanship: Formwork shall prevent leakage of mortar. Removal of wall ties shall leave holes clean cut and without appreciable spalding at face of concrete. Conform to requirements of ACI 347R.
- B. Materials:
  - 1. Unless specified otherwise, type of forms used is CONTRACTOR'S option. CONTRACTOR may use metal, plywood, presswood form liners or plastic surfaced plywood.
  - 2. Use approved commercially manufactured devices for form ties. Arrange ties so when forms are removed, no metal will be within 1 in. of formed face of concrete.
- C. Do not disturb forms until concrete adequately cured.
- D. Form system design shall be CONTRACTOR'S responsibility.

### 3.03 JOINTS

- A. Joints not shown on Drawings shall be subject to ENGINEER'S approval.
- B. Clean and prime in accordance with manufacturer's instructions before applying sealant.
- C. Control joints in slabs on grade shall consist of plastic strips set flush with finished surface or 1/4 in. wide joints cut with diamond saw within 12 hrs after pouring.
  - 1. Sawed control joint shall be 1/4 depth of slab, unless shown otherwise.
  - 2. Fill sawed control joints with epoxy joint filler.
  - 3. Cut alternating reinforcing bars or wires crossing joint.
- D. Provide Water stop in construction joints where noted. Secure Water stop utilizing hog rings or grommets spaced maximum 12 in. on center and within 1 in. of edge. Wire tie to adjacent reinforcing steel. Vibrate concrete on both sides to ensure intimate contact between Water stop and concrete.

### 3.04 REINFORCEMENT PLACEMENT

- A. Reinforcing steel shall be approved by ENGINEER before being covered with concrete.

- B. Correct displacement of reinforcement prior to and during concrete pouring operations. Maintain clear cover as noted on Drawings. Tolerances shall be in accordance with ACI 318, unless noted otherwise.
- C. Support reinforcing steel in accordance with CRSI "Placing Reinforcing Bars," with maximum spacing of 4 ft 0 in.
- D. Tie reinforcing steel at intersections in accordance with CRSI "Placing Reinforcing Bars." Maximum spacing for footings and walls, is every third intersection or 3 ft 0 in. Maximum spacing for slabs and other Work, is every fourth intersection or 3 ft 0 in. Dowels shall be tied in-place.
- E. Locate reinforcing to avoid interference with items drilled in later, such as concrete anchors.
- F. Extend wire fabric to within 2 in. of edges of slab or section. Lap sheets at least 12 in. or 2 wire spaces, whichever greater, at ends and edges and wire together. Stagger end laps.
- G. Do not field bend bars including bars partially embedded in concrete unless indicated or approved by ENGINEER.
- H. Welding of reinforcing bars is not permitted.

### 3.05 CONCRETE PLACEMENT

- A. Except as modified herein, ACI 304-Chapter V, shall constitute requirements of this Specification.
- B. Avoid damage to reinforcing, and ensure accurate positioning after concrete placed.
- C. Do not spread concrete with vibrators.
- D. When placing of concrete is temporarily halted or delayed, provide construction joints as shown on Drawings or specified herein.
- E. Place concrete with aid of internal mechanical vibrator equipment capable of 7,000 impulses/min. Transmit vibration directly to concrete. Duration of vibration at any location shall be necessary to produce thorough consolidation and to cause maximum amount of air bubbles to migrate to top of pour.
- F. Set embedded items such as bolts, anchors, and piping in concrete as required by manufacturer of equipment used. Tie and template in place for correct location, do not wet stab bolts, anchors or other type of embeds. Verify location with equipment manufacturers.
- G. Place items constructed of dissimilar metals to avoid physical contact with reinforcing. Secure item and reinforcing to ensure they will not shift and come into contact during pouring. Contact between reinforcing and other metal, other than bare, coated or plated carbon steel not permitted, unless approved by ENGINEER.

### 3.06 SLAB FINISHES

- A. Interior slabs shall receive 3 trowelings. Exterior slabs and walks shall receive 1 troweling and broom finish.
  - 1. Perform initial troweling by power or hand with trowel blade kept as flat as possible against concrete surface to prevent washboard or chatter effect.
  - 2. Perform second troweling by power if 3 trowelings specified; by hand if 2 trowelings specified.

3. Perform third troweling by hand and continue until concrete consolidated to uniform, smooth, dense surface free of trowel marks and irregularities.
  4. Allow sufficient time between successive trowelings to allow concrete to become harder. Perform each successive troweling with trowels progressively smaller and tipped more to increase compaction of concrete surface.
- B. Broom Finished: Broom at right angles to direction of traffic to give nonskid finish. Use fine, soft bristled broom for stoops, ramps, and walks.
- C. Floor Sealer: Apply in accordance with manufacturer's written instructions, one coat when surface is hard enough to sustain foot traffic on same day as pour and second coat after Work completed and building ready for occupancy. Contractor shall verify compatibility of coatings with curing compounds.

### 3.07 FINISHING FORMED CONCRETE

- A. Ordinary Finish: Finish resulting directly from formwork for surfaces which will be hidden from view by earth, submergence in water or sewage or subsequent construction.
1. Patch honeycombing, form ties, spalls, and other irregularities. For stone pockets see General Structural Notes in Contract Drawings for Structural Concrete Repairs.
  2. Where joint marks or fins on submerged surfaces exceed 1/4 in., grind smooth.
- B. Smooth Finish: Interior concrete surfaces permanently exposed to view and concrete surfaces scheduled to be painted.
1. Patch honeycombing, stone pockets, form ties, spalls, and other irregularities.
  2. Grind joint marks and fins smooth with adjacent wall surface. Remove oil stains and rinse surface.
  3. After grinding and cleaning, dampen concrete and paint entire surface with cement grout. Work cement grout into surface with cork or other suitable float. When grout has set to where it will not be pulled out of holes or depressions, brush off with dry burlap or carpet flat.
  4. Prepare surfaces to be painted in accordance with Section 09961 and paint manufacturer's requirements.
- C. Rubbed Finish: Exterior concrete surfaces permanently exposed to view extending 6 in. below grade and where indicated on Drawings.
1. Patch honeycombing, stone pockets, form ties, spalls, and other irregularities.
  2. Grind joint marks and fins smooth with flat wall surface. Remove oil stains and rinse surface.
  3. Apply heavy coat of finishing grout. After first coat has set, apply finish coat. When finish coat has set, float to uniform texture.
  4. Follow manufacturer's written instructions for finishing concrete.
  5. Finish Color: As determined by ENGINEER.

### 3.08 PROTECTION AND CURING

- A. Protect concrete from frost and rapid drying, and keep moist for minimum curing period of 3 days after placing in accordance with ACI 308.
- B. After wet curing period a curing compound can be used. Do not use curing compound where other coating or topping will be applied. Curing compound shall be applied only by use of a power sprayer or roller.

- C. Formed surfaces may be cured by leaving forms in-place. Spray surface of forms left in-place during curing period as frequently as may required to keep concrete surfaces moist. For vertical surfaces, apply water to run down on inside of forms, if necessary, to keep concrete wet.
- D. Protect concrete work from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.
- E. Protect finished concrete surfaces from damage caused by construction equipment, materials or methods, and rain or running water.
- F. Do not load self-supporting structures as to overstress concrete.

END OF SECTION

SECTION 03603  
EPOXY GROUT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
- B. Material for grouting reinforcing bars into existing concrete, and other uses where noted.
- C. Alternatives:
  - 1. CONTRACTOR may use premixed adhesive anchor material as specified in Section 05051 when approved by ENGINEER, rather than using filed mixed grout as specified herein.

1.02 SYSTEM DESCRIPTION

- A. System shall be an expansive, non-shrink, epoxy grout.

1.03 SUBMITTALS

- A. Product Data:
  - 1. Manufacturer's literature.
- B. Submit in accordance with specification Section 01330.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store materials per manufacturer's instructions.

1.05 TESTING

- A. Provide test results if required by Engineer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

(See Below)

2.02 MATERIALS

- A. Epoxy:

Manufacturers:

- 1. Sikadur 32 Hi-Mod, Sika Corporation.
- 2. Five Star HP or DP Epoxy Grout, Five Star Products, Inc.
- 3. Masterflow 648 CP, BASF Building Systems
- 4. Epoxy-Tie SET, Simpson Strong-Tie
- 5. Or approved equal

- B. Sand: Hard, durable, oven dry.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify location that it is suitable for installation of grout per manufacturer's instructions.

#### 3.02 PREPARATION

- A. Clean contact surfaces of oil, grease, and other foreign matter. Chip away unsound concrete.

#### 3.03 INSTALLATION

(Not Used)

#### 3.04 MIXING

- A. Consult material safety data sheets before use.
- B. Mix components of epoxy compounds as directed by manufacturer's instructions. Use only potable water for mixing.
- C. After binder thoroughly mixed, add sand as recommended by manufacturer's instructions immediately before combing liquid with sand.

#### 3.05 PLACING

- A. Place in accordance with manufacturer's written instruction following requirements regarding temperature and pot life.
- B. Provide suitable form materials where necessary to retain grout until hardened.

#### 3.06 CURING

- A. Cure as recommended by manufacturer.

END OF SECTION

SECTION 03604  
NON-SHRINK GROUT

PART 1 GENERAL

1.01 SUMMARY

- A. Grouting between concrete surfaces and metal base plates.

1.02 SYSTEM DESCRIPTION

- A. System shall be a cement based, non-metallic, non-shrink grout.

1.03 SUBMITTALS

- A. Product Data:

1. Manufacturer's literature.

- B. Submit in accordance with specification Section 01330.

1.04 DELIVERY, STORAGE, AND HANDLING

(Not Used)

1.05 TESTING

(Not Used)

PART 2 PRODUCTS

2.01 MATERIALS PRE-PROPORTIONED AND PREMIXED:

- A. Manufacturers:

1. Five Star Special Grout 100, Five Star Products, Inc.
2. Masterflow 928, BASF Building Systems.
3. SikaGrout 300PT, Sika Corporation.
4. Crystex, L&M Construction Chemicals, Inc.
5. Or approved equal.

2.02 MATERIALS PRE-PACKAGED FOR FIELD MIXING WITH EGGRETE

- A. Manufacturers:

1. Five Star Grout, Five Star Products, Inc.
2. SikaGrout 212, Sika Corporation.
3. N S Grout, Euclid Chemical Company.
4. Or approved equal.

## PART 3 EXECUTION

### 3.01 EXAMINATION

(Not Used)

### 3.02 PREPARATION

- A. Clean grout contact surfaces of oil, grease, and other foreign matter. Chip away unsound concrete leaving surface level but rough.
- B. Underside of base plates of machinery, rails, and bolts shall be free of grease, oil, dirt or coating.

### 3.03 INSTALLATION

- A. Verify that location is suitable for installation of grout per manufacturer's instructions.

### 3.04 MIXING

- A. Consult Material Data Sheets before use.
- B. Mix components of epoxy compounds as directed by manufacturer's instructions immediately before combing liquid with sand.
- C. After binder thoroughly mixed, add sand as recommended by manufacturer's instructions immediately before combing liquid with sand.

### 2.03 PLACING

- A. Place in accordance with manufacturer's written instruction, following manufacturer's requirements regarding temperature and pot life.
- B. Provide suitable form where necessary to retain grout until hardened.

### 2.04 CURING

- A. Cure as recommended by manufacturer.

END OF SECTION

SECTION 05051  
ANCHOR BOLTS, EXPANSION ANCHORS, TOGGLE BOLTS AND CONCRETE INSERTS

PART 1 GENERAL

1.01 SUMMARY

(Not Used)

1.02 SYSTEM DESCRIPTION

A. Scope

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown specified, and required to furnish and install anchor systems such as anchor bolts, expansion anchors, toggle bolts and concrete inserts.

B. This Section includes all bolts, anchors, toggles and inserts include required for the Work, but not specified under other Sections.

C. The types of Work using the bolts, anchors, toggles, and inserts include, but are not limited to the following:

1. Rails.
2. Slide gate.
3. Hangers and brackets.
4. Equipment.
5. Piping.
6. Tanks.
7. Grating.
8. Electrical, Plumbing and HVAC Work.
9. Partitions and ceilings.
10. Shelf angles and masonry lintels.

1.03 REFERENCES

(Not Used)

1.04 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Setting drawings and templates for location and installation of anchorage devices.
2. Copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.

B. Samples: Submit for approval the following:

1. Representative samples of bolts, anchors and inserts as may be requested by ENGINEER. Review will be for type and finish only. Compliance with all other requirements is exclusive responsibility of CONTRACTOR.

1.05 QUALITY ASSURANCE

A. Standard Specifications and Details:

1. CONTRACTOR shall conform to all applicable requirements of IBC 2006 with amendments by the City of Tempe and Section 700 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association for Governments. Where there is a conflict between the MAG Specification, the provisions of the specification will apply. All post installed anchors shall have an approved ICC-ES-Legacy Report or equal, listing allowable load values and inspection requirements.
- B. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified.
1. ASTM A 36, Standard Specification for Structural Steel.
  2. ASTM A 123, Standard Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
  3. ASTM A 153, Standard Specification for Carbon (Hot-Dip) on Iron and Steel Hardware.
  4. ASTM A 193, Grade B7
  5. ASTM A 276, Specifications for Stainless Steel Bars and Shapes.
  6. ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
  7. ASTM A 320, Standard Specification for Alloys- Steel Bolting Materials for Low-Temperature Service.
  8. ASTM A 484, Standard Specification for General Requirements for General Requirements for Stainless and Heat-Resisting Steel Bars, Billets and Forgings.
  9. ASTM A 525, Standard Specification for General requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
  10. ASTM A 536, Specification for Ductile Iron Castings
  11. ASTM A 563, Grade A, Specification for Carbon and Alloy Steel Nuts.
- C. Expansion anchors and inserts shall be ICC-ES, UL or FM approved.
- D. Toggle Bolts: Federal Specification FF-B-588C, Type I, Class A, Style 1.

1.06 DELIVERY, STORAGE AND HANDLING

(Not Used)

1.07 TESTING

(Not Used)

PART 2 PRODUCTS

2.01 MANUFACTURER

(See Below)

2.02 MATERIALS

A. Anchor Bolts:

1. Provide carbon steel bolts complying with ASTM A 307, headed type, unless otherwise indicated.
2. In buried or submerged locations, provide ASIS Type 306 stainless steel bolts complete with nuts and washers complying with ASTM 320. Other AIS types may be used, subject to ENGINEER'S approval.

3. For equipment, provide anchor bolts which meet the equipment manufacturer's recommendations for size, material, and strength.
4. Provide anchor bolts as shown or as required to secure structural steel to concrete masonry.
5. Locate and accurately set the anchor bolts using templates or other devices as necessary.
6. Protect threads and shank from damage during installation of equipment and structural steel.
7. Comply with required embedment length and necessary anchor bolt projection.

B. Drop-In Expansion Anchors:

1. Provide carbon steel drop-in expansion anchors, zinc plated, in accordance with ASTM B 633.
2. Drop-in expansion anchors shall be of the size required for the concrete strength specified and the loads required.
3. In buried or submerged location, provide AISI Type 316 stainless steel anchors complying with ASTM A 320. Other AISI types may be used, subject to ENGINEER'S approval.
4. Product and Manufacturer: Provide anchors of one of the following:
  - a. HDI Drop-In Anchor, as manufactured by Hilti Fastening Systems, Inc.
  - b. Multi-Set II Drop-In, as manufactured by ITW Ramset/Red Head, Inc.
  - c. Or approved equal.

C. Wedge Expansion Anchors:

1. Provide carbon steel wedge anchors, nuts and washers, zinc plated, in accordance with ASTM B 633, and meet the requirements of Federal Specification FF-S-325, Group II Type 4, Class 1.
2. In buried or submerged locations provide AISI Type 316 stainless steel wedge expansion anchors, nuts and washers complying with ASTM A 240, A 276, or F 594.
3. Product and Manufacturer: Provide anchors by one of the following:
  - a. Hilti Kwik Bolt by Hilti Fastening Systems, Inc.
  - b. Trubolt Wedge by ITW Ramset/Red Head Inc.
  - c. Or approved equal.

D. Sleeve Expansion Anchors for Installation in Concrete Masonry:

1. Provide carbon steel anchors complete with nuts and washers, zinc plated in accordance with ASTM B 633, and meet the requirements of Federal Specification FF- S-325, Group II, Type 4, Class 1 for expansion anchors.
2. Product and Manufacturer: Provide anchors by one of the following:
  - a. Sleeve Anchors, as manufactured by Hilti Fastenings Systems, Inc.
  - b. Dynabolt Sleeve, as manufactured by ITW Ramset/Red Head, Inc.
  - c. Or approved equal.

E. Adhesive Anchors:

1. Provide AISI Type 316 stainless steel anchors complying with ASTM A 320.
2. Anchors shall be of the size required for the concrete strength specified.
3. Anchors shall utilize epoxy resin or vinylester resin.

- a. Provide system utilizing a screen tube with a cartridge dispenser which contains two parallel tubes of resin and hardener. The installation system shall achieve minimum strength requirements recommended by the manufacturer.
- 4. Product and Manufacturer: Provide anchors by one of the following:
  - a. HIT HIT-RE 500-SD Adhesive Anchors, as manufactured by Hilti, Incorporated.
  - b. Or approved equal.
- F. Toggle Bolts:
  - 1. Provide spring-wing toggle bolts, with two-piece wings.
  - 2. Provide carbon steel bolts with zinc coating in accordance with Federal Specification FF-S-325.
  - 3. Product and manufacturer: Provide toggle bolts of one of the following:
    - a. The Rawplug Company, Incorporated.
    - b. Haydon Bolts, Incorporated.
    - c. Or approved equal.
- G. Concrete Inserts:
  - 1. For piping, grating, floor plate, and masonry lintels, provide malleable iron inserts. Comply with Federal Specification WW-H-17E (Type 18). Provide those recommended by the manufacturer for the required loading.
  - 2. Finish shall be black.
  - 3. Product and Manufacturer: Provide inserts of one of the following:
    - a. Figure 282, as manufactured by ITT Grinnell.
    - b. No. 380, as manufactured by Hohmann and Barnard, Incorporated.
    - c. Or approved equal.
- H. Powder actuated fasteners and other types of bolts and fasteners not specified herein shall not be used, unless approved by ENGINEER.

2.03 DESIGN CRITERIA

- A. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, toggle bolt, or concrete insert is not shown, provide the size, length and capacity required to carry the design load times a minimum safety factor of 4.
- B. Determine design loads as follows:
  - 1. For equipment anchors, use the design load recommended by the manufacturer and approved by the ENGINEER.
  - 2. For pipe hangers and supports, use one half the total weight pipe, fittings, valves, accessories and water contained in pipe, between the hanger or support in question and adjacent hangers and supports on both sides.
  - 3. Allowance for vibration is included in the safety factor specified above.

PART 3 EXECUTIONS

3.01 EXAMINATION

- A. CONTRACTOR shall examine areas and conditions under which anchor bolts, expansion anchors, toggle bolts and concrete insert Work is to be installed, and notify ENGINEER, in writing, of conditions detrimental to proper and timely completion of Work. Do not process with Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

### 3.02 PREPARATION

(Not Used)

### 3.03 INSTALLATION

- A. Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.
- B. Assure that embedded items are protected from damage and are not filled with concrete.
- C. Expansion anchors may be used for hanging or supporting pipe 2-inches diameter and smaller. Expansion anchors shall not be used for larger pipe, unless otherwise shown or approved by ENGINEER.
- D. Use concrete inserts for pipe hangers and supports for the pip size and loading recommended by the insert manufacturer.
- E. Use toggle bolts for fastening brackets and other elements onto masonry units.
- F. Unless otherwise shown or approved by ENGINEER, conform to following expansion anchors:
  - 1. Minimum embedment depth in concrete: 8 diameters.
  - 2. Minimum anchor spacing in centers: 12 diameters.
  - 3. Minimum distance to edge of concrete: 8 diameters.
  - 4. Increase dimensions above if required to develop the required anchor load capacity.
- G. For the adhesive anchors and adhesive material, CONTRACTOR shall comply with the manufacturer's installation instruction on the hole diameter and depth required to fully develop the tensile strength of the anchor or reinforcing bar. CONTRACTOR shall properly clean out the hole utilizing a wire brush and compressed air to remove all loose material from the hole, prior to installing adhesive capsules or material. Adhesive anchors shall not be use in an overhead position, or in any position that will put direct tension on the anchors.
- H. Adhesive anchor manufacturer's representative shall observe and demonstrate the proper installation procedure for the adhesive anchors and adhesive material at no additional expense so the OWNER. Each installer shall be certified, in writing, by the manufacturer to be qualified to install the adhesive anchors.

### 3.04 CLEANING

- A. After embedding concrete is placed, remove protection and clean bolts and inserts.

### 3.05 FIELD QUALITY CONTROL

- A. CONTRACTOR shall employ a testing laboratory to perform filed quality testing of installed anchors. Field ENGINEER is to determine the level of testing which is required for the various types of expansion anchors and bolts. A minimum of the 10 percent of the adhesive anchors and reinforcing bars are to be tested to 50 percent of the ultimate tensile capacity of the anchor or reinforcing bar.

- B. If failure of any of the adhesive anchors or reinforcing bars occurs, CONTRACTOR will be required to pay for the costs involved in testing the remaining 90 percent.
- C. CONTRACTOR shall correct improper workmanship, remove and replace, or correct as instructed by the ENGINEER, all anchors or bars found unacceptable or deficient at no additional cost to the OWNER.
- D. CONTRACTOR shall pay for all corrections and subsequent tests required to confirm the integrity of the anchor or bar.
- E. The independent testing and inspection agency shall complete a report on each area. The report should summarize the observations made by the inspector and be submitted to the ENGINEER.
- F. CONTRACTOR shall provide access for the testing agency to places where Work is being produced so that required inspection and testing can be accomplished.

END OF SECTION

SECTION 09961  
COATINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Coated surfaces to include:
  - a. Interior and exterior piping, regardless of type of factory-applied finish, where color-coding required.
  - b. Exposed interior and exterior structural and non-structural steel surfaces.
  - c. Exterior and interior equipment, motors, and appurtenances.
  - d. Interior and exterior concrete and masonry where noted in drawings.
  - e. Wood surface where noted in drawings.
  - f. Plaster and gypsum board surfaces where noted in drawings.
  - g. Metallic and non-metallic wall, floor, ceiling or architectural surfaces where noted in drawings.
2. Labeling and directional arrows on piping, equipment with valves or electrical connections, valves, and ducts whether coated or not.
3. Do not coat the following unless specifically noted otherwise:
  - a. Factory-finished electrical motor control panels (MCC) and main instrument panels (MIP), flow indicators, and related equipment.
  - b. Underground equipment and piping.
  - c. Surfaces above suspended ceiling systems (unless color coded).
  - d. Existing surfaces.
  - e. Factory-finished trim.
  - f. Stainless steel.
  - g. Aluminum
  - h. Galvanized surfaces.
4. Do not coat over any code-required labels such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

B. CONTRACTOR shall be required to coordinate with the equipment manufacturer for surface preparation and coatings of equipment, motors, and appurtenances. Equipment to be coated and coating system are identified in equipment Specification section(s).

C. DEFINITIONS

1.02 Definitions:

1. Coatings: Heavy duty finishes for use on any surfaces, especially surfaces subject to submerged, high moisture, splash or chemical environment.
2. Ambient Conditions:
  - a. Interior: Surface subject to normal temperatures and humidity such as found in offices and corridors.
  - b. Exterior: Surface subject to weathering, sunlight or wet areas such as shower rooms and rooms with open tanks.

- c. Submerged: Surface submerged in a liquid as specified. Coat all surfaces in regular contact with the liquid plus 1 ft 0 in. above high liquid level.
  - d. Chemical Splash: Surface subject to corrosive chemical splash or fumes, as specified.
  - e. Buried Below Grade: Footings, buried pipe or other materials buried below ground and in direct contact with the surrounding soil.
- B. Surface Preparation: Any cleaning, sand-blasting or other preparation to be performed on the surface prior to the first coating application.
  - C. Primer Coat: Field prime, factory prime, or shop prime.
  - D. Intermediate Coat: Any successive coats applied over primer coat before the finish coat.
  - E. Finish Coat: Final coat applied to surface. When only one coat is required, it is listed as finish coat.

### 1.03 SUBMITTALS

#### A. Product Data

- 1. Submit manufacturer's literature stating application recommendations and generic makeup of each type of coating scheduled.
- 2. Substitutions: For coatings not specified, provide substitute manufacturer's literature with specified coating literature for ENGINEER to make proper evaluation.

#### B. Samples:

- 1. Actual color samples available for each type of coating scheduled.
- 2. Two 4 in. by 4 in. steel panels for each method of metal preparation specified. Panel shall be representative of steel used and prevented from deterioration of surface quality. Upon acceptance by ENGINEER, panel shall be preserved as reference source for inspection.

#### C. Miscellaneous:

- 1. Letter of Certification/Shop Painting:
  - a. CONTRACTOR has option of shop coating materials and equipment partially or totally.
  - b. If CONTRACTOR applies coatings in factory submit following:
    - i. Coatings used.
    - ii. Manufacturer's written certificate factory-applied coating system is identical to, or exceeds, specified requirements.
    - iii. Requirements for touch-up or coating.
    - iv. History of coating performance in same environment.
  - c. Submit following for factory-applied first coat.
    - i. First coat used.
    - ii. CONTRACTOR'S certification factory-applied first coat is compatible with field-applied finish coats.

#### 2. Certification:

- a. Certification by the manufacturer that products supplied, comply with local regulations controlling use of volatile organic compounds (VOCs).

3. Schedules:

- a. Submit schedule of proposed coating systems.
- b. Schedule of proposed coating systems shall identify same information as shown in coating schedule.
- c. Schedule is not required if Tnemec coating materials are provided. Provide schedule for materials that are not Tnemec. Schedule will be used by ENGINEER to evaluate materials proposed.

D. Submit in accordance with Section 01330.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications:

- 1. Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those indicated for Project.

B. Single-Source Responsibility:

- 1. Provide coating material produced by same manufacturer for each system. Use only thinners recommended by manufacturer and only within recommended limits.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in original, sealed, unopened packages and containers bearing manufacturer's name. Each container shall have manufacturer's printed label stating type of coating, color of coating, instructions for reducing, and spreading rate.

B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturer for most sensitive coating, but not less than 55 degrees F.

C. Keep storage area neat and clean and replace or repair damage thereto or to its surroundings.

D. Avoid danger of fire. Deposit cleaning rags and waste materials in metal containers having tight covers or remove from building each night. Provide fire extinguishers of type recommended by coating manufacturer in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvents. Store solvents in safety cans.

E. Empty containers shall have labels canceled and be clearly marked as to use.

F. Upon Substantial Completion, remaining material will become property of OWNER. Seal material as required for storage, marked as to contents and shelf life, and store where required by ENGINEER. Provide OWNER with a minimum of 1 gallon of each color and sheen used on the project.

1.06 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

- 1. Do not apply exterior coating in cold, foggy, damp or rainy weather.

2. Do not apply finish in rooms where dust is being generated.
3. Do not apply exterior coating when temperature is lower than 50 degree F or as required by manufacturer.
4. Maintain interior temperature and relative humidity of space, as recommended by coating manufacturer, 24 hrs before applying and until coating is cured.

B. Protection:

1. Cover materials and surfaces, including floors, adjoining or below Work with clean drop cloths or canvas.
2. Remove hardware, accessories, plates, lighting fixtures, and similar items or provide protection by masking. Upon completion, replace above items or remove protection and clean.
3. Maintain manufacturer's environmental requirements while coating dries.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Coatings:

1. Tnemec (or as specially called out in the coating schedule).
2. AMERON Protective Coatings Division.
3. Or approved equal.

### 2.02 MATERIALS

A. Coatings:

1. Color shall be formed of pigments free of lead, lead compounds or other materials which might be affected by presence of hydrogen sulfide or other gases likely to be present at Project.
2. Coatings shall meet surface burning characteristics as required by code and established by ASTM E84.

### 2.03 COLORS

A. Colors shall be selected and approved by ENGINEER.

B. A piping color schedule may be found at the end of this specification.

C. Equipment Colors:

1. Equipment includes equipment, motors, and structural supports, fasteners, and attached portions of electrical conduit.
2. Equipment and piping color shall be selected by ENGINEER.

### 2.04 MIXING AND TINTING

A. Each coat shall be slightly darker than preceding coat, unless otherwise approved.

B. Tint undercoats similar to finish coats.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. If surfaces to be finished cannot be put into proper condition for finishing by customary cleaning, sanding, and puttying operations or if surfaces were improperly primed by others, report defects to ENGINEER, in writing, or assume responsibility and correct unsatisfactory finish resulting from improper surfaces. Commencement of Work indicates acceptance of surfaces.
- B. Materials removed and replaced to correct defects due to Work placed on unsuitable surfaces shall be at CONTRACTOR'S expense.
- C. Where surface dryness is questioned, test with dampness indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted in manufacturer's printed instructions.
- D. Provide coats compatible with the surface and prior coats.

### 3.02 SURFACE PREPARATION AND TOUCH-UP

#### A. General:

- 1. Surfaces, including floors shall be clean, dry, and free of loose dirt, dust, and foreign matter before applying coating.
- 2. Comply with coating manufacturer's recommendations for surface preparation.

#### B. Ungalvanized Ferrous Metal:

##### 1. General:

- a. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
- b. Prepare welds and adjacent areas to remove undercutting or reverse ridges on weld bead, weld spatter on or adjacent to weld or area to be coated, and sharp peaks or ridges along weld bead. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.
- c. Coat surfaces same day prepared. Re-prepare surfaces starting to rust before coating.

##### 2. Cleaning Methods:

- a. Workmanship for metal surface preparation as specified shall conform with SSPC specifications as follows:
  - i. SP-1: Solvent Cleaning
  - ii. SP-2: Hand Tool Cleaning
  - iii. SP-3: Power Tool Cleaning
  - iv. SP-5: White Metal Blast Cleaning
  - v. SP-6: Commercial Blast Cleaning
  - vi. SP-7: Brush-off Blast Cleaning
  - vii. SP-8: Pickling
  - viii. SP-10: Near-White Blast Cleaning
- b. Wherever "solvent cleaning," "hand tool cleaning," "wire brushing," "blast cleaning," or similar words of equal intent used in Specifications or coating

manufacturer's specifications, they shall be understood to refer to applicable SSPC specifications listed above.

c. Use hand tools to clean areas that cannot be cleaned by power tools.

3. Shop Preparation: Equipment, structural steel, metal doors and frames, metal louvers, and similar items may be shop-prepared and first coat applied at CONTRACTOR'S option. Centrifugal wheel blast cleaning is acceptable alternate to shop blast cleaning. Clean and prime in accordance with this section.
4. Field Touch-Up: Sandblast items and equipment as specified to restore damaged surfaces previously shop or field blasted and first coat applied. Materials, equipment, procedures, and safety equipment for personnel shall conform to SSPC.

C. Galvanized Metal:

1. Touch-up damaged areas with zinc-rich primer.
2. Wash galvanized metal surfaces with mineral spirits or comparable manufactured products.

D. Masonry:

1. Remove loose grit and mortar.
2. Remove grease, oil, dirt, salts or other chemicals, loose materials or other foreign matter by solvent, detergent or other suitable cleaning methods.

E. Concrete:

1. Do not begin surface preparation until 30 days after concrete has been placed.
2. Remove grease, oil, dirt, salts or other chemicals, loose materials or other foreign matter by solvent, detergent or other suitable cleaning methods.
3. Brush-off blast to remove laitance, form release agents, and solid contaminants. Perform sufficiently close to surface to open up surface voids, bug holes, air pockets, and other subsurface irregularities, but so as not to expose underlying aggregate. Resulting surface should be clean and uniform as required by coating manufacturer. If brush-off blasting is impractical, acid etch with muriatic acid solution and wash with water or neutralizing agent as required by coating manufacturer.

F. Plastic:

1. Solvent clean pipe in accordance with manufacturer's recommendations.
2. Hand sand with medium grit sandpaper to provide tooth for coating system.
3. Large areas may be power sanded or brush-off blasted, provided sufficient controls employed so surface roughened without removing excessive material.

G. Existing Surface Preparation:

1. General:
  - a. Remove and replace or mask attachments if attachments are not to be coated.
  - b. Remove surface contamination such as oil, grease, loose or otherwise defective paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers to assure sound bonding to tightly adhering old paint. Glossy surfaces of old paint films shall be clean and dull before repainting.
  - c. Sand surfaces and feather edges where chipped surfaces occur.
  - d. Cut out and fill cracks or other defects in existing surface to match adjoining surfaces.

- e. Exact nature of existing coatings is not known in all cases. While it is assumed they have oxidized sufficiently to prevent lifting or peeling when overcoated with coatings or paints specified, check compatibility by application to small area prior to starting coating. If lifting or other problems occur, notify ENGINEER for direction.
  - f. Comply with new coating manufacturer's recommendations for preparation of previously painted or coated surfaces.
2. Existing ferrous metal surfaces subject to chemical, submerged or splash conditions: As specified for ferrous metals.
  3. Existing masonry surfaces subject to chemical, submerged, or splash conditions: As specified for masonry.
  4. Existing concrete and precast concrete surfaces subject to chemical or splash conditions: As specified for concrete and precast.

### 3.03 APPLICATION

#### A. General Requirements:

1. Spread evenly and flows on smoothly without runs, lumps or sags.
2. Make edges of coating adjoining other materials or colors sharp and clean without overlapping.
3. Number of coats and film thickness required is same regardless of application method. Do not apply succeeding coats until previous coat has cured as required by manufacturer. Where sanding is required, according to manufacturer's direction, sand between applications to produce smooth, even surface.
4. Finish edges of doors as specified for faces. Apply one coat finish on tops and bottoms of doors after fitting.
5. Term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain system's integrity and provide desired protection.
  - a. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces.
  - b. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - c. Omit first coat on metal surfaces that have been shop-primed and touch-up painted.
6. Manufacturer-Applied Coating Systems:
  - a. Repair abraded areas on factory-finished items in accordance with manufacturer's directions.
  - b. Blend repaired areas into original finish.
7. Existing Surfaces:
  - a. If finish coat will not produce uniform coverage, provide first coat base over existing Work.
  - b. Where ceilings or walls scheduled for patching or remodeling, coat entire ceiling or wall in that area.
  - c. At altered rooms, wherever new Work adjoins existing Work, finish new Work to match existing. Apply first coats as specified for new Work on new Work and wash adjacent existing coated surfaces and apply finish coat(s) over entire area.

8. Application Procedures:

- a. Apply coatings by brush, roller, spray, or other applicators according to manufacturer's instructions.

B. Priming and Sealing:

1. Refer to Coating Schedule for specific coating material.
2. Shop:
  - a. Shop first coat for ferrous metal shall comply with SSPC guidelines, and as specified in Coating Schedules of this Specification.
  - b. Hand or power sand chipped, peeled or abraded first coat and feather edges. Spot coat areas with specified first coat.
  - c. Prior to application of finish coats, clean shop-first coat surfaces free of dirt, oil, and grease.
  - d. Prepare and prime holdback areas as required for specified coating system.

3.04 FIELD QUALITY CONTROL

A. Sampling of Materials:

1. ENGINEER reserves right to select unopened containers of materials furnished for project and have materials tested at an independent testing laboratory. OWNER will pay for first tests.
2. Retests of rejected materials and tests of replacement materials shall be paid for by CONTRACTOR.
3. Remainder of contents of containers not required for testing will be returned to CONTRACTOR.

B. Coverage:

1. If coverage is not acceptable to ENGINEER, ENGINEER reserves right to require extra application of paint at no extra cost to OWNER.
2. Work at site where coat of material is applied will be inspected by ENGINEER before application of succeeding specified coat, otherwise no credit for coat applied will be given and CONTRACTOR automatically assumes responsibility to recoat Work in question. Furnish ENGINEER report of particular coat applied and when completed for inspection to comply with above.

3.05 COATINGS SCHEDULE

A. General:

1. Unless otherwise noted, Tnemec products are identified in this schedule to establish quality and type desired only.
2. Scheduled thickness or coverage rate is as recommended by Tnemec. If other manufacturers are proposed and accepted, manufacturer's requirements shall be followed, but in no case may thickness or coverage rate be less.
3. DFT = dry film thickness (mils/coat). DFT shown is for spray application. Additional coats may be required if brushed and rolled.
4. sfpg = sq ft/gal (per coat).
5. Examples of surfaces to be coated are not all inclusive.

B. Coating Schedule:

<b>C CONCRETE / MASONRY</b>
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**C1 Interior**

Surface Preparation	SSPC-SP13
Primer Coat	Series 66 or N69 Hi-Build Epoxoline; $\geq 5.0$ DFT
Finish Coat	Series 66 or N69 Hi-Build Epoxoline; $\geq 5.0$ DFT

**C2 Exterior**

Surface Preparation	Clean and Dry
Primer Coat	Series 180 or 181 W.B. Tneme-Crete; $\geq 6.0$ DFT
Finish Coat	Series 180 or 181 W.B. Tneme-Crete; $\geq 6.0$ DFT

**C3 Submerged Potable**

Surface Preparation	SSPC-SP13, Abrasive Blast ICRI CSP2-3
Primer Coat	Series 20 or N140 Pota-Pox; $\geq 5.0$ DFT
Finish Coat	Series 20 or N140 Pota-Pox; $\geq 5.0$ DFT

**C4 Submerged Non-Potable**

Surface Preparation	SSPC-SP13
Primer Coat	Series 66 or N69 Hi-Build Epoxoline; $\geq 5.0$ DFT
Finish Coat	Series 66 or N69 Hi-Build Epoxoline; $\geq 5.0$ DFT

**C5 Submerged Sludge**

Surface Preparation	SSPC-SP13, ICRI CSP3-5
Primer Coat	Series 218 Mortar Clad; $\geq 1/16$ in
Intermediate Coat	Series 434 Perma-Shield H <sub>2</sub> S; $\geq 125.0$ DFT
Finish Coat	Series 435 Perma-Glaze; $\geq 35.0$ DFT

**C6 Submerged Wetwell**

Surface Preparation	SSPC-SP13, ICRI CSP5
Finish Coat	Saureisen Sewergard Type 210; $\geq 60.0$ DFT -or- Environmental Coatings Sewer Shield 100; per manufacturer

**C7 Buried Below Grade**

Surface Preparation	SSPC-SP13
Finish Coat	Series 46-465 H.B. Themecol; $\geq 10.0$ DFT

**C8 Chemical Splash - General**

Surface Preparation SSPC-SP13  
Primer Coat Series 61 Tneme-Liner;  $\geq 5.0$  DFT  
Finish Coat Series 61 Tneme-Liner;  $\geq 5.0$  DFT

**C9 Chemical Splash - Acid**

Surface Preparation SSPC-SP13, ICRI CSP5  
Primer Coat Series 120-5002 Vinester;  $\geq 15.0$  DFT  
Finish Coat Series 120-5001 Vinester;  $\geq 15.0$  DFT

**C10 Chemical Splash - 40% Ferric Chloride**

Surface Preparation SSPC-SP13  
Primer Coat Series 104 High Solids Epoxy;  $\geq 9.0$  DFT  
Finish Coat Series 104 High Solids Epoxy;  $\geq 9.0$  DFT

<b>S STEEL</b>
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**S1 Interior**

Surface Preparation SSPC-SP6  
Primer Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 4.0$  DFT  
Finish Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 5.0$  DFT

**S2 Exterior**

Surface Preparation SSPC-SP6  
Primer Coat Series 90-97 Tneme-Zinc;  $\geq 3.0$  DFT  
Intermediate Coat Series 27 Typoxy or Series 66 Epoxoline;  $\geq 2.5$  DFT  
Finish Coat Series 73, 1074 or 1075 Endura-Shield;  $\geq 3.5$  DFT

**S3 Submerged Potable**

Surface Preparation SSPC-SP10  
Primer Coat Series 20 or N140 Pota-Pox;  $\geq 4.0$  DFT  
Finish Coat Series 20 or N140 Pota-Pox;  $\geq 5.0$  DFT

**S4 Submerged Non-Potable**

Surface Preparation SSPC-SP10  
Primer Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 4.0$  DFT  
Intermediate Coat Series 104 H.S. Epoxy;  $\geq 7.0$  DFT  
Finish Coat Series 104 H.S. Epoxy;  $\geq 7.0$  DFT

**S5 Submerged Sludge**

Surface Preparation SSPC-SP5  
Primer Coat Series 435 Perma-Glaze;  $\geq 27.0$  DFT  
Finish Coat Series 435 Perma-Glaze;  $\geq 27.0$  DFT

**S6 Buried Below Grade**

Surface Preparation SSPC-SP10  
Primer Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 4.0$  DFT  
Finish Coat Series 46H-413 Hi-Build Tneme-Tar;  $\geq 17.0$  DFT

**S7 Submerged Calcium, Sulfates, Magnesium, Sodium Chloride**

Surface Preparation Series 104 H.S. Epoxy;  $\geq 5.0$  DFT  
Finish Coat Series 104 H.S. Epoxy;  $\geq 7.0$  DFT

**S8 Chemical Splash - 40% Ferric Chloride**

Surface Preparation SSPC-SP10  
Primer Coat Series 104 H.S. Epoxy;  $\geq 9.0$  DFT  
Finish Coat Series 104 H.S. Epoxy;  $\geq 9.0$  DFT

<b>I IRON</b>
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**I1 Interior**

Surface Preparation per manufacturer  
Primer Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 4.0$  DFT  
Finish Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 5.0$  DFT

**I2 Exterior**

Surface Preparation per manufacturer  
Primer Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 4.0$  DFT  
Intermediate Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 5.0$  DFT  
Finish Coat Series 73, 1074 or 1075 Endura Shield;  $\geq 2.5$  DFT

**I3 Buried Below Grade**

Surface Preparation per manufacturer  
Primer Coat Series 46H-413 Hi-Build Tneme-Tar  
Finish Coat Series 46H-413 Hi-Build Tneme-Tar;  $\geq 17.0$  DFT

**I4 Submerged**

Surface Preparation per manufacturer  
Primer Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 4.0$  DFT  
Finish Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 5.0$  DFT

**M NON-FERROUS METAL**

**M1 Interior**

Surface Preparation per manufacturer  
Primer Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 2.5$  DFT  
Finish Coat Series 73, 1074 or 1075 Endura-Shield;  $\geq 2.5$  DFT

**M2 Exterior**

Surface Preparation per manufacturer  
Primer Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 2.5$  DFT  
Finish Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 2.5$  DFT

**M3 Submerged**

Surface Preparation SSPC SP-1 - Brush-Off Blast  
Primer Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 4.0$  DFT  
Finish Coat Series 66 or N69 Hi-Build Epoxoline;  $\geq 5.0$  DFT

**P PLASTIC**

**P1 Interior**

Surface Preparation Tack Coat  
Finish Coat Devoe Water Base Paint;  $\geq 4.0$  DFT

**P2 Exterior**

Surface Preparation Tack Coat  
Primer Coat Devoe Water Base Paint;  $\geq 1.5$  DFT  
Finish Coat Devoe Water Base Paint;  $\geq 3.0$  DFT

**F FIBERGLASS**

**F1 Exterior**

Surface Preparation  
Primer Coat  
Finish Coat

**F2 Exterior**

Surface Preparation  
Primer Coat  
Finish Coat

**W WOOD**

**W1 Interior / Exterior**

Surface Preparation	Clean and Dry
Primer Coat	Series 36 Undercoater; $\geq 3.0$ DFT
Finish Coat	Series 6 Treme-Cryl; $\geq 2.5$ DFT

**G GYPSUM AND PLASTER**

**G1 Interior**

Surface Preparation	Clean and Dry
Primer Coat	Series 151-1051 Elasto-Grip FC; $\geq 1.5$ DFT
Finish Coat	Series 297 Enviro-Glaze; $\geq 2.5$ DFT

**T STUCCO**

**T1 Exterior**

Surface Preparation	Clean and Dry
Finish Coat	Series 607 Conformal Stain; per manufacturer

<b>N INSULATION</b>
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**N1 Vinyl-coated Pipe and Duct**

Surface Preparation	<u>Hand sanded</u>
Primer Coat	Series 66 or N69 Hi-Build Epoxoline; $\geq 5.0$ DFT
Finish Coat	

<b>A Aluminum</b>
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**A1 Interior / Exterior**

Surface Preparation	per manufacturer
Finish Coat	Series 115 Uni-Bond DF; $\geq 3.0$ DFT

3.06 ADDITIONAL COATING REQUIREMENTS

- A. Where noted in drawings, additional coating may be required on surfaces to protect against vandalism or graffiti.
1. Protective coating shall be ND Graffiti Shield as provided New Dimensions Solutions, LLC or approved equal.
  2. Apply coating per manufacturer's recommendations or as follows:
    - a. Apply four (4) separate coats. Allow each coat to dry completely before applying successive coats.
    - b. Porous materials (concrete/masonry, stucco): Use a coverage rate of approximately 250 square feet per gallon.
    - c. Semi-porous materials (wood): Use a coverage rate of approximately 500 square feet per gallon.
    - d. Non-porous materials (metal, plastic): Use a coverage rate of approximately 500 square feet per gallon.

3.07 SYSTEMS COLOR CODING AND LABELING SCHEDULE

- A. Colors for piping and equipment in piping systems are to be selected and approved by Engineer.
- B. Provide banding and labels.

3.08 FINAL TOUCH-UP

- A. Prior to Substantial Completion, examine coated surfaces and retouch or refinish to leave surfaces in condition acceptable to ENGINEER.
- B. After doors have been fitted and hung, refinish edges, tops, and bottoms.

3.09 CLEANING

- A. Before Substantial Completion, remove masking, coating, and other material from floors, glass, and other surfaces and remove rubbish and accumulated materials of whatever nature not caused by other trades from premises and leave in clean, orderly condition, with floors broom clean.

Piping Color Schedule:

PIPING AND LEGEND	PIPE COLOR	BANDS	LETTERING	BACKGROUND
<b>WATER</b>				
Spray Water	Red		Black	Red
Potable Water	Blue	White	Black	Blue
Potable Water (Hot)	Blue	White	Black	Red
Seal Water	Red		White	Red
Chilled Water Return	Blue		White	Green
Chilled Water Supply	Blue		White	Green
Cold Water	Blue		White	Green
Hot Water Return	Blue	Red	Black	Yellow
Hot Water Supply	Blue	Red	Black	Yellow
Raw Water	Dk. Green		Black	Lt. Gray
Non-Potable Water	Red	Black	White	Red
Reuse Water	Purple		Black	Red
Deionized Water	Lt. Blue		Black	Red
<b>AIR AND GAS</b>				
Process Air	White		Black	White
Blower Air	Lt. Green		Black	White
Digester Gas, H.P	Red		Black	Yellow
Digester Gas, L.P.	Red		Black	Yellow
Compressed Air	Green	Red	Black	Yellow
High Pressure Air	White	Red	Black	White
Odor Control Piping	Lt. Green		Black	Yellow
<b>CHEMICALS</b>				
Alum	Med. Green		Black	Yellow
Ferric Chloride	Safety Orange		Black	Safety Orange
Chlorine Solution	Yellow		Black	Yellow
Chlorine Gas	Yellow		Black	Green
Chlorine Liquid	Yellow		Black	-
Polymer Feed	Yellow		Black	Yellow
Polymer - Coagulant	Lt. Green		Green	Lt. Blue
Polymer - Filter Aid	Lt. Green		White	Dk. Blue
Polymer - Thickener	Lt. Green		White	Dk. Blue
Polymer - Centrifuge	Lt. Green		White	Dk. Blue
Methanol	Yellow		Black	Yellow
Sodium Hydroxide	Yellow		Black	Yellow
Sodium Hypochlorite	Yellow		Black	Yellow
Sulfur Dioxide Gas	Yellow	Blue	Black	Yellow
Hydrochloric Acid	Yellow		Black	Yellow
Polyphosphate	Medium Green		Black	Yellow

CHEMICALS, CONT.

Carbon	Black	White	Black
Sulfuric Acid	Yellow	Black	Red
Caustic Soda	Dk. Green	White	Blue
Lime	Medium Green	Black	Blue
Fluoride	Yellow	Black	Lt. Blue
Copper Sulfate	Medium Green	Black	Blue

PROCESS

Plant Influent	Dk. Gray	Black	Green
Plant Effluent	Lt. Gray	Black	Green
Primary Effluent	Brown	Black	Green
Digester Tank Drains	Brown	Black	Green
Drains	Gray	Black	Green
Settling Tank Drains	Gray	Black	Green
Storage Tank Drains	Gray	Black	Green
Storm Drains	Gray	Black	Green
Sump Drains	Gray	Black	Green
Acid Drains	Black	Yellow	Black
Mixed Liquor	Brown	Black	Green
Scum	Black	Black	Green
Sewage (Wastewater)	D. Gray	Black	Green
Sewage Sampling Lines	D. Gray	Black	Green
Sludge	Brown	Black	Green
Digested Sludge	Brown	Black	Green
Primary Sludge	Brown	Black	Green
Raw Sludge	Brown	Black	Green
Recirculated Digester Sludge	Brown	Black	Green
Return Activated Sludge	Brown	Black	Green
Waste Activated Sludge	Brown	Black	Green
Thickened Sludge	Dk. Brown	Orange	Black
Supernatant	Black	Black	Green
Digester Tank Overflow	Brown	Black	Green
Storage Tank Overflow	Brown	Black	Green
Grit Lines	Brown	Black	Yellow
Grit Overflow	Brown	Black	Yellow
Grit Dewatering	Brown	Black	Yellow
Centrate Lines	Gray	Black	Yellow
Sludge Cake Lines	Brown	White	Green
Scrubber Blowdown	Yellow	Black	Yellow

OTHER

Lube Oil	Brown		White	Brown
Waste Oil	Brown		White	Brown
Fuel Oil	Red	White	White	Brown
Roof Drains	Gray		Black	Green
Methanol Solution	Yellow		Black	Yellow
Natural Gas	Red		Black	Yellow

EXPOSED ELECTRICAL CONDUITS

120V/ 480V/ 4160V	Orange or Match Wall		Black	Yellow
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FIRE QUENCHING MATERIALS

Water, Foam, CO <sub>2</sub> , Halon, Fire Hydrants, including sections of potable water for Fire Dept. access (no label)	Red		-	-
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SAMPLE LINE PIPING

Raw Water Sample Lines	Dk. Blue		White	Black
Non Raw Water Sample Lines	Dk. Blue		Black	Lt. Blue
Process Sample Lines	Lt. Gray	Red	Black	Lt. Blue

END OF SECTION

SECTION 15011  
CONNECTION FITTINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide steel fittings and other items as shown on Drawings and specified herein.
- B. Extent of piping and piping products specified in this section is indicated on Drawings.
- C. Contractor shall verify size and connection requirements of existing piping prior to submittal of shop drawings.

1.02 SUBMITTALS

A. Shop Drawings:

- 1. Submit catalog cuts, manufacturer specifications, installation instructions, and dimensioned drawings for each type of fitting, flange, and special.
- 2. Submit fitting schedule showing manufacturer, pipe weight or schedule, fitting type, flange class and joint type.
- 3. Fabrication Information
  - a. Pipe/fitting wall construction details which indicate the type and thickness of cylinder, the position, type, size, and area of reinforcement, manufacturing tolerances; maximum angular joint deflection limitations; and all other pertinent information required for the manufacture and installation of the product.
  - b. Welding joint details shall be submitted for all joint types, including beveled ends for alignment conformance and deep bell or butt strap joints required for control of temperature stresses.
  - c. Pipe Fabricator's Credentials: Submit the credentials of the pipe manufacturer/fabricator. Credentials shall include references names, telephone numbers, and descriptions of projects for pipe conforming to AWWA C200 that is of similar diameter, length, and wall thickness to the pipe in this project. Project description shall include length, diameter, wall thickness, steel metallurgy, location of facility where pipe was manufactured/fabricated, and names of key plant personnel responsible for the manufacturing process. Submit names and qualifications of current plant personnel to be responsible for manufacture of the pipe in this project.
- 4. Materials: Material lists and steel reinforcements schedules which include and describe all materials to be utilized. Metallurgical test reports for steel proposed for use on the project. Submit chemical and physical test reports from each heat of steel that indicate the steel conforms to the Specifications.
- 5. Welding: Information regarding location, type, sizes, and extent of all welds with reference called out for Welding, Procedure Specifications (WPS) numbers shall be shown on the shop drawings. The shop drawing shall distinguish between shop and field welds. Shop drawings shall indicate by welding symbols or sketches the details of the welded joints, and the preparation of parent metal required to make them.

- a. Written welding procedures for shop and field welds, including Welding Procedure Specifications (WPS's) and Procedure Qualification Records (PQR's).
  - b. Written nondestructive testing procedure specifications, and nondestructive testing personnel qualifications for each shop and field weld.
  - c. Current welder performance qualifications (WPQ's) shall be submitted for each welder used prior to its performing any Work either in the shop or field.
  - d. Submit all nondestructive testing (NDT) data for each field-welded joint and each shop-welded joint. This data shall include all testing on each weld joint, including re-examination of repaired welds, using radiographic, magnetic particle, dye penetrant examination, ultrasonic, or air test examination methods specified. Shop and Field Test data shall be reviewed and signed by the welding inspector(s).
  - e. Submit a welder log for all field and shop welding. Log shall list all welders to be used for the Work and the types of welds each welder is qualified to perform.
  - f. Submit a written weld repair procedure for each type of shop and field weld proposed for use on the Project.
- B. Certifications: Furnish a certified affidavit of compliance for all pipe and other products, materials, or related work provided under this Section, as specified in ANSI/AWWA C200, C205, C602, and C206, respectively, and the following supplemental requirements:
- 1. Compliance with the additional requirements included in these Contract Documents.
  - 2. Physical and chemical properties of all steel.
  - 3. Results of production weld tests.
  - 4. All materials in contact with potable water shall be NSF approved for use with potable water.
  - 5. All welds were performed in conformance with these documents.
- C. All expenses incurred in making samples of collecting data for certification of tests shall be borne by the Contractor at no increased cost to the OWNER.

### 1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of pipe, tube, and fittings of types and sizes required.
- 1. Ameron
  - 2. Or Approved Equal
- B. Inspection: All pipe, linings, welds, coating, and related work shall be subject to inspection at the place of manufacture and the place the Work is performed in accordance with the provisions of ANSI/AWWA C200, C205, C206, C602, C209, C214, and C215, as applicable, as supplemented by the requirements herein. Notify the OWNER in writing no less than 14 calendar days prior to the start of any phase of the pipe manufacture, welding, lining, coating, testing, or field operations.
- C. Welder Performance Qualifications: All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified by the Contractor under the provisions of ASME BPVC for shop welds and ANSI/AWS D1.1 for field welds. Furnish all material and bear the expense of qualifying welders.

- D. Onsite Observation: The pipe fabricator shall provide an experienced staff member to be onsite as may be required by the OWNER or the Contractor while the pipe and fittings are being installed. The staff member's duties shall include, by not be limited to, the following:
1. Observe the installation and welding of the pipe and fittings.
  2. Report any concerns to the OWNER'S onsite observer.
  3. Answer questions and provide assistance to the OWNER and the Contractor.
- E. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of ANSI/AWWA C200, C205, C206, and C602, as applicable.
- F. Commercial Standards:
1. ANSI/ASTM
    - a. A 20 – General Requirements for Steel Plates for Pressure Vessels
    - b. A 36 – Carbon Structural Steel
    - c. A 370 – Test Methods and Definitions for Mechanical Testing of Steel Products.
    - d. A 516 -- Pressure Vessel Plates, Carbon Steel for Moderate and Lower Temperature Service.
    - e. A 572 – High Strength Low Alloy Columbium Vanadium Structural Steel.
  2. ANSI/AWWA
    - a. C 200 – Steel Water Pipe 6 inches and Larger
    - b. C 205 – Cement Mortar Protective Lining and Coating for Steel Water Pipe – 4in and Larger – Shop Applied.
    - c. C 206 –Field Welding of Steel Water Pipe
    - d. C 207 – Steel Pipe Flanges for Steel Water Pipe
    - e. C 208 -- Dimensions for Fabricated Steel Water Pipe Fittings
    - f. C 209 – Cold Applied Tape Coating for the Exterior of Special Sections, Connections and Fittings for Steel Water Pipelines.
    - g. C 214 – Tape Coating Systems for the Exterior of Steel Water Pipelines
    - h. C 602 – Cement Mortar Lining of Water Pipelines 4-in (100 mm) and Larger – In Place.
    - i. M -11 – Steel Water Pipe – A Guide for Design and Installation.
  3. ANSI/AWS
    - a. D 1.1 – Structural Welding Code – Steel
  4. ASME
    - a. Boiler and Pressure Vessel Code
  5. API Standards
    - a. 1104 --Welding Pipelines and Related Facilities

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect pipe flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.
- B. Markings: Legibly mark all pipes and specials in accordance with the laying schedule and marking diagram. Each pipe shall be numbered in sequence and said number shall appear on the laying schedule and marking diagram in its proper location for installation. All special pipe section and fittings shall be marked at each end with top field centerline. The work "top" shall be painted or marked on the outside top spigot of each pipe section
- C. Pay the cost of replacement or repair of pipe damaged at no increased cost to the OWNER.

## PART 2 PRODUCTS

### 2.01 MATERIALS

#### A. Carbon Steel Pipe:

- 1. 24 in. and Smaller: Seamless carbon steel, ASTM A53, Grade B.
- 2. Larger than 24 in.: Straight seam fusion welded plate in accordance with ASTM A134 Grade A238C or API-5L Grade B.
- 3. Wall Thickness:
  - a. 2 in. and smaller: Schedule 80.
  - b. 2-1/2 in. through 10 in.: Schedule 40.
  - c. 12 in. and larger: 3/8 in. standard weight.

#### B. Fittings:

- 1. 2 in. and smaller: Socket weld end type, forged carbon steel, ASTM A105, Class 300.
- 2. 2-1/2 in. through 12 in.: Factory-made, wrought steel butt-welding type to match pipe wall thickness, ASTM A234, Grade WPB.
  - a. Fittings shall conform to ANSI B16.9 standards, except for short radius elbows, which shall conform to ANSI B16.28 standards.
  - b. Provide long radius elbows unless otherwise noted on Drawings.
- 3. 14 in. and larger: Fabricate from pipe material in accordance with AWWA C208.

#### C. Flanges:

- 1. Forged steel, ASTM A105.
- 2. 24 in. and smaller: Slip-on or welding neck type Class 150, 1/16 in. raised face, conforming to ANSI B16.5 standard except as otherwise indicated.
- 3. Larger than 24 in.: AWWA C207, Class F, steel hub type.
- 4. Provide welding neck flanges when abutting butt-welded fittings.
- 5. Machine off raised face of steel flanges when mating with piping components with flat faced flanges.
- 6. For sizes 24 in. and smaller, when mating with piping components with 250 or 300 lb flanges, use welding neck flanges conforming to 300 lb ANSI B16.5 standards.
- 7. When mating with cast iron 250 lb raised face flanges, mating steel 300 lb flanges shall have flat faces or raised faces of outside diameter at least as large as those of cast iron flanges, in accordance with ANSI B31.1.

D. Flange Bolting:

1. Provide carbon steel, ASTM A307 Grade B bolting unless otherwise noted.
2. When 1/8 in. undersized bolting material is used for insulating flanges, use ASTM A193, Grade B7 alloy stud bolts and ASTM A194, Grade 2H carbon steel heavy hex nuts.

E. Gaskets:

1. Pipe Sizes 24 in. and Smaller: 1/16 in. thick compressed synthetic fiber, flat ring type with raised face flanges and full face type with flat face flanges.
2. Pipe Sizes Larger than 24 in.: 1/8 in. thick cloth inserted rubber.
3. Provide material compatible with fluid in pipe.

F. Shop-Welded Surfaces: All weld seams on pipe surfaces that will have a flexible tape coating and shall be ground such that the maximum weld bead height will not exceed 1/32 inch. All grouped weld seams shall be smooth and free of all burrs. Do not grind into, or gouge, the adjacent pipe wall material.

G. Cement: Cement for mortar shall conform to the requirements of ANSI/AWWA C205, provided, that cement for mortar coatings shall be Type V, and mortar lining shall be Type II or V, per ASTM C150. Fly ash or pozzolan shall not be used as a cement replacement.

## 2.02 FABRICATION

A. Fittings:

1. Fabricate in accordance with AWWA C208.
2. Shell thickness of reducing sections shall be the same as required thickness for larger ends.
3. Special Sections: Provide fittings and specials with ends as required and fabricate to shapes, sizes, and dimensions to match new and existing piping.

B. Flanges:

1. Attach flanges normal to axis of pipe so that alignment is satisfactory.
2. After attachment to pipe, maximum layback from inside edge of flange to outside edge of flange shall not exceed 1-1/2".
3. Test flanges, after welding to pipe, for true plane and reface if necessary to bring them within specified tolerances.

## 2.03 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Welded Materials: Except as otherwise indicated, provide welding materials as determined by installer to comply with installation requirements.

1. Comply with ANSI B31.1.

B. Thread Lubricant: Teflon tape.

## 2.04 MECHANICAL COUPLINGS

A. Manufacturers:

1. Dresser "Style 38."
2. Rockwell.

B. Provide plain-end type ends to be joined by mechanical couplings.

1. Join welds on ends by couplings without pipe stops. Ground flush to permit slipping coupling in at least one direction to clear pipe joint.
2. Outside diameter and out-of-round tolerances shall be within the limits specified by coupling manufacturer.
3. Provide lugs in accordance with ASTM A36.
4. Provide hardened steel washers in accordance with ASTM A325.
5. Plastic plugs shall be fitted in coupling to protect bolt holes.
6. Nuts and Bolts:
  - a. Bolts and bolt studs shall be in accordance with ASTM A307 and ANSI B1.1 with hexagonal or square heads, coarse thread fit, threaded full length with ends chamfered or rounded.
  - b. Project ends 0 to 1/4 in. beyond surface of nuts.
  - c. Use coarse threads in accordance with ANSI B1.1.

C. Middle ring of each mechanical coupling shall have thickness at least equal to specified for size of pipe on which coupling to be used and not less than 10 in. long for pipe 30 in. and larger and not less than 7 in. long for pipe under 30 in. in diameter.

1. Omit pipe stop from inner surface of middle rings of couplings whenever necessary to permit removal of valves, flow meters, and other installed equipment.
2. Provide pipe stops in other couplings.

D. Clean and shop prime with manufacturer's standard rust-inhibitive primer.

## 2.05 FLANGED COUPLING ADAPTERS

A. Manufacturers:

1. Dresser "Style 128."
2. Rockwell.

B. Restrain flanged coupling adapters.

C. Provide tie rods of sufficient number and strength to restrain coupling at test pressure as listed in Pipe Schedule and piping detail plan.

D. Use minimum of two 5/8 in. diameter tie rods at connections.

## 2.06 EXPANSION JOINTS

A. Manufacturers:

1. Sliding Expansion Joints:

- a. Dresser "Style 63."
- b. Rockwell.
- c. Or equal.

2. Flexible Connectors and Expansion Joints:

- a. Garlock.
- b. Goodall.
- c. Mercer.
- d. Or equal.

B. Materials:

1. Joints shall allow minimum of 0.4375 in. pipe expansion (joint compression), 0.250 in. pipe compression (joint expansion). Design in accordance with Fluid Sealing Association, Series B.
2. Provide flexible connectors and expansion joints at equipment for isolation design in accordance with Fluid Sealing Association, Series B.
3. Provide tie rods at flexible connectors and expansion joints of sufficient number and strength to restrain connection at test pressure. Use minimum of two 5/8 in. diameter tie rods at connections.
4. Support flexible connectors and expansion joints adequately. Locate vertical supports within 3 pipe diameters of connection and provide on each side of connection.

2.07 GROOVED PIPE COUPLINGS

A. Manufacturers:

1. Victaulic.
2. Or equal.

B. Materials:

1. Conform victaulic couplings to latest applicable requirements of AWWA C606.
2. Arrange piping so pipe ends are in full contact.
3. Ends to be joined by victaulic couplings shall be of grooved and collared type as recommended by coupling manufacturer for size and wall thickness of pipe, fitting or special being coupled, and for maximum test pressure to which it will be subjected.
4. Locate grooves or collars and install so coupling keys bear against shoulder of groove or collar nearest each end of pipes being connected so as to prevent separation of joins or longitudinal movement of pipes.
5. Grooved pipe shall have such thickness that wall thickness in groove is not less than 1/4 in.

2.08 PROTECTIVE COATINGS

A. Steel pipe, fittings, specials, and wall fittings shall be prepared, primed, lined, coated, painted or wrapped as hereinafter specified.

B. Exterior Surfaces in Interior Locations:

1. Thoroughly clean by sandblasting and prime coat exterior surfaces, except machined surfaces, of pipe, fittings, specials, flanges, anchors, pipe supports, and blocking exposed in interior or exterior locations as specified in corresponding COATINGS section and applied in shop.
2. Field paint as specified in corresponding COATINGS section.

C. Machined Surfaces:

1. Shop coat machined surfaces with rust preventive compound Dearborn Chemical "No-Ox-Id 2W," Houghton "Rust Veto 344," Rust-Oleum "R-9" or equal.

2.09 CEMENT MORTAR LINING

- A. The minimum lining thickness shall be ½ inch, with a tolerance of plus 1/8 inch or minus 1/16 inch.
- B. The pipe shall be left bare where field joints occur as indicated. Ends of the linings shall be left square and uniform. Feathered or uneven edges will not be permitted.
- C. Defective linings, as determined by the OWNER, shall be removed from the pipe wall and shall be replaced to the full thickness required. Defective linings shall be cut back to a square shoulder in order to avoid feather edged joints. Temperature and shrinkage cracks in the mortar less than 1/16 inch wide need not be repaired. Pipe, specials or fittings with cracks wider than 1/16 inch, but less than or equal to 1/8 inch shall be repaired with a cement paste approved by the OWNER. Any crack having an area greater than 1/8 inch, as determined by the OWNER, shall be evaluated for repair in accordance with the approved procedure, or shall be rejected by the OWNER based on evaluation of the damage lining or coating. Materials rejected by the OWNER shall be replaced by the Contractor at no additional cost to the OWNER. The repair and patch procedure shall be submitted for the OWNER's approval.
- D. Cement-Mortar Lining: Unless otherwise indicated, all steel pipe shall be mortar-lined. The materials and design of in-place cement-mortar lining shall be in accordance with ANSI/AWWA C602 and the following supplementary requirements:
  1. Pozzolanic material shall not be used in the mortar mix
  2. Admixtures shall be contain no calcium chloride.
  3. The minimum lining thickness shall be indicated for shop applied cement-mortar lining and finished inside diameter after lining shall be as indicated.
  4. Field applied mortar lining shall meet the requirements of this section.
- E. Protection of Pipe Lining/interior: For all pipe and fittings with plant-applied cement-mortar linings, provide a polyethylene or other suitable bulkhead on the ends of the pipe and on all special openings to prevent drying out of the lining. All bulkheads shall be substantial enough to remain intact during shipping and storage until the pipe is installed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with approved submittals.

- B. Install pipe, fittings, and specials in accordance with recognized industry practices achieving permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum of joints. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections.
- C. Comply with ANSI B31.1.
- D. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor at no additional cost to the OWNER
- E. Inspect each pipe and fitting to insure that there are no damaged portions of the pipe. Remove or smooth out any burrs, gouges weld splatter or other small defects prior to laying the pipe.
- F. Before placement of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance, which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the Work.
- G. Pipe shall be laid directly on moist sandbags or other suitable supports approved by the OWNER in preparation for CLSM pipe zone material. Sandbags shall be placed to provide at least 6 inches of CLSM below the bottom of the pipe. Sandbags shall be spaced at a maximum interval of 8 feet and one set shall be placed within 3 feet on both sides of each joint. Provide additional sandbags as needed to support the pipe on line and grade. No blocking using granular material from the trenches will be permitted, and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Excavations shall be made as needed to facilitate removal of handling devices after the pipe is laid. Bell holes shall be formed at the ends of the pipe to prevent point trench section at field joints to permit adequate access to the joints for connections and for application of coating on field joints.
- H. Bulkheads:
  - 1. Prior to shipment with cement mortar lining, the lining shall be wetted then a suitable bulkhead shall be attached to each end of the pipe section. This bulkhead shall remain in place and in good conditions through transit to the Project and be removed immediately before pipe placement work commences.
  - 2. During construction the openings of all pipe and specials where the pipe and specials have been cement-mortar lined in the shop shall be protected with suitable bulkheads to maintain a moist atmosphere and to prevent unauthorized access by persons, animals, water or any undesirable substance. The bulkheads shall be so designed to prevent drying out of the interior pipe. Introduce water into the pipe as needed to keep the mortar moist, where moisture has been lost due to damaged bulkheads. Contractor shall provide for maintaining barrier integrity and moisture content to protect pipe lining.
- I. Pipe Cleanup: As pipe laying progresses, keep the pipe interior free of all debris. Completely clean the interior of the pipe of all sand, dirt, mortar splatter and any other debris following completion of pipe laying and any necessary interior repairs prior to testing and disinfecting the completed pipeline
- J. Protection of Pipe: At locations where the Contractor proposes to cross the installed pipeline with heavy equipment, precautions as approved by the OWNER shall be taken to protect the pipe from damage. Acceptable precautions include: backfilling the pipe trench as necessary to protect the pipe, concrete encasing the pipe, and placing steel plating over the pipe. Any damage to the

pipe caused by the Contractor's operation or his equipment shall be repaired at no additional cost to the OWNER.

### 3.02 CLEANING AND COATING

- A. After installation of pipe, fittings, and specials, uncoated ends adjacent to field welded joints, including weld proper, shall be cleaned, primed, lined, and coated as specified for pipe adjacent to weld.
- B. Preparation of surfaces to be lined and coated shall be as stipulated for shop application of coal tar primers and enamels, except foreign matter, including damaged coating materials, shall be removed by scraping, chipping or brushing, and surfaces cleaned to bright metal free of all rust, slag, and scale by means of wire brushing or sandblasting.

### 3.03 JOINT COATING AND LINING

- A. Joint Coating: After the completion of joint testing and cleaning, all joints shall be coated. Cement-mortar coated pipe joints shall be protected as follows:
  - 1. After the pipe has been laid, the joint welded and cleaned, and after sufficient backfill has been placed between the joints to hold the pipe securely in place, the outside annular space between pipe sections shall be completely filled with grout formed by the use of a diaper. The grout space prior to filling shall be flushed with water so that the surface of the joint to be in contact with the grout will be thoroughly moistened with the grout is poured. The joint shall be filled with grout by pouring from one side only, and shall be rodded with a wire or other flexible rod or vibrated so that the grout completely fills the joint recess by moving down one side of the pipe, around the bottom of the pipe and up the opposite side. Pouring and rodding the grout shall be continued to allow completion of the filling of the entire joint recess in one operation. Care shall be taken to leave no unfilled space. Grouting of the outside joint spaces shall be kept as close behind the laying of the pipe as possible except that in no case shall grouting be closer than three joints of the pipe being laid.
  - 2. The grout band (diaper) shall be centered over the joint space with approximately equal widths extending over each pipe end and securely attached to the pipe with the steel straps. After filling the exterior joint space with grout, the flaps shall be closed and overlapped in a manner that fully encloses the grout with polyethylene foam, as applicable. The grout band shall remain in position on the pipe joint.
- B. Joint Lining: After the backfill has been completed to final grade, the interior joint recess of shop-lined pipe shall be filled with grout, tightly packed into the joint recess and troweled flush with the interior surface. All excess shall be removed. At no point shall there be in indentation or projection of the grout exceeding 1/16 inch. With pipe smaller than 24 inches in diameter, before the spigot is inserted into the bell, the bell shall be daubed with grout containing one part cement to two parts sand. The spigot end then shall be forced to the bottom of the bell and excess mortar on the inside of the joint shall be swabbed out.

### 3.04 INSTALLATION OF PIPE APPURTENANCES

- A. Installation of Valves: All valves shall be handled in a manner to prevent any injury or damage to any part of the valve. All joints shall be thoroughly cleaned and prepared prior to installation. Adjust all stem packing and operate each valve prior to installation to insure proper operation.

Valves (body and seat) shall not be subjected to test pressures greater than manufacturer's recommendation. In some cases this may require an increase in the valve pressure class.

- B. Installation of Flanged Joints: Before the joint is assembled, the flange face shall be thoroughly cleaned of all foreign material with a power wire brush. The gasket shall be centered and the connecting flanges drawn up watertight without unnecessarily stressing the flanges. All bolts shall be tightened in a progressive diametrically opposite sequence and torqued with a suitable, approved and calibrated torque wrench. All clamping torque shall be applied to the nuts only.
- C. Flexible Coupled Joints: When installing flexible couplings and gaskets are clean and free of all dirt and foreign matter with special attention being given to the contact surfaces of the pipe, gaskets and couplings. The couplings shall be assembled and installed in conformity with the recommendation and instruction of the coupling manufacturer.

### 3.05 DISINFECTION

- A. Steel pipe used for potable water service shall be disinfected after cleaning. Provide all necessary equipment and labor for the disinfection.
- B. Disinfection shall be in accordance with AWWA C651 standard and Section 02510.
- C. Discharge of chlorinated water shall comply with all Federal, State and local standards. Provide sodium bisulfite for dechlorination prior to discharge.

END OF SECTION

SECTION 15012  
DUCTILE IRON PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Detailed requirements for various ductile iron piping products.

1.02 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications, catalog cuts, and literature:

- a. Pipe.
- b. Inside linings.
- c. Mechanical and push-on joints.
- d. Flanged joints/Restrained joints.
- e. Grooved joints.
- f. Standard fittings.
- g. Special fittings.
- h. Wall pipe and floor pipe.
- i. Polyethylene encasement.

B. Submit outside coating system for buried, interior and exterior piping locations. Include submittal information specified in Section 09961.

C. Submit product data and coating system information specified above in one complete submittal.

D. Submit in accordance with Section 01330.

E. Shop drawings showing layout for ductile iron piping systems shall be submitted in accordance with and transmitted under appropriate piping system specification section.

PART 2 PRODUCTS

2.01 PIPE

A. Liquid service pipe: AWWA C151, ductile iron.

B. Gas service pipe: ANSI A21.52, ductile iron.

C. Minimum Thickness Class:

1. Mechanical and push-on joint pipe: Thickness Class 52, unless specified otherwise in piping system specification section.
2. Flanged joint pipe: Thickness Class 53.
3. Grooved joint pipe: Thickness Class 53 or as required by manufacturer conforming to AWWA C-606.

## 2.02 INSIDE LINING

- A. Comply with MAG requirements.
- B. Cement lining shall be in accordance with AWWA C104.

## 2.03 JOINTS

### A. Joint Type:

- 1. Liquid services in buried locations shall be mechanical or push-on joint. Restrain pipe as necessary.
- 2. Liquid service in locations other than buried shall be flanged, grooved end joint, or restraint mechanical coupling.
- 3. As shown on Drawings, or as specified in system Specification if different than specified above, for services and locations.

### B. Mechanical and Push-on Joints:

- 1. AWWA C111 standard shall be followed.
- 2. Gasket material:
  - a. Suitable for service and maximum operating temperature of piping system as specified in piping system specification section.
  - b. Selected by pipe manufacturer.
- 3. Restrained Joints:
  - a. Manufacturers:
    - i. American Cast Iron Pipe Company, Flex-Ring and Lok-Ring.
    - ii. U.S. Pipe and Foundry Company, TR-Flex.
  - b. Provide restrained joints for buried piping systems specifically identified to have restrained joints and for buried piping systems where use of concrete thrust blocks is not practical.
  - c. Mechanical locking type to provide positive restraint from joint separation without use of restraining rods, straps, clamps, or setscrew retainer glands.
  - d. Minimum pressure rating: 150 psi.

### C. Flanged Joints:

- 1. Flanged pipe for liquid service shall be in accordance with AWWA C115.
- 2. Flanged pipe for gas service shall be in accordance with AWWA C115 and ANSI A21.52. In addition to pipe marking specified in AWWA C115 and ANSI A21.52.
- 3. Fabrication of flanged pipe, including assembly of flange on pipe shall be performed by pipe manufacturer in accordance with AWWA C115. Assembly of flange on pipe outside of manufacturer's shop is unacceptable.
- 4. Flange material for flanged pipe shall be ductile iron. Flanged pipe with gray iron flanges is not acceptable.

5. Gasket material shall be suitable for service and maximum operating temperature of piping system as specified in piping system specification section. Torque requirement of gaskets shall be less than torque rating of flange, bolt, and nuts.
  6. Gaskets shall be ring or full face, 1/8 in. thick, and conform to dimensions shown in Appendices to AWWA C110 and AWWA C115.
  7. Bolts:
    - a. Size, length, and number as shown in AWWA C110 and AWWA C115.
    - b. Material: Potable water facility - Zinc Plated Carbon Steel, ASTM A307, Grade B;  
Non-potable water facility - Stainless Steel, ASTM Type 316.
    - c. Dimensions: ANSI B18.2.1, heavy hex.
  8. Nuts:
    - a. Size, length, and number as shown in AWWA C110 and AWWA C115.
    - b. Material: Potable water facility - Zinc Plated Carbon Steel, ASTM A307, Grade B;  
Non-potable water facility - Stainless Steel, ASTM Type 316.
    - c. Dimensions: ANSI B18.2.2, heavy hex.
- D. Grooved Joints:
1. AWWA C606.
  2. Rigid joint. Pipe ends radius cut grooved to rigid groove specifications.
  3. Grooved couplings shall be Victaulic Style 31, or approved equal.
  4. Grooved joint adapter flanges shall be Victaulic Styles 341 or 342, or approved equal.
  5. Gasket material:
    - a. Suitable for service and maximum operating temperature of piping system as specified in piping system specification section.
    - b. Selected by grooved coupling manufacturer.
  6. Coatings for grooved couplings and adapter flanges shall be same product as coatings for pipe.
- E. Ball Joint:
1. Manufacturer:
    - a. American Cast Iron Pipe Company, Flex-Ring.
    - b. Or approved equal.
  2. AWWA C151.
  3. Asphalt coating on exterior and interior cement line are in accordance with AWWA C104.
  4. Flexible ball and socket type joint, with available joint deflections of 15 degrees in any direction.
  5. Spherical Socket:
    - a. Material requirement in accordance with ASTM A536.
    - b. Ductile iron pipe barrel threads conform to ANSI B2.1.
  6. Spherical Ball is threaded onto or integrally cast with pipe barrel and machine to fit in adjoining sockets and provide compression of gasket through range of deflection. Extra

metal thickness is provided at junction of the ball and barrel to withstand the stress induced. One end of gasket is hard rubber, approximately 85 Shore Durometer hardness for protection against weathering and deterioration. Large end of gasket is soft rubber, 65 Shore Durometer hardness providing for ease of assembly.

7. Locking System:
  - a. 4 inch through 24 inch sizes: Locking system employs a heavy section external locking ductile iron gland.
  - b. 30 inch through 54 inch sizes: Joint is restrained with a ductile iron retainer ring fitted into a matted groove inside the heavy section bell.

## 2.04 FITTINGS

- A. Pressure rating shall be 150 psi, minimum.
- B. Standard fittings for liquid and air service:
  1. Mechanical and push-on joint fittings:
    - a. Ductile iron.
    - b. AWWA C110 or AWWA C153.
  2. Flanged joint fittings:
    - a. Ductile iron.
    - b. AWWA C110.
    - c. Flange dimensions in accordance with AWWA C115.
  3. Grooved joint fittings:
    - a. Ductile iron.
    - b. AWWA C110 except end preparation and wall thickness.
    - c. End preparation in accordance with AWWA C606, rigid radius groove.
    - d. Minimum wall thickness in accordance with AWWA C153.
- C. Special fittings for liquid service, not included in AWWA standards, shall be manufacturer's standard, based on AWWA design principles, and in compliance with applicable requirements of AWWA standards.
- D. Miscellaneous Fittings:
  1. Provide miscellaneous fittings, such as cutting in sleeves, tapping sleeves, caps, plugs, and other fittings, as required for complete system.
  2. Manufacturer of miscellaneous fittings shall be same manufacturer as pipe.
  3. Miscellaneous fittings shall be suitable for service.

## 2.05 OUTSIDE COATING

- A. Provide buried piping with asphaltic coating in accordance with applicable AWWA and ANSI standards.

- B. Surface preparation, priming, and finish coating of non-buried piping shall be compatible and in accordance with Section 09961 as follows:
  - 1. Interior piping: System I1.
  - 2. Exterior piping: System I2.
  - 3. Submerged piping in non-potable liquid: System I4C.
  - 4. Submerged piping in potable water: System S3.
- C. Finish color for interior and exterior piping shall be as specified in piping system Specification section.
- D. Coating for piping embedded in concrete is not required.

#### 2.06 POLYETHYLENE ENCASEMENT

- A. Provide polyethylene encasement for buried piping in accordance with AWWA C105.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. In accordance with piping system Specification section.
- B. Buried Piping: In accordance with local standards.

#### 3.02 JOINT ASSEMBLY

- A. Push-on, mechanical, and grooved joint in accordance with manufacturer's written instructions.
- B. Flanged joint in accordance with piping system specification section, flanged pipe manufacturer's written instructions, and gasket manufacturer's written instructions.

#### 3.03 POLYETHYLENE ENCASEMENT

- A. Install in accordance with AWWA C105.

#### 3.04 TAPPING

- A. Taps for cement-lined and unlined pipe shall be in accordance with pipe manufacturer's instructions.
- B. Provide service saddles for tap sizes greater than 1 in. Service saddles are not required for tap sizes 1 in. and smaller.

END OF SECTION

SECTION 15018  
POLYVINYL CHLORIDE (PVC) PIPE

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data:

1. Product data for pipe, fittings, flanges, gaskets, and bolting.
2. Proposed gasket material for each service. Submit document confirming gasket material selection is appropriate for fluid carried in system.

B. Shop Drawings:

1. Layout for PVC/CPVC piping systems in accordance with and transmitted under appropriate piping system section.

C. Submit in accordance with Section 01330.

PART 2 PRODUCTS

2.01 PVC MATERIAL

A. Type 1, Grade 1 conforming to ASTM D1784.

2.02 PIPE

A. Schedule 80 PVC conforming to ASTM D1785.

B. Schedule 80 CPVC conforming to ASTM F441.

C. PVC Pressure-Rated Pipe (SDR Series) conforming to ASTM D2241.

D. CPVC Pressure-Rated Pipe (SDR Series) conforming to ASTM F442.

E. PVC Potable Water piping conforming to ANSI/AWWA standards:

1. Standard C900 for 4" to 12" diameters.
2. Standard C905 for 14" to 48" diameters.

2.03 FITTINGS

A. Fittings shall be consistent in type to the adjacent pipe line.

B. For Schedule 80 PVC/CPVC:

1. Standard ASTM D2464 for threaded joint type.
2. Standard ASTM D2467 for socket joint type.

2.04 JOINTS

A. Provide socket type at all locations except unions, valves, and equipment with threaded or flanged end connections.

- B. Threaded connections are not acceptable for nominal piping size greater than 2 in. 2 in. and larger piping shall be solvent welded or flanged.
- C. Do not provide threaded joints for piping systems identified on Drawings or in other Sections to be provided without threaded joints.
- D. Provide joints consistent with the pipe type and type of service.

#### 2.05 FLANGES

- A. PVC/CPVC, 1 piece socket type, flat faced, conforming to ANSI B16.5 150 lb bolt hole drilling pattern.

#### 2.06 GASKETS

- A. Full-face, 1/8 in. thick flat type.
- B. When mating flange has raised face, use flat ring gasket and provide filler gasket between outside diameter of raised face and flange outside diameter to protect flange from bolting moment.
- C. Material compatible with fluid carried in system.

#### 2.07 BOLTING

- A. Material:
  - 1. Potable water facility – Zinc Plated Carbon Steel, ASTM A307, Grade B.
  - 2. Non-potable water facility - Type 316 Stainless Steel, ASTM A193, Grade B8M hex head bolts and ASTM A194, Grade 8M hex head nuts.
- B. Bolts shall conform to ANSI B.1.20.1. Provide washers of same material as bolts.
- C. Bolt threads shall be protected from galling by the use of Teflon tape or paste.

#### 2.08 SOLVENT CEMENT

- A. Join socket connections with PVC solvent cement conforming to ASTM D2564. Use appropriate primer and solvent for CPVC.
- B. As recommended by pipe and fitting manufacturer to assure compatibility.

#### 2.09 THREAD LUBRICANT

- A. Teflon tape.

#### 2.10 COATING

- A. Surface preparation and coating of non-buried piping shall be in accordance with Section 09961 as follows:
  - 1. Interior Piping: System P1.
  - 2. Exterior Piping: System P2.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Unless otherwise specified, all plastic piping installed indoors shall be Schedule 80 PVC and outdoor piping shall be Schedule 80 CPVC.
- B. All chemical piping shall be Schedule 80 CPVC.
- C. Install products as shown on Drawings, and as specified in applicable piping system Specification section(s).
- D. Install products in accordance with manufacturer's written instructions. Do not paint over threaded joints.
- E. For buried pipe, PVC/CPVC SDR series pipe may be used in lieu of PVC/CPVC Schedule 80 pipe.
- F. All potable water pipe, fittings and appurtenances shall conform to NSF Standard 61.

END OF SECTION

SECTION 15050  
GATE VALVES

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

A. Design Requirements:

1. Provide bubble-tight at rated pressures with flow in either direction.
2. Satisfactory for applications involving frequent operation and applications involving valve operation after long periods of inactivity.
3. Water working pressure:
  - a. 3 inch. through 12. inch: 175 psi
  - b. 14 inch. and larger: 150 psi

1.02 SUBMITTALS

A. Shop Drawings:

1. Submit in accordance with Section 01330.

B. Operation and Maintenance (O&M) Data:

1. Submit in accordance with Section 01785.

1.03 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements:

1. Components and installation shall comply with all federal, state and local codes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Mueller Co.
- B. Or approved equal.

2.02 VALVE CONSTRUCTION

- A. Comply with AWWA C509 or C515, resilient seated gate valve.

- B. Provide with clear waterway equal to full nominal diameter of valve.
- C. For interior or exposed installations, provide handwheel with arrow cast in metal to indicate direction of opening. Opening effort shall not exceed 80 ft-lbs. Provide enclosed spur or bevel gearing as required with gear cases.
- D. Provide bypasses on 14 in. and larger valves. Process isolation valves will not require bypasses.
- E. End Connection:
  - 1. Flanged joint end connections in accordance with AWWA C115.

### 2.03 VALVE OPERATORS

- A. Furnish gear actuator or lever as indicated below.
- B. Valve Boxes:
  - 1. 3 piece assembly.
  - 2. Provide 5-1/4 in. valve box diameter.
    - a. Class I, Div 1, Group D where indicated.
    - b. Class I, Div 2, Group D where indicated.
  - 3. Construct box and cover of cast iron in accordance with ASTM A48, Class B.
  - 4. Provide valve with extended stem.
  - 5. Stop stem 12 in. below box cover.
  - 6. Provide one 4 ft long tee wrench for operating valve.
- C. Stuffing Boxes:
  - 1. Provide O-ring seal type with two rings.
  - 2. Upper ring serving as dust seal and lower ring as pressure seal.
- D. Bolts and Nuts: ASTM A307, galvanized.
- E. Non-Rising Stems: cast integral stem collar.
- F. Gates and Gate Rings for AWWA C509 Valves.
  - 1. Construct of high strength cast iron or bronze.
  - 2. Apply resilient seat to body and/or gate.
  - 3. Resilient seat shall seal against corrosion resistant surface.
  - 4. Bond rubber material seats in accordance with ASTM D429.
  - 5. Use non-corrosive hardware for mechanically attached resilient seats.
  - 6. Epoxy coating meets or exceeds all requirements of AWWA C550.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Installation shall follow manufacturer's recommendations.

END OF SECTION