

Alto Lakes Water & Sanitation District
Phase A Waterline Completion Project

TECHNICAL SPECIFICATIONS

SECTION 01 00 00
BASIC REQUIREMENTS

PART 1 GENERAL

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1.2 CONTRACT DESCRIPTION

- A. Work of the Project includes installation of new 8-inch PVC C900 DR25 waterline, gate valves, pressure reducing valves in traffic rated vaults, air release valves, fittings, meter re-connections, new meter connections, fire hydrants, completion of incomplete fire hydrants, restoration of driveway and roadways, restoration of landscaping elements, asphalt patching and overlay of Lincoln County Roads, and interconnections. Contractor will be responsible for testing and disinfecting the completed waterline (including the existing waterline within the project limits).

- B. Perform Work of Contract on a unit cost basis with Owner in accordance with Conditions of Contract.

1.3 SPECIAL CONSIDERATIONS

- A. Ground surfaces will be restored to their original condition by grading, and seeding with native plant species.

- B. Should nesting of a species protected under the Migratory Bird Treaty Act be identified in the construction zone, construction will be limited to a time of year outside the general migratory bird nesting season of March through August, avoided until nesting is complete, or the nest will be relocated by a properly trained and authorized expert.
- C. The length of trench left open overnight will be minimized and, should a trench be left open, a ramp will be maintained to allow the escape of trapped animals.
- D. Contractor will be responsible for re-grading the existing road and driveways in order to provide access to residential site.
- E. Contractor must provide water for construction at the Contractor's expense. The Owner has indicated that water can be made available for purchase.
- F. Contractor shall submit a Testing and Disinfection schedule to the Engineer for approval prior to performing the respective activities. Hydrostatic testing of the waterline, disinfection and bacteriological testing shall follow specifications outlined in Section 33 11 00 Water Utility Distribution Piping, 33 13 00 Disinfection of Water Distribution, AWWA C600, AWWA C605, AWWA C651 and New Mexico Standard Specifications for Public Works Construction.
- G. Prior to beginning construction, the Contractor must furnish full-coverage video documentation of the entire construction site prior to beginning construction activities. The video must include coverage of all areas and adjacent features that may potentially be impacted by the impending construction work. Contractor must submit two (2) copies of the video documentation on DVD format as part of the submittal process.
- H. Contractor shall prepare record drawing information under the direction of a Licensed Professional Surveyor. Refer to Article 1.51 Project Record Documents below and General Notes on the Drawings for specific requirements related to As-Built Drawings.
- I. Contractor shall coordinate with Owner for tie-in to existing water system. Contractor shall notify Engineer prior to performing the respective activities.
- J. Owner shall warrant those portions of the previously installed waterline within the project limits. Defect found during pressure testing shall be repaired by the Owner in a timely manner.
- K. Contractor shall be responsible for notifying residents adjacent to construction 48 -hours in advance of work affecting their properties. Access to driveways must be maintained at all times.
- L. The Contractor shall consider the material to be provided and warranted by Owner for related bid items.
- M. Prior to handling, all materials shall be visually inspected for damage, including coatings and surfaces. Any damaged materials should be reported to the Owner, Engineer, and Construction Observer before removing from the Owner's storage yard.

- N. Owner inventory is listed below in Section 1.4.C.
- O. Reference Supplementary Conditions-4.04 Underground Facilities.

1.4 WORK BY OWNER

- A. Owner will provide 750,000 gallons of construction water to the Contractor at a metered fire hydrant adjacent to the Owner water storage tanks at no charge to the Contractor.
- B. The Owner has an active Stormwater Pollution Prevention Plan (SWPPP) in place for this project. The Contractor shall prepare and submit an amendment to the SWPPP, which identifies them as the responsible contractor.
- C. Material provided and warranted by Owner:

Item No.	DESCRIPTION	Unit	Qty
1	Pressure reducing valve 6" F115 p.n. 201804 R & L Carrier Pro Number 1023320809	EA	5
2	Bend 8" 22.5° MJ FBE	EA	13
3	Bend 8" 11.25° MJ FBE	EA	15
4	Bend 8" 45° MJ FBE	EA	23
5	Air Release valve 1" #25.5 150 psi	EA	5
6	Tape 6" x 1000' detectable Water	RL	34
7	Pipe 8" x 20ft DR25 C900 165 psi*	FT	18,554
8	Pipe 6" x 20ft C900 DR18 CL235	FT	36
9	Tee 8"x6" DI SSB MJxFlg w/o acc. Fusion bonded	EA	37
10	Stargrip 8" series 4000 w/accys	EA	377
11	Stargrip 6" series 4000 w/accys	EA	237
12	Stargrip 3" series 4000 w/accys	EA	64
13	Wye 8" MJ less/accys Fusion Bonded	EA	1
14	Tee 8in DI SSB MJ w/o acc. Fusion bonded	EA	5
15	Tee 8" x 6" DI SSB MJ w/o acc. Fusion bonded	EA	32
16	Reducer 8" x 3" consisting of 8" x 4 MJ reducer and 4" x 3" SEB reducer fusion bonded	EA	11
17	Reducer 8 x 6 DI MJ FBE w/o acc. Fusion bonded	EA	9
18	Bend 8" 90 deg FBE w/o acc. Fusion bonded	EA	16
19	Bend 8" 45 deg FBE w/o acc. Fusion bonded	EA	23
20	Bend 6" 45 deg FBE w/o acc. Fusion bonded	EA	1
21	Bend 3" 45 deg FBE w/o acc. Fusion bonded	EA	22
22	Cap 6" FBE w/o acc. Fusion bonded	EA	3
23	Cap 3" FBE w/o acc. Fusion bonded	EA	10
24	Valve gate 8" MJ 8571 Res seat	EA	40
25	Valve gate 6" MJ 8571 Res seat	EA	68

26	Valve gate 8571 4" MJ Res seat	EA	9
27	Gate Valve 3" #8572 MJ x Flange	EA	2
28	Hydrant K81D NST 4ft 6in Bury MJ 3 Way #K6151026345R	EA	31
29	Tracer Wire 12 Gauge Blue in 500ft rolls	EA	36
30	Saddle 8in x 3/4, 202B-962-CC3 CC Tap for AC Pipe	EA	87
31	Adapter 6" MJ x FLG FBE w/o acc. Fusion bonded	EA	8
32	8" to 4" MJ adapter	EA	10
33	6"x12" flange to flange barrels (5-with 1" coupling welded in barrel)	EA	24
34	6"x30" flange to flange barrels	EA	8
35	Romac Industries #105-0730040, SST-MJ-7.30x4 outlet OD, range 6.90-7.30 nom 6"	EA	8
36	Romac Industries #105-0945080, SST-MJ-9.45x8 outlet, range 9.40-9.45, 8x8	EA	1
37	Romac Industries #100-0945031, SST-9.45x3SS flange, 8" nom	EA	1
38	Romac Industries #100-0730031, SST-7.3x3SS flange, 6" nom	EA	1
39	Pipe joint lube, 8# bucket	EA	7
40	Pipe joint lube, 2# bucket	EA	3
41	8"X4" MJ adaptor	EA	10

*see Exhibit "B" for pipe manufacturer's identification of pipe suitability for use.

- D. Contractor to provide all parts necessary to complete the project bid items beyond those identified in the Owner inventory as part of the unit pricing on the Bid Form.

1.5 CONTRACTOR'S USE OF PREMISES

- A. No work shall be done before 7:00 A.M. or after 7:00 P.M., local time on a working day, on Sundays, or on legal holidays, except as necessary for the proper care and protection of work already performed, or during emergencies.
- B. The Contractor shall make every effort to minimize noise caused by his operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise.
- C. The Contractor shall restrict his operations as nearly as possible to the immediate site. Unnecessary cutting of vegetation adjacent to the site is prohibited. Every effort shall be made to minimize erosion during and after construction and the site shall be returned to its original condition, except where improvements are indicated or required.
- D. The Contractor shall take affirmative action to prevent the misuse of the natural environment, wasting of natural resources, or destruction of natural values.

- E. The Contractor shall conform to all requirements set forth in the latest edition of the New Mexico Standard Specifications for Public Works Construction with latest revision, and Occupational Safety and Health Administration Regulations for trenching, shoring and excavation, and all other activities where such regulations apply. The Contractor and all subcontractors shall conduct all activities in conformance with federal and state laws and regulations relating to occupational health and safety. Authorized inspectors from NMED's Occupational Health and Safety Bureau shall have unobstructed access to project sites and shall not be impeded in any way from performance of their duties.

1.6 SPECIFICATION CONVENTIONS

- A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.
- B. The Contractor shall furnish all materials, labor, plant and equipment necessary to complete the contract work as called for by the Technical Specifications and as indicated on the Drawings. Material and work, either expressed or implied, necessary for the satisfactory completion of the contract work shall be considered an integral part thereof.

- C. All standards incorporated herein by reference shall be the latest edition, unless otherwise specified. The abbreviations and applicable standards are described below:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AIA	American Institute of Architects
ANSI	American National Standards Institute, Inc.
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CID	Construction Industries Division of the NM Regulation and Licensing Department
EJCDC	Engineers Joint Contract Documents Committee
EPA	Environmental Protection Agency
IBC	International Building Code
ISO	International Organization for Standardization
MSJC	Masonry Standards Joint Committee
NACE	National Association of Corrosion Engineers
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Department of Environment
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
SAE	Society of Automotive Engineers
SSPC	Steel Structure Painting Council
UL	Underwriters Laboratories, Inc.

1.7 MINIMUM WAGE RATE DETERMINATION

- A. Article 13-4-11, NMSA, 1978, requires that prevailing local wages be determined by labor category, and that this prevailing wage be the minimum acceptable pay rate. The Public Works Minimum Wage Act covers all public works construction, alteration, demolition, or repair projects when the project cost is \$60,000 or more, and when the

state or any political subdivision is a party. The wage rate determination provided by the New Mexico Department of Workforce Solutions for the present project can be found in an appendix to the Contract Documents.

1.8 TESTING AND INSPECTION ALLOWANCES

- A. Testing Allowance: The bid schedule includes a predetermined sum to cover the cost of testing and inspection services as required in the Contract Documents.
- B. Costs Included in Allowance: Cost of engaging testing or inspection firm, execution of tests or inspection, and reporting of results.
- C. Costs Not Included in Allowance:
 - 1. Incidental labor and facilities required to assist testing or inspection firm.
 - 2. Cost of disinfection of waterlines.
 - 3. Costs of hydrostatic pressure testing or testing of material welds as called for in the Contract Documents.
 - 4. Costs of failed tests.
- D. Costs will be drawn from testing allowance and paid based on invoice(s) submitted to Contractor by testing or inspection firm(s). Contractor shall submit appropriate NTTC form to testing firm to assure tax is not included on invoices.

1.9 SCHEDULE OF VALUES

- A. Submit schedule of values on the Construction Progress sheet within the Application for Payment forms provided in the Construction Contract Documents or on other form acceptable to the Engineer. Contractor's standard form or electronic media printout will be considered.
- B. Base structure of Schedule of Values on Bid Schedule with identical item numbering, quantities, and values.
- C. Submit Schedule of Values in duplicate at least 15 days prior to first Progress Meeting.

1.10 APPLICATIONS FOR PAYMENT

- A. Application for Payment is synonymous with Partial Payment Estimate.
- B. Submit four [4] copies of each application on the Partial Payment Estimate form provided in the Contract Documents, together with updated Schedule of Values identifying fully the list of items in the Application for Payment.
- C. The Partial Payment Estimate forms consist of four sections: Cover Sheet, Construction Progress spreadsheet, Materials-On-Hand form, and Monthly Construction Progress Certificate. The purpose of the Monthly Construction Progress Certificate is to provide a complete account of all change orders/claims for the corresponding contract period, and

all outstanding change orders/claims from previous contract periods, and waives any rights to further adjustments in contract times or price for any change orders/claims that originated in the current contract period.

- D. Payment Period: Monthly, however payment may not be made by the owner until 45 days after submission of an undisputed request for payment for portions of the Work to be paid for with State funding.

1.11 CHANGE PROCEDURES

- A. All Change Orders shall be prepared on the form provided in these Contract Documents.
- B. Unit Price Change Order: For pre-determined unit prices and quantities, Change Order will be executed on fixed unit price basis. For unit costs or quantities of units of work not pre-determined, refer to Article 12 - Change of Contract Price; Change of Contract Times, of the Standard General Conditions (EJCDC C-700 Standard General Conditions of the Construction Contract).

1.12 UNIT PRICES

- A. Engineer will take measurements and compute quantities accordingly. The Contractor will assist in taking of measurements and determination of work completed prior to preparation of corresponding Application for Payment.

1.13 ALTERNATES

- A. No Owner alternatives are included on the Bid Form.

1.14 COORDINATION

- A. Coordinate scheduling, submittals, and Work of various sections of specifications to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify utility requirement characteristics of operating equipment are compatible with building utilities.
- C. Submit a Traffic Control Plan, which shall be approved by the Engineer before continuing with the project.
 - 1. All existing signs, markers, delineators, etc. within the construction limits shall be removed, stored, and reset.
 - 2. Subject to the approved Traffic Control Plan, at least one lane shall be open to traffic at all times. Provide proper signage to maintain the traffic lane in such a manner as to assure proper safety to the traveling public on all affected roads. Provide access to all private and public property at all times except when grading, excavation and backfill operations are being conducted immediately in front of the property, in which case access will not be denied for more than 4 hours without approval from the Engineer.

3. Traffic lanes provided during construction shall be maintained in such a condition under all weather conditions, to permit the reasonable passage of passenger vehicles, and shall be kept graded smooth, and watered several times daily, as needed, to control dust.
- D. Obtain all applicable permits from the Lincoln County Roads Department before boring under any roadways or working along or across Lincoln County rights-of-way, unless the permits have already been obtained by the Engineer. The Contractor is also responsible for obtaining all applicable local, county and state building and development permits not previously obtained by Engineer or Owner. This includes permits from the Construction Industries Division of the Regulation and Licensing Department of the State of New Mexico, and any other regulatory agency having jurisdiction.
 - E. Contractor is responsible for timely scheduling of any pertinent inspections with local, county, and state agencies with jurisdiction, and as required by the permits.
 - F. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable.
 - G. All notices, demands, requests, instructions, approvals, proposals, and claims must be in writing.
 1. Any notice to or demand upon the Contractor shall be sufficiently given if delivered at the office of the Contractor stated on the signature page of the Agreement.
 2. All papers required to be delivered to the Owner shall, unless otherwise specified in writing to the Contractor, be delivered to the Owner at the address stated on the signature page of the Agreement.
 3. Any such notice shall be deemed to have been given as of the time of actual delivery, in the case of mailing, when the same should have been received in due course of post, or in the case of telegrams, certified mail, or telephone facsimiles, at the time of actual receipt as the case may be.

1.15 SUSPENSION OF WORK

- A. The Owner may order suspension of work due to seasonal or other conditions unsuitable for construction work.
- B. Maintenance during suspension: Prior to suspension for any cause, the Contractor shall take necessary precautions to protect the work during the period of suspension from any factors, which would contribute to its deterioration.
- C. Time elapsed during suspension of the work shall not count as contract time. The Contractor shall make no claim for damages due to delay, additional mobilization charges, nor any additional costs that may be incurred solely due to suspension of work.
- D. Requests for additional time to be added after the “contract completion date” due to delays or extra work shall be made to the Owner in writing by the Contractor within ten

(10) days after the time of the occurrence of the delay or receipt of a Change Order for extra work. Such requests shall set forth the justification for the additional time.

- E. Upon approval, the additional contract time shall then be in full force and effect, the same as though it were the original date for completion, and will be shown as the completion date plus an amount of additional working days. Any time required to complete the work beyond the contract time or additional contract time will result in the assessment of liquidated damages, as specified in the Contract Documents. Failure to make such requests within the above limits will be considered as a waiver on the part of the Contractor as to the need for additional contract time.

1.16 FIELD ENGINEERING

- A. Establish elevations, lines, and levels, certify and confirm elevations and locations of the Work, conforming with the Contract Documents, with the Engineer prior to performing any excavation.
- B. Verify field measurements are as indicated on shop drawings or as instructed by manufacturer.
- C. From the information provided by the Owner, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, easement alignments, stakes for pipe locations and other working points, lines, elevations and cut sheets.

1.17 PRE-CONSTRUCTION CONFERENCE

- A. Engineer will schedule Pre-Construction Conference after Notice of Award for affected parties.
- B. The Contractor, or his duly authorized representative, and subcontractor representatives will attend the meeting.

1.18 PROGRESS MEETINGS

- A. Schedule in coordination with the Engineer at maximum monthly intervals, and attend all Progress Meetings throughout progress of the Work.
- B. The purpose of the meetings will be to review the following:
 1. Work progress since previous meetings.
 2. Field observations, problems, conflicts.
 3. Problems which impede construction schedule.
 4. Corrective measures and procedures to regain projected schedule.
 5. Revisions to construction schedule.
 6. Plan progress and schedule during succeeding work period.
 7. Coordination of schedules.
 8. Off-site fabrication and delivery schedules.
 9. Maintenance of quality standards.
 10. Proposed changes, construction schedule and completion date.

11. Coordination of separate contracts.
 12. Record or "as-built" drawings of completed work.
 13. Other business as required.
 14. Regulatory requirements including OSHA, New Mexico Board of Labor, and others as applicable.
 15. Funding requirements including RUS, NMED, NMFA, DFA, USEPA and others as applicable.
- C. During each meeting, the Contractor is required to present any issues, which may affect his Work, with a plan to resolve these issues expeditiously.
- D. Together with each payment application, Contractor must present the current as-built drawings reflecting all work performed to date.

1.19 CUTTING AND PATCHING

- A. Employ skilled and experienced installer to perform cutting and patching new Work; restore Work with new Products.
- B. Execute cutting, fitting, and patching, including excavation and fill, to complete Work, and to:
1. Uncover Work to install or correct ill-timed Work.
 2. Remove and replace defective and non-conforming Work.
 3. Remove samples of installed Work for testing.
 4. Provide openings in elements of Work for penetration of mechanical and electrical Work.
- C. Cut masonry and concrete materials using masonry saw or core drill. Restore Work with new Products in accordance with requirements of Contract Documents.
- D. Fit Work tight to adjacent elements. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- E. Refinish surfaces to match adjacent finishes.

1.20 SUBMITTAL PROCEDURES

- A. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- B. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions and elevations, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- C. Identify variations from Contract Documents and Product or system limitations, which may be detrimental to successful performance of completed Work.

- D. Revise and resubmit submittals as required by the Engineer; identify changes made since previous submittal.
- E. Submit number of copies Contractor requires, plus two copies Engineer will retain, at a minimum, unless otherwise indicated at the Pre-Construction Conference.
- F. Transmit each submittal with Engineer accepted form.
- G. Distribute copies of reviewed submittals as appropriate. Instruct parties to report promptly inability to comply with requirements.
- H. Prior to commencing construction activities, Contractor must submit a safety plan for approval by Engineer.

1.21 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedule in duplicate within fifteen [15] days after date of Owner-Contractor Agreement for Engineer review.
- B. Submit revised schedules with each Application for Payment, identifying changes since previous version. Indicate estimated percentage of completion for each item of Work at each submission.
- C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.
- D. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.
- E. Indicate delivery dates for Owner furnished products and products identified under Allowances.

1.22 PROPOSED PRODUCTS LIST

- A. Unless required as an attachment to Bid, within 15 days after date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.23 PRODUCT DATA

- A. Product Data: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Submit copies and distribute in accordance with Submittal Procedures article.

- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.24 SHOP DRAWINGS

- A. Shop Drawings:
 - 1. Submitted to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
 - 2. Include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items.
 - 3. Design calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state wherein the project is to be built, unless otherwise directed.
 - 4. After review, provide copies and distribute in accordance with Submittal Procedures article and for record documents purposes as specified.
 - 5. Except as may otherwise be indicated herein, the Engineer will return copies of each submittal to the Contractor with comments noted thereon, within 30 calendar days following their receipt by the Engineer.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Submit number of opaque reproductions Contractor requires, plus two copies Engineer will retain.

1.25 TEST REPORTS

- A. Submit for Engineer's knowledge as contract administrator or for Owner.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.26 MANUFACTURER'S INSTRUCTIONS AND CERTIFICATES

- A. When specified in individual specification sections, submit manufacturer printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- C. When specified in individual specifications sections, submit certifications by manufacturer to Engineer, in quantities specified for Product Data.

- D. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- E. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

1.27 QUALITY CONTROL

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturer's instructions.
- C. Comply with specified standards as minimum quality for the Work except when tolerances that are more stringent, codes, or specified requirements indicate higher standards or more precise workmanship.

1.28 TOLERANCES

- A. Monitor fabrication and installation tolerance control of installed products over suppliers, manufacturers, products, site conditions, and workmanship, to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply fully with manufacturer's tolerances.

1.29 REFERENCES

- A. Conform to reference standards by date of issue current as of date of Contract Documents.
- B. When specified reference standard conflict with Contract Documents, request clarification from Engineer before proceeding.

1.30 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to furnish qualified staff personnel to observe site conditions and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions that are supplemental or contrary to manufacturer's written instructions.

1.31 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify utility services are available, of correct characteristics, and in correct location.

- C. Contractor is solely responsible for utility location, protection and verification. Contractor must notify New Mexico One Call System Inc., at 811, and all local utility providers, three (3) days before starting utility line construction.
- D. It shall be the responsibility of the Contractor to become acquainted with the location of all underground structures which may be encountered or which may affect the Work hereunder.

1.32 TEMPORARY SERVICES

- A. Provide, maintain, and pay for suitable quality water service as required.
- B. Maintain uninterrupted water and electric service to all properties adjoining the Work, except where specifically approved by the authority having jurisdiction. Services damaged by the Contractor shall be immediately and permanently repaired or replaced at the expense of the Contractor. Give a minimum of 48-hour advance notice to occupants of adjacent properties before interrupting any service. Any interruption of service shall be kept to the minimum length of time possible.
- C. Until final inspection and approval of the Work and issuance of the Certificate of Substantial Completion, the Contractor is responsible for all Work directly or indirectly affected by the Contractor's activities. Such responsibility continues for all Work detailed on the punch list that may accompany the Certificate of Substantial Completion, until satisfactorily completed by the Contractor and approved by the Owner and Engineer.
- D. Furnish, install and maintain any temporary water storage structures, electrical connections, meters, wiring, outlets, switches, lamps, etc., as necessary for the work. The Contractor shall provide such temporary heat as may be necessary for the prevention of injury to the work or material through dampness or cold. All temporary connections, installations, facilities and supplies furnished or installed as specified in this paragraph, shall be removed prior to the completion of the Contract, and the premises left perfectly clean and satisfactory to the Owner.
- E. Maintain ambient temperature above freezing in enclosed/occupied areas where construction is in progress, unless indicated otherwise in specifications.
- F. Provide temporary electricity and power outlets for construction operations, connections, branch wiring, distribution boxes, and flexible power cords as required. Do not disrupt Owner's need for continuous service.
- G. Provide and maintain required sanitary facilities and enclosures in clean and sanitary condition.

1.33 ACCESS ROADS

- A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.
- B. Existing on-site roads, designated by the Owner, may be used for construction traffic.

1.34 PROGRESS CLEANING AND WASTE REMOVAL

- A. Collect and maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Remove waste and surplus materials, rubbish, and construction facilities from site. Restore all job sites and adjoining areas, including roads and driveways, to a condition equal to or better than the original status. Special attention will be made to not disturb unimproved roads by placing any excavated material to the sides of these roads when water lines are located along the right-of-way.
- C. Brush and trees shall be felled parallel to the right-of-way to minimize damage to trees and structures on adjacent property. All brush, tree tops, stumps and other debris shall be removed from the right-of-way and disposed of by the Contractor, subject to and in conformity with the special provisions applying to the tract of land involved (if any). The Contractor shall not destroy nor remove any trees, shrubbery, nor any other improvements, without permission of the Owner.
- D. The Contractor shall not dispose of debris, refuse, or sanitary wastes in an open dump or in a natural watercourse, whether on public or private property, or in such places that undesirable wastes can eventually be exposed or carried to a natural watercourse.

1.35 PROJECT IDENTIFICATION

- A. No project sign is required
- B. The Contractor shall not erect, or permit the erection of advertising signs. Only minimal identification and direction signs shall be permitted on the site. Unnecessary or obnoxious posters, pictures, signs, symbols, drawings or writing on work, material, or equipment, resulting from vandalism or other causes, shall be covered or removed by the Contractor.

1.36 BARRIERS AND FENCING

- A. Provide barriers or fencing to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage.

1.37 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual specification sections.

1.38 SECURITY

- A. Provide security and facilities to protect Work and existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.39 WATER CONTROL

- A. Provide erosion control.
- B. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. The Contractor shall submit to the Owner's Representative an amendment to the Owners Storm Water Pollution Prevention Plan (SWPPP), which was prepared in accordance with the National Pollution Discharge Elimination System (NPDES) general permit requirements for all construction activities, and shall include all required reporting. If the Bid Form does not include an item for preparation and implementation of the SWPPP, the cost thereof will be considered incidental to related work.
- D. The Contractor shall conduct his operations to minimize damage to natural watercourses, and shall not permit petroleum products, volatile fluid wastes, or any other wastes which are prohibited by local ordinances, or excessive amounts of silt, clay, or mud to enter any drainage system. The bed of natural watercourses or man-made irrigation ditches shall be restored to normal gradient and cross-section after being disturbed.

1.40 POLLUTION AND ENVIRONMENTAL CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Provide dust control, erosion and sediment control, noise control, pest control and rodent control to allow for proper execution of the Work. Short term effects of dust produced by equipment will be mitigated by sprinkling traffic areas with water. Motor equipment shall be kept in repair and equipped with anti-pollution devices, if possible, to cut down on exhaust emissions. Burning as a method of cleaning or disposal will not be permitted without approval of the proper authorities.
- C. Comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act of 1970 (42 U.S.C. 1251 et seq.) as amended. Violations shall be reported to the New Mexico Environment Department.
- D. The Contractor shall be responsible for the reporting and the cleanup of spills associated with project construction and shall report and respond to spills of hazardous materials such as gasoline, diesel, motor oil, solvents, chemicals, toxic and corrosive substances, and other materials which may be a threat to the public health or the environment. The Contractor shall be responsible for reporting past spills encountered during construction and of current spills not associated with construction. Reports shall be made to the New Mexico Environment Department Emergency Response Team at (505) 827-4308 or (505) 470-3657 and to the Owner's Representative. The Contractor shall clean up any unreported spills associated with project construction identified after construction.

1.41 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, and materials, prior to Substantial Completion review.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.42 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials or components specifically identified for reuse.
- B. Do not use materials and equipment removed from existing premises, except as specifically identified or allowed by the Contract Documents.
- C. Provide interchangeable components of same manufacturer for components being replaced.

1.43 DELIVERY, HANDLING, STORAGE, AND PROTECTION

- A. Deliver, handle, store, and protect Products in accordance with manufacturer's instructions.

1.44 SUBSTITUTIONS

- A. Substitutions will only be considered when Product becomes unavailable through no fault of Contractor.
- B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- C. Submit three [3] copies of request for Substitution to the Engineer for consideration. Limit each request to one proposed Substitution.

1.45 CLOSEOUT PROCEDURES

- A. Submit written certification Contract Documents have been reviewed, Work has been inspected, and Work is complete in accordance with Contract Documents and ready for Engineer's inspection.
- B. Submit final Application for Payment identifying total adjusted Contract Price, previous payments, and amount remaining due.

- C. Required closeout submittals include: Release of Liens, Consent of Surety, and Certification of Labor Standards.

1.46 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Upon completion of the work under this contract, thoroughly clean and make any needed repairs caused by damage during construction to any existing utilities or other structures on the site.
- C. Notify the Engineer in writing once final cleaning is complete. The final estimate will not be prepared until the Contractor has complied with all requirements set forth and the Engineer has made his final inspection of the entire work and is satisfied that it is properly constructed and the site properly cleaned.

1.47 STARTING OF SYSTEMS

- A. Provide seven [7] days notification prior to start-up of each item.
- B. Ensure each piece of equipment or system is ready for operation.
- C. Execute start-up under supervision of responsible persons in accordance with manufacturer's instructions.
- D. Submit written report stating equipment or system has been properly installed and is functioning correctly.

1.48 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six [6] months.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at designated location.

1.49 TESTING, ADJUSTING, AND BALANCING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Owner retains the right to appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing. Reports will be submitted by independent firm to Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with requirements of Contract Documents.

- C. Contractor will cooperate with independent firm; furnish assistance as requested.
- D. Re-testing required because of non-conformance to specified requirements will be charged to Contractor.

1.50 PROTECTING INSTALLED CONSTRUCTION

- A. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- B. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- C. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- D. Prohibit traffic from landscaped areas.

1.51 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of Contract Documents to be utilized for record documents.
- B. Record actual revisions to the Work. Record information concurrent with construction progress.
- C. Specifications: Legibly mark and record at each Product section description of actual Products installed.
- D. Record Documents and Shop Drawings (As-Built Drawings): Legibly mark each item to record actual construction. Deliver two (2) sets of As-Built Drawings with redlines to the Owner upon completion of the Project. The As-Built Drawings will be submitted to the Engineer prior to processing of final payment to the Contractor.
- E. Contractor shall prepare record drawing information under the direction of a Licensed Professional Surveyor. As-Built Record Drawings shall include elevation at top of pipe, northing and easting of top of waterline or new utility at intervals not to exceed 100 feet and at all fittings, valves and transitions and other appurtenances as well as finished grade elevations at same and at the top of flange or top of nut (specify on drawing point description) of all hydrants. Ties to surface features for triangulation purposes in the field shall also be included. Final As-Built Record Drawings shall be stamped by a Licensed Professional Surveyor, tied to established control monuments and other reference points (including D.O.T. monuments and mile markers if available) on the New Mexico State Plane Coordinate System, Central Zone, NAD83/NAVD88 datum, stating combined ground-to-grid scale factor used, equipment used and date of completion of survey.
- F. Submit documents to Engineer together with claim for final Application for Payment.

1.52 OPERATION AND MAINTENANCE DATA

- A. Submit 3 sets prior to final inspection, bound in 8-1/2 x 11 inch text pages, three D side ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.
- C. Internally subdivide binder contents with permanent page dividers, logically organized.
- D. Contents:
 - 1. Part 1: Directory
 - a. List names, addresses, and telephone numbers of Engineer, Contractor, subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system:
 - a. Equipment summary, operational procedures, preventive maintenance procedures and schedules, parts list, shop drawings, safety issues.
 - 3. Part 3: Project documents and certificates.
 - a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

1.53 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.
- B. Deliver to project site and place in location as directed by Engineer; obtain receipt prior to final payment.

1.54 WARRANTIES

- A. Execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers for all products with extended warranties beyond one (1) year.
- B. Submit prior to final Application for Payment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 03 05 00

BASIC CONCRETE MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes formwork, reinforcement, accessories, cast-in-place concrete, transporting, placing, finishing, curing, and other pertinent items of construction.
- B. Concrete and Standards - Except as noted or modified in this section, all concrete materials, transporting, placing, finishing, curing, and sealing shall conform to requirements as follows:
 - 1. American Institute of Concrete (ACI)
 - a. 301 - Specifications for Structural Concrete.
 - b. 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - c. 306 - Cold Weather Concreting.
 - d. 308.1 - Standard Specification for Curing Concrete.
 - 2. American Society for Testing and Materials (ASTM)
 - a. ASTM C31 - Practices for Making and Curing Concrete Test Specimens in the Field.
 - b. ASTM C33 - Specifications for Concrete Aggregate.
 - c. ASTM C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - d. ASTM C94 - Specification for Ready-Mixed Concrete.
 - e. ASTM C143 - Test Method for Slump of Hydraulic Cement Concrete.
 - f. ASTM C150 - Specification for Portland Cement.
 - g. ASTM C156 - Test Methods for Water Retention by Concrete Curing Materials.
 - h. ASTM C227 - Test for Potential Alkali Reactivity of Cement- Aggregate Combinations.
 - i. ASTM C260 - Specification for Air-Entraining Admixtures for Concrete.
 - j. ASTM C441 - Test for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to Alkali-Aggregate Reaction.
 - k. ASTM C494 - Specification for Chemical Admixtures for Concrete.

1.2 QUALITY ASSURANCE

- A. Inform Engineer at least 48 hours in advance of time at which Contractor intends to place concrete.
- B. When required by any applicable permits, such as CID permits, Contractor shall have reinforcement inspected by the agency with jurisdiction prior to placement of concrete.
- C. Construct and erect concrete formwork in accordance with ACI 301 and ACI 347.

- D. Concrete tests shall be in accordance with requirements of ACI 301, Chapter 16 - Testing, except as noted or modified in this Section.
1. Strength test:
 - a. Mold and cure 5 cylinders from each sample.
 - b. Test one at 7 days and one at 14 days for information and two at 28 days for acceptance.

- E. Samples:
1. Collect the following minimum samples for each 28-day strength concrete used in the work for each days placing. No sample shall be required for thrust blocks or fence posts.
 2. Hold fifth cylinder for future considerations.

<u>Quantity</u>	<u>Number of Samples</u>
50 cubic yards or less	1
50 to 100 cubic yards	2
100 cubic yards or more	2 plus 1 sample for each additional 100 cubic yards

3. Sample marking.
 - a. Mark or tag each sample of compression test cylinders with date and time of day cylinders were made.
 - b. Identify location in work where concrete represented by cylinders was placed.
 - c. Identify delivery truck or batch number, air content and slump.
 4. Slump test:
 - a. Conduct test for each strength test sample and whenever consistency of concrete appears to vary.
 5. Air content:
 - a. Conduct test from 1 of first 3 batches mixed each day and for each strength test sample.
- F. Coordinate concrete placement with the Engineer to ensure proper testing in compliance with the Drawings and Specifications. The cost of all tests shall be covered by the Testing Allowance provided for in the bid schedule, except for failed tests, or new analyses required due to failed tests.
- G. The Contractor is free to take additional specimens for his own information, at his own expense, not reimbursable from the Testing Allowance.
- H. Acceptance of Concrete: Strength level of concrete will be considered satisfactory so long as average of all sets of 3 consecutive strength test results equal or exceeds specified 28-day strength and no individual strength test result falls below specified strength by more than 500 psi.
- I. Failure of Test Cylinder Results: Upon failure of test cylinder results, Engineer may require Contractor, at his expense, to test remaining cylinder after curing for a period of

time specified by Engineer. If strength level of this cylinder is not greater than specified 28-day strength, Engineer may require Contractor to obtain and test at least three 2-inch diameter cored samples from an area in question.

1. Conform to ASTM C42.
2. Concrete will be considered adequate if average of 3 cores is at least 85 percent of, and if no single core is less than 75 percent of, specified 28-day strength.
3. Upon failure of core test results, Engineer may require Contractor, at his expense, to perform load tests as specified in ACI 318, Chapter 20.
4. Fill all core holes as specified for repairing defective concrete.

J. Completed Work

1. Completed concrete work which fails to meet 1 or more requirements, but which has been repaired to bring it into compliance, will be accepted without qualification.
2. Completed concrete work which fails to meet 1 or more requirements and which cannot be brought into compliance shall be rejected as provided in these Contract Documents. In this event, modifications shall be required to assure that concrete work complies with requirements. Modifications, as directed by Engineer, to be made at no additional cost to Owner.

K. Perform concrete reinforcing and cast-in-place concrete work in accordance with ACI 301.

L. The maximum deviation of the top surface of curb and gutter shall not exceed 1/8" in 10' nor shall the inside face deviate more than 1/4" in 10' from a straight line. Prior to or during final inspection, curb and gutter shall be water flow tested as directed by the Engineer. All areas with standing water will be rejected.

PART 2 PRODUCTS

2.1 FORM MATERIALS AND ACCESSORIES

- A. Steel Forms: Symons "Steel-Ply", Simplex "Industrial Steel Frame Forms", Universal "Uniform". Forms shall be clean, straight and true, without surface defects.
- B. Plywood Forms: Product standard PS-1, waterproof, resin-bonded exterior type Douglas Fir or Larch. Forms shall be clean, straight and true, without surface defects.
- C. Lumber: Douglas Fir or Larch, straight, uniform width and thickness, clean and free from offsets, holes, dents and other surface defects.
- D. Chamfer Strips: Clean white pine, surface against concrete planed.
- E. Form Release Agent: Colorless mineral oil not capable of staining concrete or impairing natural bonding characteristics of coating intended for use on concrete.

2.2 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615, deformed. Reinforcement bar, size and spacing as indicated on the Drawings.
- B. Welded wire fabric reinforcement shall conform to the requirements of ASTM A185 and the details shown; provided, that welded wire fabric with longitudinal wire of W4 size wire and smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W4 size shall be furnished in flat sheets only.
- C. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for support of reinforcing; plastic tipped or non-corroding for supports in slabs where supports are exposed to weather.
- D. Concrete blocks used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.
- E. Fabricate concrete reinforcing in accordance with ACI 315.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150 Type I Portland type.
- B. Batching and Mixing Equipment: Conform to ACI 304.
- C. Slump:
 - 1. Keep as low as possible consistent with proper handling and thorough compaction.
 - 2. Shall not exceed 4 inches unless otherwise authorized by Engineer.
- D. Fine and Coarse Aggregates: ASTM C33.
- E. Water: Clean and not detrimental to concrete.
- F. Air Entrainment Admixture: ASTM C260.

2.4 CONCRETE MIX

- A. Mix and deliver concrete in accordance with ASTM C94.
- B. Retempering of prepared concrete will not be permitted.
- C. Furnish concrete of the following strength:

Type of Work	Min. 28-Day Compressive Strength (psi)	Max. Size Aggregate (in.)	Min. Cement W/C per CY (94# sacks)	Maximum Ratio (by wt.)
Slabs on grade, footings floor slabs, and all other concrete items not specified elsewhere.	4,000	1	6.0	0.50
Site work concrete such as fence posts, thrust blocks, valve collars, etc.	3,000	1	6.0	0.50

D. Proportioning:

1. Proportion ingredients to produce a well-graded mix of high-density maximum workability consistent with approved mix design.
2. Entrained air - all concrete:
 - a. Five (5) percent, plus or minus one (1) percent, for concrete in the forms. Concrete samples for air content tests shall be taken at the end of the concrete truck chute or the output of the concrete pump, whichever applies. A reduction in air content of pumped concrete should be expected. Contractor shall be responsible to coordinate with the concrete supplier to provide the specified air content of the in-place concrete.
 - b. Refer to Table 3.4.1 of ACI 301 for further requirements.
3. Fly ash: The mineral admixture Class F fly ash shall be proportioned by weight of cement to provide a fly ash to Portland cement ratio not less than 1:4, not less than 20 per cent of the total cementitious material. Portland cement concrete submitted under this Specification shall be proportioned with Class F fly ash, unless a variance is authorized by the Engineer. The Contractor shall provide the Engineer with chemical and physical analysis of the fly ash.
4. Aggregates supplied under this Specification shall be assumed to be "alkali-silica reactive", ASR. Variance from this position for a particular aggregate source may be authorized by the Engineer. Application for a variance may be made to the Engineer.
 - a. An aggregate may be classified non-alkali-silica reactive if, when tested in accordance with ASTM C227, using low alkali cement demonstrates an expansion at one (1) year not greater than 0.05%, and the rate of expansion is negative decreasing, based on test measurements at 1 month, 3 months, 6 months, 9 months, and 15 months, as authorized by the Engineer.
 - b. Portland cement concrete design mixes using non alkali-silica reactive aggregates will not be required to be proportioned with Class F fly ash.

2.5 CEMENT GROUT

- A. Portland Cement: ASTM C150, Type I and II.

- B. Water:
 - 1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts.

- C. Fine Aggregate:
 - 1. Washed natural sand.
 - 2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
 - 3. Free from injurious amounts of organic impurities as determined by ASTM C40.

- D. Mix:
 - 1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.
 - 2. Water content shall be such that the grout can be readily spread, yet not wet enough to cause trouble with surface water or laitance, or failure to stay in place after screeding. All grout mixes and mixing procedures shall be submitted in accordance with submittal requirements, and shall be subject to review and approval by the Engineer prior to commencing the grouting operations.

- E. The minimum compressive strength at 28 days shall be 4000 psi.

- F. Procedures for Grout placement shall be approved by the equipment supplier, to insure that no equipment is overstressed, as well as proper placement tolerances. Equipment Supplier shall have final say on grouting procedures and final tolerances.

PART 3 EXECUTION

3.1 FORMWORK ERECTION

- A. Erect formwork, shoring, and bracing to achieve design requirements.

- B. Erect forms substantially and sufficiently tight to prevent leakage of mortar and braced or tied to maintain desired position, shape and alignment before, during, and after concrete placement.

- C. Carefully remove forms only after concrete is able to support all dead and live loads and curing requirements are met. Apply curing compound to all formed surfaces immediately after form removal.

- D. Camber slabs and framing to achieve ACI 301 tolerances.

- E. Provide bracing to ensure stability of formwork.

- F. Clean forms as erection proceeds, to remove foreign matter.

3.2 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

- A. Provide formed openings where required for work to be embedded in and passing through concrete members.
- B. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install concrete accessories straight, level, and plumb.
- D. Install water stops continuous without displacing reinforcement.

3.3 REINFORCEMENT PLACEMENT

- A. Place reinforcement, supported and secured against displacement.
- B. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.

3.4 PLACING CONCRETE

- A. Do not place concrete during rain, sleet, or snow unless adequate protection is provided and Construction Observer approval is obtained. Do not allow rainwater to increase mixing water or damage surface finish.
- B. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
- C. Convey concrete from mixer to final position as rapidly as practicable without segregation or loss of material. Limit chute length to less than 20 feet with maximum slope of 1 vertical to 2 horizontal.
- D. Maximum height of concrete free fall is 4 feet.
- E. Place concrete continuously between predetermined expansion, control, and construction joints. Do not break or interrupt successive pours creating cold joints.
- F. On large volume pours, concrete shall be placed with the aid of approved mechanical vibrators. Vibration shall be supplemented by manual forking or spading adjacent to the forms on exposed faced in order to secure smooth dense surfaces. The concrete shall be thoroughly consolidated around reinforcement, pipes or other shapes built into the work.
- G. Where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack with non-shrink grout.
- H. Screed slabs-on-grade and concrete base for toppings level.

3.5 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Remove formwork progressively and in accordance with code requirements.

3.6 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.
- B. Uniformly spread, screed, and float concrete.
- C. In areas with floor drains, maintain floor level at walls and slope surfaces uniformly to drains.
- D. Provide surface conforming to proper elevation and contour with all aggregates completely embedded in mortar by screening.
- E. Provide an initial float as soon as concrete has stiffened sufficiently for proper working.
- F. Provide a second floating at time of initial set.
- G. Apply a broom finish.

3.7 CURING

- A. Immediately after placement, protect concrete from premature drying.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete, for not less than ten (10) days in warm to hot weather and fourteen (14) days in cold weather after placing, unless otherwise indicated by the Engineer, in accordance with the methods specified herein for the different parts of the Work.
 - 1. Cold weather is defined as when the temperature reaches or goes below 35 degrees F for one (1) hour during any 24-hour period during the curing period.
- C. Use a pre-approved concrete curing method. Acceptable curing methods, as detailed in ACI 308R-01, are as follows:
 - 1. Water Curing Methods:
 - a. Ponding/Immersion.
 - b. Fogging/Sprinkler.
 - c. Burlap/Cotton Mats/Absorbent Material.
 - d. Wet Sand Curing.
 - e. Straw/Hay.
 - f. Plastic Film.
 - g. Reinforced Paper.
 - 2. Liquid Membrane-Forming Compounds.

- D. The covering used, if applicable, must be overlapped adequately to ensure 100% coverage, and must not be allowed to become dry at any point during the curing period. Place and anchor covers, mats, and/or sheeting to ensure continuous contact with the concrete surfaces.
- E. When using one of the water curing methods, keep the concrete structures thoroughly and continuously moist and covered during the entire curing period.

3.8 FIELD QUALITY CONTROL

- A. Three (3) Concrete Test Cylinders: Taken for every 75 or less cubic yards of each class of concrete placed.
- B. One (1) Additional Test Cylinder: Taken during cold weather concreting, and cured on job site under same conditions as concrete incorporated into the Work.
- C. One (1) Slump Test: Taken for each set of test cylinders taken.

3.9 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by Engineer.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish all materials for concrete formwork, bracing, shoring and supports and shall design and construct all forms, bracing, shoring and falsework, all in accordance with the requirements of the Contract Documents.
- B. Section Includes:
 - 1. Formwork for cast-in place concrete.
 - 2. Shoring, bracing, and anchorage.
 - 3. Form accessories.
 - 4. Form stripping.
- C. Related Sections:
 - 1. Section 03 20 00 - Concrete Reinforcement
 - 2. Section 03 30 00 - Cast-in-Place Concrete

1.2 REFERENCES

- A. International Building Code (IBC), as referenced herein, shall be the most recent New Mexico Construction Industries Division (CID) adopted edition
- B. American Concrete Institute:
 - 1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 - Specifications for Structural Concrete.
 - 3. ACI 318 - Building Code Requirements for Structural Concrete.
 - 4. ACI 347 - Guide to Formwork for Concrete.
- C. Government Standards:
 - 1. PS 1-74 U.S. Product Standard for Concrete Forms, Class I.
- D. American Forest and Paper Association:
 - 1. AF&PA - National Design Specifications for Wood Construction.
- E. The Engineered Wood Association:
 - 1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- F. American Society of Mechanical Engineers:
 - 1. ASME A17.1 - Safety Code for Elevators and Escalators.

- G. ASTM International:
 - 1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - 2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

- A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 - 1. List of form materials and locations of use.
 - 2. Form release agent with EPA Certification.

1.4 QUALITY ASSURANCE

- A. Tolerances: The variation from established lines and grades shall not exceed 1/4-inch in ten (10) feet and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the "Suggested Tolerances" specified in Section 3.3 and 3.4 of ACI 347.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Except as otherwise expressly accepted by the Engineer, all lumber brought on the job site for use as forms, shoring or bracing shall be new material. All forms shall be smooth surface forms and shall be of the following materials:
 - 1. Walls: Steel or plywood panel
 - 2. Columns: Steel, plywood or fiberglass
 - 3. Roof and Floor Slabs: Plywood
 - 4. All Other Work: Steel panels, plywood or tongue and groove lumber

2.2 FORM TIES

- A. Form ties with Integral water stops shall be provided with a plastic cone or other suitable means for forming a conical hole to ensure that the form tie may be broken off back of the face of the concrete.
 - 1. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-inch and all such fasteners shall be such as to leave holes of regular shape for reaming.
 - 2. Form ties for water-retaining structures shall have integral water stops. Removable taper ties may be used when approved by the Engineer. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

2.3 FORM AND FALSEWORK MATERIALS

- A. Materials for concrete forms, formwork and falsework shall conform to the following requirements:
 - 1. Lumber shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS10.
 - 2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured especially for concrete formwork and shall conform to the requirements for PS 1 for Concrete Forms, Class I, and shall be edge sealed.
 - 3. Form materials shall be metal, wood, plywood or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.
- B. Unless otherwise shown, exterior corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise shown.
- C. Forms and falsework to support roof and floor slabs shall be designed for the total dead load, plus a live load of 40 psf (minimum).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.
- C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.2 GENERAL

- A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of all forms. Forms which are unsafe or inadequate in any respect shall promptly be removed from the Work and replaced at the Contractor's expense. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable Local, State and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer, shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

- B. Concrete forms shall conform to the shape, lines, and dimensions of structural components as called for on the Drawings and shall be free from surface defects and sufficiently tight to prevent leakage.

3.3 FORM DESIGN

- A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete.
- B. Suitable and effective means shall be provided on all forms for holding adjacent edges and end of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets or similar surface defects in the finished concrete.
- C. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The form joints shall be tight so as to prevent the loss of water, cement and fines during the placing and vibrating of the concrete. The bottom of the wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Adequate cleanout holes shall be provided at the bottom of each lift of forms.

3.4 INSTALLATION

- A. Formwork - General:
 - 1. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
 - 2. All vertical surfaces of concrete members shall be formed.
 - 3. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
 - 4. Complete wedging and bracing before placing concrete.
- B. Forms for Smooth Finish Concrete:
 - 1. Use steel, plywood or lined board forms.
 - 2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
 - 3. Install form lining with close-fitting square joints between separate sheets without springing into place.
 - 4. Use full size sheets of form lines and plywood wherever possible.
 - 5. Tape joints to prevent protrusions in concrete.
 - 6. Use care in forming and stripping wood forms to protect corners and edges.
 - 7. Level and continue horizontal joints.
 - 8. Keep wood forms wet until stripped.
- C. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

- D. Framing, Studding and Bracing:
 - 1. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
 - 2. Distribute bracing loads over base area on which bracing is erected.
 - 3. When placed on ground, protect against undermining, settlement, or accidental impact.
- E. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- F. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- G. Obtain Engineer's approval before framing openings in structural members not indicated on Drawings.
- H. Install fillet and chamfer strips on external corners of beams, joists, and/or columns, as called for on the Drawings.
- I. Install void forms in accordance with manufacturer's recommendations.

3.5 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.6 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Install formed openings for items to be embedded in or passing through concrete work.
- B. Locate and set in place items required to be cast directly into concrete.
- C. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- D. Install water stops continuous without displacing reinforcement.

- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- G. Form Ties:
 - 1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
 - 2. Leave inner rods in concrete when forms are stripped.
 - 3. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.
 - 4. Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified for "Finish of Concrete Surfaces" in Section 03 30 00 - Cast-In-Place Concrete.
 - 5. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties that cause spalling of the concrete form stripping or tie removal will not be permitted.
 - 6. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.
- H. Removable Ties:
 - 1. Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond.
 - 2. A precast neoprene or polyurethane taped plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink grout for above-grade walls that are dry on both sides.
 - 3. Exposed faces of walls shall have the outer 2-inches of the exposed face filled with a cement grout, which shall match the color and texture of the surrounding wall surface.
- I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.
- J. Construction Joints:
 - 1. Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer.
 - 2. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
 - 3. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.

4. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
 5. Arrange joints in continuous line straight, true and sharp.
- K. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
 2. Do not embed wood or uncoated aluminum in concrete.
 3. Obtain installation and setting information for embedded items furnished under other Specification sections.
 4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
 5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.
- L. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
 2. Coordinate work to avoid cutting and patching of concrete after placement.
 3. Perform cutting and repairing of concrete required as result of failure to provide required openings.
- M. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
 2. Slope slabs to drain where required or as shown on Drawings.
 3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.
- N. Screenshot Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
 2. Staking through membrane is not permitted.
- O. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
 2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.7 MAINTENANCE OF FORMS

- A. Forms shall be maintained at all times in good condition, particularly as to cleanliness, strength, rigidity, tightness and smoothness of surface. After forms have been removed, from a concrete placement they shall be immediately and thoroughly cleaned and repaired and surface treated before reuse.

- B. The form surfaces shall be treated with a non-staining mineral oil or other lubricant acceptable to the Engineer. Any excess lubricant shall be satisfactorily removed before placing the concrete. Oil shall be kept off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.8 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.
- B. For roof slabs and aboveground floor slabs, forms shall remain in place until test cylinders attain a minimum compressive strength of seventy-five percent (75%) of the 28-day strength specified in Section 03 30 00 - Cast-In-Place Concrete.
- C. No forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent panel or unit has attained seventy-five percent (75%) of the specified 28-day strength and has been in place for a minimum of seven (7) days. Forms for all vertical walls and columns shall remain in place at least forty-eight (48) hours after the concrete has been placed, except for periods of cold weather when forms shall remain in place at least seventy-two (72) hours after concrete has been placed.
- D. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- E. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- F. Leave forms in place for minimum number of days as specified in ACI 347.

3.9 REUSE OF FORMS

- A. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces that are permanently exposed to view.

3.10 FALSEWORK

- A. The Contractor shall be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements specified herein.
- B. All falsework shall be designed and constructed to provide the necessary rigidity and to support the required dead load plus a minimum of 40 psf live load. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time. Falsework shall be placed upon a solid footing, safe against undermining and protected from softening. When falsework is

supported on any portion of the structure that is already constructed, the load imposed by the falsework shall be spread, distributed and braced in such a way as to avoid any possibility of damage to the structure. Falsework supported off finished floor slabs shall be set in such a way to protect the finish floor surface from being scarred, chipped or gouged.

3.11 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- C. Notify Engineer after placement of reinforcing steel in forms, but prior to placing concrete.
- D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03 29 00

JOINTS IN CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. The Contractor shall construct all construction joints, expansion joints and control joints in concrete at the locations shown and formed in accordance with the details shown in the drawings.
- B. Waterstops shall be provided in all construction and expansion joints of hydraulic or below grade structures unless specifically noted otherwise on the drawings.
- C. Related Sections:
 - 1. Section 03 10 00 - Concrete Forms and Accessories
 - 2. Section 03 05 00 - Basic Concrete Materials and Methods
 - 3. Section 03 30 00 - Cast-in-Place Concrete

1.2 REFERENCES

- A. Federal Specifications:
 - 1. TSS-S-00227E(3) Sealing Compound, elastomeric type, multi-component (for Caulking, Sealing, Glazing Buildings and Other Structures)
- B. Commercial Standards:
 - 1. ASTM C 920-86 Specification for Elastomeric Joint Sealants
 - 2. ASTM D 624-81 Test Method for Rubber Property - Tear Resistance
 - 3. ASTM D 1752-84 Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.3 CONTRACTOR SUBMITTALS

- A. Waterstop: Prior to production of the waterstop material required under this Contract, the Contractor shall submit for review complete product data, including qualification samples of extruded sections of each size and shape to be used. The submittal shall also include the manufacturer's certification that the water stop material meets the physical requirements as outlined under paragraph 2.01, herein.

1.4 QUALITY ASSURANCE

- A. Waterstop Inspection: Waterstop installation shall be subject to rigid inspection. No waterstop shall be cast in concrete without the Engineer's inspection. Not less than twenty-four (24) hours notice shall be provided to the Engineer for scheduling such inspections.

- B. Waterstop Field Samples: Prior to use of the waterstop material in the field, a sample of a fabricated mitered cross and a tee constructed of each size or shape of material to be used shall be submitted to the Engineer for review. These samples shall be fabricated so that the material and workmanship represent in all respects the fittings to be furnished under this Contract. Field samples of fabricated fittings (crosses, tees, etc.) may be selected at random by the Engineer for testing by a laboratory at the Owner's expense. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.
- C. All field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets and other defects. All defective joints shall be replaced and all weathered, damaged or otherwise faulty material shall be removed from the site and disposed of by the Contractor at its own expense.
- D. Waterstops shall be stored on site where it will not be subjected to freezing temperatures or exposed to the direct rays of the sun.
- E. Construction Joint Sealant: The Contractor shall prepare adhesion and cohesion test specimens as specified herein from each shipment of material received at the jobsite. Sealant shall be stored at room temperature and shall not be stored longer than seventy-five percent (75%) of the manufacturer's stated shelf life.
- F. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure:
 - 1. Sealant specimen shall be prepared between two concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1/2-inch. Coated spacers (2-inch by 1-1/2 inch by 1/2-inch) shall be used to ensure sealant cross-sections of 1/2-inch by 2-inches with a width of 1/2-inch.
 - 2. Sealant shall be cast and cured according to manufacturer's recommendations except that curing period shall not exceed twenty-four (24) hours.
 - 3. Following curing period, the gap between blocks shall be widened to 1-inch. Spacers shall be used to maintain this gap for twenty-four (24) hours prior to inspection for failure.

1.5 GUARANTEE

- A. The Contractor shall provide a three (3) year written guarantee of the entire joint sealant installation against faulty and/or incompatible materials and workmanship, together with a statement that it agrees to repair or replace, to the satisfaction of the Owner, at no additional cost to the Owner, any such defective areas which become evident within said three (3) year guarantee period.

PART 2 PRODUCTS

2.1 PVC WATERSTOPS

- A. General: Waterstops shall be extruded from an elastomeric plastic compound consisting of virgin polyvinylchloride and additional plasticizers and stabilizers necessary to meet or exceed the requirements and performance criteria of these Specifications and the Corps of

Engineers Specifications CRD-C572. No reclaimed scrap or reprocessed material shall be used.

- B. Flatstrip, Center-Bulb and Multi-Rib Waterstops: Flatstrip, center-bulb and multi-rip waterstops shall be detailed and as manufactured by: Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; or approved equal; provided, that at no place shall the thickness of flat strip waterstops, including the center-bulb type, be less than 3/8-inch. Prefabricated joint fittings shall be used at all intersections of the ribbed-type waterstops.
- C. Physical Properties: When tested in accordance with the specified test standards, the waterstop material shall meet or exceed the following requirements:

<u>Physical Property, Sheet Material</u>	<u>Value</u>	<u>ASTM Test Method</u>
Tensile Strength-Min (psi)	1750	D 638
Ultimate Elongation-Min (percent)	350	D 638
Low Temp. Brittleness-Max (-35 Deg F)	Pass	D 746
Stiffness in Flexure-Min (psi)	400	D 747
<u>Accelerated Aging (CRD-C572)</u>		
Tensile Strength-Min (psi)	1500	D 638
Ultimate Elongation-Min (percent)	300	D 638

2.2 HYDROPHILIC WATERSTOPS

- A. General: Hydrophilic waterstops may be substituted for PVC waterstops. Hydrophilic waterstops may not contain bentonite.
- B. Hydrophilic waterstops shall be manufactured by: Asadi Denka Kogyo K.K. distributed by Mitsubishi International Corp; SYNKO-FLEX Products, Huston Texas; Sika Corporation, Santa Fe Springs, CA. Hydrophilic waterstops shall be install according to the manufactures recommendations.
- C. Physical Properties: When tested in accordance with the specified test standards, the waterstop material shall meet or exceed the following requirements:

<u>Physical Property</u>	<u>Value</u>	<u>ASTM Test Method</u>
Hardness	30	2240
Tensile Strength	100	D412
Elongation %	500	D412
Specific Gravity	1.18	D792

PART 3 EXECUTION

3.1 GENERAL

- A. Unless otherwise shown, waterstops of the type specified herein, shall be fully continuous for the extent of the joint. The Contractor shall take suitable precautions and means to

support and protect the waterstops during the progress of the Work and shall repair or replace at its own expense any waterstops damaged during the progress of the Work.

- B. Suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.
- C. Splices in waterstops shall be performed by heat-sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is essential that the splices have a tensile strength of not less than sixty percent (60%) of the unspliced materials tensile strength and the continuity of the waterstop ribs and of its tubular center axis be maintained.

3.2 INSTALLATION OF WATERSTOP

- A. All joints with waterstops involving more than two (2) ends to be jointed together and all joints which involve an angle cut, alignment change or the joining of two (2) dissimilar waterstop sections shall be prefabricated by the Contractor prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.
- B. Adequate provisions must be made to support the waterstops during the progress of the Work and to ensure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be ensured by thoroughly working it in the vicinity of all joints.
- C. Adequate means shall be provided to prevent waterstops from being folded over by the concrete as it is placed. Unless otherwise shown, all waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through the edge of the waterstop and tied to the curtain of reinforcing steel. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be carefully worked under the waterstops so as to avoid the formation of air and rock pockets.
- D. Where a bentonite waterstop is called for in the Contract Documents, it shall be installed in accordance with the manufacturer's instructions. The bentonite waterstop shall be located at the center of the joint and it shall be continuous around the entire joint. Bentonite waterstop shall not be used in joints with only one curtain of reinforcing steel. Where a bentonite waterstop is used in combination with PVC waterstop, the bentonite waterstop shall overlap the PVC waterstop for a minimum of 6-inches.

3.3 JOINT CONSTRUCTION

- A. Joint Location: Construction joints, expansion joints and control joints shall be provided where shown. When not shown, construction joints shall be provided at 10 foot

maximum spacing for all concrete construction, unless noted otherwise. The location of all joints shall be submitted for acceptance by the Engineer.

- B. Special care shall be used in preparing concrete surfaces at joints where bonding between two (2) sections of concrete is required. Unless otherwise shown, such bonding will be required at all horizontal joints in walls and wall to slab joints. Surfaces shall be prepared by sandblasting and washing for removal of laitance or any objectionable material. Joints shall be kept clean until the concrete is placed. Vertical joints shall be clean and free of concrete fins, rock pockets or any objectionable material.
- C. Sealant grooves shall be formed as shown on the drawings and shall be protected from damage until final application of the sealant. Care shall be taken to prevent chipping of the sealant groove during removal of forms.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the Contract Documents.
- B. The following types of concrete shall be covered in this Section:
 - 1. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, thrust blocks, fence and guard post embedment, and other concrete ties unless otherwise shown.
 - 2. Structural Concrete: Concrete to be used where noted in the Contract Documents.
 - 3. Lean Concrete: Concrete to be used for pipe trench cut-off walls and cradles, where the preceding items are detailed on the Drawings as un-reinforced.
 - 4. Duct Bank Concrete: Red colored concrete to be used for electrical duct banks.
- C. The term "hydraulic structure" used in these specifications shall refer to environmental engineering concrete structures for the containment, treatment, or transmission of water, wastewater, or other fluids.
- D. Related Sections:
 - 1. Section 03 10 00 - Concrete Forms and Accessories.
 - 2. Section 03 20 00 - Concrete Reinforcement.
 - 3. Section 03 29 00 - Joints in Concrete.
 - 4. Section 31 23 23 - Backfill.
 - 5. Section 32 12 16 - Asphalt Paving.
 - 6. Section 33 11 00 - Water Utility Distribution Piping.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 117 - Standard Tolerances for Concrete Construction and Materials.
 - 2. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
 - 3. ACI 301 - Specifications for Structural Concrete.
 - 4. ACI 308.1 - Standard Specification for Curing Concrete.
 - 5. ACI 309 - Consolidation of Concrete.
 - 6. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
6. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C156 - Test Methods for Water Retention by Concrete Curing Materials.
10. ASTM C157 - Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.
11. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
12. ASTM C192 - Method of Making and Curing Concrete Test Specimens in the Laboratory.
13. ASTM C227 - Test for Potential Alkali Reactivity of Cement- Aggregate Combinations.
14. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
15. ASTM C309 - Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C441 - Test for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to Alkali-Aggregate Reaction.
17. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction & Criteria for Laboratory Evaluation.
19. ASTM D2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
20. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

1.3 SUBMITTALS

- A. **General:** Submittals shall be submitted to the Engineer for review in accordance with Section 01 00 00, Contractor Submittals. Submittals shall include, but not be limited to the following:
 1. **Mix Designs:** Prior to beginning the Work and within 14 days of the Notice To Proceed, the Contractor shall submit to the Engineer, for review, the proposed ready-mix supplier and their Laboratory-Certified concrete mix design for each class and type of concrete specified for the Work. Submitted mix designs shall have been performance-tested and certified by an independent laboratory approved by the Owner. All costs related to providing mix design shall be borne by the Contractor. Mix designs shall show the following in accordance with ACI 301:
 - a. Proportions for all materials proposed.
 - b. Mill tests for cement.

- c. Admixture certification, chloride ion content must be included.
 - d. Aggregate gradation and certification.
 2. Delivery Tickets: Where ready-mix concrete is used, the Contractor shall furnish delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate added at the batching plant, and the amount allowed to be added at the site for the specific design mix. In addition, each ticket shall state the approved mix design number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the site, when unloading began, and when unloading was finished.
 3. Materials and methods for curing:
 - a. List of curing methods to be used on each type and class of concrete.
 - b. Curing compound.
 - c. Curing blankets and mats.
 - d. Evaporation retardant.

1.4 QUALITY ASSURANCE

- A. When required by any applicable permits, such as CID permits, Contractor shall have reinforcement inspected by the agency with jurisdiction prior to placement of concrete.
- B. General:
 1. Tests on concrete will be field performed in accordance with all requirements of applicable ASTM standards for such tests, including but not limited to obtaining samples, temperature, slump, air entrainment, making and curing specimens, breaking concrete cylinders, and other as may be applicable.
 2. The cost of all laboratory tests on cement, aggregates, and concrete, for the development of the mix design, will be borne by the Contractor. The laboratory must meet or exceed the requirements of ASTM C1077.
 3. Concrete for testing shall be supplied by the Contractor as part of the project cost, and the Contractor shall provide assistance in obtaining samples, and disposal and cleanup of excess material.
 4. Test cylinders will be prepared at the frequency determined by the Owner and Engineer.
- C. Compression Tests:
 1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Engineer to ensure continued compliance with these specifications. Each set of test specimens will be a minimum of 5 cylinders.
 2. Compression test specimens for concrete shall be made in accordance with ASTM C31. Specimens shall be 6-inch diameter by 12-inch high cylinders.
 3. Compression tests shall be performed in accordance with ASTM C39. One test cylinder will be tested at 7 days and 2 at 28 days. The remaining cylinders will be held to verify test results, if needed.
 4. Compression testing will be paid for by the Owner.

- D. Evaluation and Acceptance of Concrete:
1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, and as specified herein.
 2. All concrete that fails to meet the ACI requirements and these specifications, is subject to removal and replacement at the cost of the Contractor.
 3. Concrete delivered to the site that does not meet the requirements as herein specified may be rejected.

1.5 CONSTRUCTION TOLERANCES

- A. The Contractor shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.
- B. The following construction tolerances are hereby established and apply to finished walls and slabs unless otherwise shown:

<u>Item</u>	<u>Tolerance</u>
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4-inch In 20 feet or more: 1/2-inch
Variation from the level or from the grades shown.	In 10 feet: 1/4-inch In 20 feet or more: 1/2-inch
Variation from the plumb.	In 10 feet: 1/4-inch In 20 feet or more: 1/2-inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch; Plus 1/2-inch
Variation in the locations and sizes of slabs and wall openings.	Plus or minus 1/4-inch

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Except as otherwise specified, all cement shall be standard brand Portland Cement conforming to ASTM C150 for Type II, low alkali. Portland Cement shall contain not more than 0.60 percent total alkalies. The term "alkalies" is defined as the sum sodium oxide (Na₂O), potassium oxide (K₂O), calculated as sodium oxide (.658 K₂O). Only one (1) brand of cement shall be used for exposed concrete in any individual structure. The cement shall be suitably protected from exposure to moisture until used. Certified mill test reports for each shipment of cement to be used shall be submitted to the Engineer. Mill test reports shall include the alkali content.

- B. Water shall be potable, clean and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purpose of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.
- C. All concrete aggregates shall be obtained from pits acceptable to the Engineer, shall be non-reactive, sound, uniformly graded and free of deleterious material in excess of allowable limits specified. Combined aggregates shall be well graded from coarse to fine sizes, and be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Lightweight sand for fine aggregate will not be permitted. Aggregates shall conform to ASTM C33.

1. Coarse Aggregate: Coarse aggregate shall consist of gravel, crushed gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter or other foreign substances. Thin or elongated pieces having a length greater than four (4) times the average thickness shall not exceed fifteen percent (15%) by weight. Deleterious substances shall not be present in excess of the following percentages by weight, and in no case shall the total of all deleterious substances exceed one and one-half percent (1.5%):

Soft Fragments	1.5%
Shale	1.5%
Coal and Lignite	0.25%
Clay Lumps	0.25%
Materials Finer than No. 200 Sieve	0.50%*

*Except that when material finer than No. 200 sieve consists of crusher dust, the maximum amount maybe 1%.

Except as otherwise specified or approved in writing by the Engineer, coarse aggregate shall be graded as specified in ASTM C33, size No. 57.

2. Fine Aggregate: Fine aggregate for concrete or mortar shall consist of clean, natural sand or a combination of natural and manufactured sands that are hard and durable. Deleterious substances shall not be present in excess of the following percentages by weight of contaminating substances. In no case shall the total exceed three percent (3%):

Removed by Decantation (Dirt, Silt, Etc.)	3%
Shale	1%
Clay Lumps	1%

Fine aggregate shall not contain strong alkali nor organic matter which gives a color darker than a standard color when tested in accordance with ASTM C40. Fine aggregate shall have a fineness modulus not less than 2.50 nor greater than 3.00. Except as otherwise specified, fine aggregate shall be graded from coarse to fine in accordance with the requirements of ASTM C33.

- D. If non-reactive aggregates are unavailable, and either the coarse or fine aggregates are found to be alkali-silica reactive, the Contractor shall submit a proposed design mix that effectively mitigates the alkali-silica reactivity, per ASTM C441. The admixture will be considered effective if the mean mortar bar expansion at 14 days is less than or equal to 0.10%.
- E. Admixtures of any type, except as otherwise specified, shall not be used unless written authorization has been obtained from the Engineer. The use of calcium chloride will not be permitted.
1. All concrete shall contain five percent (5%), plus or minus one percent (1%) entrained air of evenly dispersed air bubbles at the time of placement. The air-entraining agent shall contain no chloride and conform to ASTM C260, or U.S. Army Corps of Engineers Specifications CRD-C13. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. The Engineer, or Owner and his duly authorized representatives reserve the right, at any time, to sample and test the air-entraining agent or the air content of concrete received on the job by the Contractor. Air entrainment in the concrete shall be tested by ASTM C138, ASTM C231 or ASTM C173. If any sample tested does not have the specified air content, a second test shall be performed. If the second test does not meet the specified air content, the concrete represented by the test shall be removed from the job.
 2. A "super plasticizer" water reducing agent may be used at the Contractors option, subject to approval by the Engineer, for concrete in hydraulic structures. The amount of cement in the mix shall not be reduced. The slump may be increased to a maximum of 8-inches. Quantities of admixtures and procedures shall be in accordance with the manufacturers published recommendations. The super plasticizer shall conform to ASTM C494, Type F or G. The admixture shall be a second-generation type, free of chlorides and alkalies, composed of a synthesized sulfonated complex polymer that shall be added to the concrete mixer at the batch plant.
 3. Fly ash/pozzolan shall conform to ASTM C618, including the requirements of Table 1A, therein, and the following supplementary requirements:
 - a. Class C Fly Ash

Loss on ignition, maximum	1%
SO ₃ content, maximum	4%
Moisture content, maximum	1%
R = (CaO - 5%)/(Fe ₂ O ₃), maximum	4.5
 - b. Class F Fly Ash

Loss on ignition, maximum	1%
SO ₃ content, maximum	3%
Moisture content, maximum	1%
R = (CaO - 5%)/(Fe ₂ O ₃), maximum	1.5

2.2 CONCRETE CURING MATERIALS

- A. Materials for curing concrete shall conform to the following requirements:

1. Concrete curing compound shall be Protex LR-151 as manufactured by Protex Industries, Denver, CO; Hunt Process Clear ARB as manufactured by Hunt Process Co., Santa Fe Springs, CA; Select Cure CRB as manufactured by Select Products Co., Upland, CA; or equal. The curing compound shall contain a fugitive dye so that areas of application will be readily distinguishable.
2. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a normal thickness of 10 mils.
3. Burlap, cotton mats or other covering material for use as concrete curing blanket must be overlapped adequately to ensure 100% coverage at all times, and must not be allowed to become dry at any point during the curing period
4. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 grams per square centimeter of surface.

2.3 CONCRETE DESIGN REQUIREMENTS

- A. General: The concrete mixes shall be designed to produce a concrete of such consistency and composition so as to obtain maximum density and minimum shrinkage. Mix designs with more than forty-one percent (41%) of sand of the total weight of fine and coarse aggregate shall not be used.
- B. Water-Cement Ratio and Compressive Strength: The minimum compressive strength and cement content of concrete shall not be less than that specified in the following Table:

Type of Work	Min. 28-Day Compressive Strength (psi)	Max. Size Aggregate (in.)	Min. Cement W/C per CY (94# sacks)	Maximum Ratio (by wt.)
Slabs on grade, footings, floor slabs, and all other concrete items not specified elsewhere.	4,000	1	6.0	0.50
Site work concrete such as fence posts, thrust blocks, valve collars, etc.	3,000	1	6.0	0.50

- C. Adjustments to Mix Design: The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability and surface finish and the Contractor shall be entitled to no additional compensation because of such changes.
- D. At the Contractors option, fly ash/pulverized fuel ash may be used as a partial cement replacement in concrete as follows:
 1. Fly ash shall replace not more than twenty five percent (25%) by weight of the Portland Cement in the design mix. The design mix shall contain a minimum of six (6) sacks of cement per cubic yard before the replacement is made.
 2. Fly ash for hydraulic/liquid containing structures shall be Class C fly ash. Fly ash concrete for all other structures shall be Class C or F fly ash.
 3. If the coarse or fine aggregates are proven to be potentially alkali-silica reactive per ASTM C227, the mineral admixture Class F fly ash shall be proportioned by

weight of cement to provide a fly ash to portland cement ratio not less than 1:4, not less than 20 per cent of the total cementitious material. The Contractor shall provide the Engineer with chemical and physical analysis of the fly ash, and detailed design mix to meet the requirements of ASTM C441.

2.4 CONSISTENCY

- A. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

<u>Part of Work</u>	<u>Slump (inches)</u>
Footings and Slabs	3-inches + 1/2-inches, - 1 inch.
Other Work With High Range Water Reducer Added	8-inches maximum. 3-inches \pm 1-inch.

2.5 TRIAL BATCH AND LABORATORY TESTS

- A. Before placing any concrete, the Contractor shall submit the certified trial batch results of each class of concrete having a 28-day strength of 3,500 psi or higher, based on the preliminary concrete mixes submitted by the Contractor. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the Contractors preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates, cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain three (3) drying shrinkage, and six (6) compression test specimens from each batch. The costs for the trial batch tests shall be borne by the Contractor.
- B. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C192 and ASTM C39. Three (3) compression test cylinders will be tested at 7-days and three (3) at 28-days. The average compressive strength for the three (3) cylinders tested at 28-days for any given trial batch shall not be less than one hundred twenty-five percent (125%) of the specified compressive strength.
- C. A standard sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements for ASTM C136. Values shall be given for percent passing each sieve.

2.6 SHRINKAGE LIMITATION

- A. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10-inches, fabricated, cured, dried and measured in accordance with ASTM C157 modified as follows: Specimens shall be removed from molds at an age of 23+ hours after trial batching, shall be placed immediately in water at 70 degrees F. +3 degrees F. for at least thirty (30) minutes, and shall be measured within thirty (30) minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F. +3 degrees F. Measurement to determine expansion expressed as a

percentage of original length shall be made at age 7-days. This length at age 7-days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F. +3 degrees F. and fifty percent (50%) +4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21 and 28-days of drying after 7-days of moist curing.

- B. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001-inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing during shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be specified herein.
- C. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age, shall be 0.036 percent or 0.042 percent, respectively. The Contractor shall only use a mix design for construction that has first met the trial batch shrinkage requirements.
- D. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than twenty-five percent (25%).
- E. If the required shrinkage limitation is not met during construction, the Contractor shall take all necessary action, at not additional cost to the Owner, for securing the specified shrinkage requirements. These actions may include changing the source of aggregates, cement and/or admixtures; reducing water content ratio; washing or aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

2.7 CEMENT GROUT

- A. Portland Cement: ASTM C150, Type I and II.
- B. Water:
 - 1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:
 - a. Corrosion of steel.
 - b. Volume change increasing shrinkage cracking.
 - c. Efflorescence.
 - d. Excess air entraining.
- C. Fine Aggregate:
 - 1. Washed natural sand.

2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
 3. Free from injurious amounts of organic impurities as determined by ASTM C40.
- D. Mix:
1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.
 2. Water content shall be such that the grout can be readily spread, yet not wet enough to cause trouble with surface water or laitance, or failure to stay in place after screeding. All grout mixes and mixing procedures shall be submitted in accordance with Section 01 00 00 - Contractor Submittals, and shall be subject to review and approval by the Engineer prior to commencing the grouting operations.
- E. The minimum compressive strength at 28 days shall be 4000 psi.
- F. Procedures for Grout placement shall be approved by the equipment supplier, to insure that no equipment is overstressed, as well as proper placement tolerances. Equipment Supplier shall have final say on grouting procedures and final tolerances.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 MIXING CONCRETE

- A. Mixing equipment shall be subject to the Engineers approval. Mixers shall be of the stationary plant or truck mixer type. Adequate equipment and facilities shall be provided for accurate measurement and control of all materials and for readily changing the proportions of the material. The mixing equipment shall be maintained in good working order and shall be capable of combining the aggregates, cement and water within the specified time into a thoroughly mixed and uniform mass and of discharging the mixture without segregation. Cement and aggregate shall be proportioned by weight.
- B. The batch plant shall be capable of controlling and delivering of all material to within one percent (1%) by weight of the individual material. If bulk cement is used, it shall be weighed on a separate visible scale that will accurately register the scale load at any stage of the weighing operation from zero to full capacity.
 1. Cement shall not come in contact with aggregate or with water until the materials are in the mixer ready for complete mixing with all mixing water. The procedure of mixing cement with sand or with sand and coarse aggregate for delivery to the

jobsite for final mixing and an addition of mixing water will not be permitted. Retempering of concrete (addition of water to previously prepared concrete mix) will not be permitted. The entire batch shall be discharged before recharging. The volume of the mixed material per batch shall not exceed the manufacturers rated capacity of the mixer.

2. Each mixer shall be equipped with a device for accurately measuring and indicating the quantity of water entering the concrete, and the operating mechanism shall be such that leakage will not occur when the valves are closed. Each mixer shall be equipped with a device for automatically measuring, indicating and controlling the time required for mixing. This device shall be interlocked to prevent the discharge of concrete from the mixer before the expiration of the mixing period.
 3. Transit-mixed concrete shall be mixed and delivered in accordance with ASTM C94. After the drum is once started, it shall be revolved continuously until it has completely discharged its batch. Water shall not be admitted to the mix until the drum has started revolving. The right is reserved to increase the required minimum number of revolutions allowed, if necessary, to obtain satisfactory mixing, and the Contractor will not be entitled to additional compensation because of such an increase or decrease.
- C. Mixed concrete shall be delivered to the site of the work and discharge shall be completed within one (1) hour after the addition of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees F. or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed forty-five (45) minutes. The use of non-agitating equipment for transporting concrete will not be permitted.
- D. Truck mixers shall be equipped with counters so that the number of revolutions of the drum may be readily verified. The counter must be capable of being reset and shall be actuated at the time of starting mixers at mixing speeds. Concrete shall be mixed in a truck mixer for not less than seventy (70) revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

3.3 PREPARATION OF SURFACES FOR CONCRETING

- A. Earth surfaces shall be thoroughly and uniformly wetted by sprinkling prior to the placing of any concrete. These surfaces shall be kept moist by frequent sprinkling up to the time concrete is placed thereon. The surface shall be free from standing water, mud and debris at the time of placing concrete.
- B. The surfaces of all horizontal construction joints shall be cleaned of all laitance, loose or defective concrete and foreign material. Such cleaning shall be accomplished by sandblasting followed by thorough washing. All pools of water shall be removed from he surface of construction joints before the new concrete is placed.

- C. No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel and preparation of surfaces involved in the placing have been completed and accepted by the Engineer at least four (4) hours before placement of concrete. All reinforcement, anchor bolts, sleeves, inserts and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the Engineer before any concrete is placed. Accuracy of placement is the responsibility of the Contractor. All surfaces of embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.
- D. All form surfaces in contact with the concrete shall be thoroughly cleaned of all previous concrete, dirt and other surface contaminants prior to use. Damaged form surfaces shall not be used.
 - 1. Wood form surfaces in contact with the concrete shall be coated with an approved release agent prior to form installation. The release agent shall be non-staining and non-toxic after thirty (30) days. Mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface of steel forms.
 - 2. All steel forms shall have the contact surfaces coated with an approved release agent. The release agent shall be effective in preventing discoloration of the concrete from rust and shall be non-toxic after thirty (30) days.
- E. Where concrete is to be cast against old existing concrete, the old concrete shall be thoroughly roughened to exposed, hard aggregate by sandblasting or chipping. Any additional surface preparation shall be as called for in the drawings.
- F. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or diverted out of the forms and clear of the work. No concrete shall be deposited under water or allowed to rise on any concrete until the concrete has attained its initial set. Pumping or other necessary dewatering operations for removing ground water, if required, shall be the responsibility of the Contractor and will be subject to review by the Engineer.
- G. Pipe, conduit, dowels, sleeves and other ferrous items required to be embedded in concrete construction shall be adequately positioned and supported prior to placement of concrete. There shall be a minimum of 2-inches clearance between embedded items and any of the concrete reinforcement. Securing embedments in position by wiring or welding them to the reinforcement will not be permitted.

3.4 PLACING CONCRETE

- A. No concrete shall be placed without prior inspection of the forms, reinforcing and embedded items and approval from an authorized representative of the Engineer. The Contractor shall notify the Engineer at least twenty-four (24) hours in advance of any scheduled concrete placement and shall call for final inspections no later than four (4) hours in advance of the scheduled placement. The Contractor shall notify the Engineer at least two (2) hours in advance of setting the opposite side of wall forms so that the construction joint preparation, water stop installation and reinforcing steel inspections can be conducted. It is the Contractor's responsibility to see that the forms are properly

cleaned and oiled before being set, the construction joints properly prepared, reinforcing steel is securely and properly supported in the correct position and that all embedment items including electrical conduit is correctly installed before calling for inspections. The Engineer may at his option require the use of placement cords if deemed necessary.

- B. Placement of concrete shall conform to the requirements and recommendations of ACI 301, 304 and 318, except as modified herein.
- C. Concrete, which upon or before placing is found not to conform to the requirements specified herein, shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these specifications, or which is of inferior quality, shall be removed and replaced at the expense of the Contractor.
- D. No concrete shall be placed during rain or snow storms, unless completely covered to prevent storm water from coming in contact with it. Sufficient protective covering material shall be kept on hand at all times should rain or snow storms arise during concrete placement operations.
- E. Concrete shall be deposited at or near its final position to avoid segregation caused by rehandling or flowing. Concrete shall not be deposited in large quantities in one place and worked along the forms with vibrator or other means. Concrete shall be uniformly distributed during the placing process and in no case after depositing shall any portion be displaced in the forms more than 2-feet in horizontal direction. Concrete shall be deposited in forms in horizontal layers not to exceed 24-inches in depth and shall be brought up evenly in all parts of the form. The rate of placement of concrete in forms shall not exceed 5-feet of vertical rise per hour. As the concrete is placed it shall be consolidated thoroughly and uniformly by mechanical vibration to secure a dense mass, close bond with reinforcement and other embedded items and smooth surface. The mechanical vibrator shall penetrate not only the freshly placed concrete, but also the previously placed lift to ensure the lifts become monolith. New concrete shall be placed against previously placed concrete, not away from it. When concrete is placed on a slope, placement shall begin at the lower end of the slope and progress to the upper end for the full width of the placement. Consolidation by mechanical vibration shall follow directly behind placement and the rate of placement shall never get ahead of the consolidation crew. Concrete placement shall continue without avoidable interruption, in a continuous operation until the end of the placement is reached.
- F. The drop of concrete into slab or wall forms shall be vertical. Concrete shall not be dropped through reinforced steel, but deposited in forms using a hopper with a drop chute to avoid segregation and to keep mortar from coating the reinforcement steel and forms above the in-place concrete. In no case shall the free fall of concrete exceed 4-feet below the end of the hopper or chute.
- G. If it takes more than 20-minutes to get back to place concrete over concrete previously placed, the depth of the layers being placed at one time shall be reduced, and/or placing equipment increased, until it is possible to return with the placing operation to previously placed concrete within 20-minutes. If concrete is to be placed over previously poured concrete and more than 20-minutes have elapsed, then a layer of grout not less than 1/2-inch thick shall be spread over the surface before placing the additional concrete.

- H. The placement of concrete for slabs, beams or walkways cast monolithically with walls or columns shall not commence until the concrete in the walls or columns has been allowed to set and shrink. The time allowed for shrinkage shall be not less than one (1) hour.
- I. Concrete shall be placed with the aid of approved mechanical vibrators. Vibration shall be supplemented by manual forking or spading adjacent to the forms on exposed faced in order to secure smooth dense surfaces. The concrete shall be thoroughly consolidated around reinforcement, pipes or other shapes built into the work. The vibration shall be sufficiently intense to cause the concrete to flow and settle readily into place and to visibly affect the concrete over a radius of at least 18-inches.
 - 1. Sufficient vibrators shall be on hand at all times to vibrate the concrete as placed. In addition to the vibrators in actual use while concrete is being placed, the Contractor shall have on hand one (1) spare vibrator in serviceable condition. No concrete shall be placed until it has been ascertained that all vibrating equipment, including spares, is in serviceable condition.
- J. Special care shall be taken to place the concrete solidly against the forms so as to leave no voids. Every precaution shall be taken to make all concrete solid, compact and smooth, and if for any reason the surfaces or interiors have voids or are in any way defective, such concrete shall be repaired as directed by the Engineer. No defective work shall be patched or repaired without the prior inspection and approval of the Engineer.
- K. The temperature of concrete when it is being placed shall be not more than 90 degrees F. nor less than 40 degrees F. in moderate weather, and not less than 50 degrees F. in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F., the Contractor shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The Contractor shall be entitled to no additional compensation on account of the foregoing requirements.
- L. Concrete shall not be placed on a frozen subgrade or subgrade that contains frozen materials. All ice and snow shall be removed from inside forms and from reinforcing steel and embedded items. The temperature of all surfaces that the concrete will contact shall be raised above the freezing point for at least 12-hours prior to placing new concrete.
 - 1. The minimum temperature of fresh concrete as mixed shall be 60 degrees F. for ambient temperature above 30 degrees F.; 65 degrees F. for ambient temperature 0 degrees F. to 30 degrees F.; and 70 degrees F. for ambient temperature below 0 degrees F. The minimum temperature of fresh concrete after placing shall be 55 degrees F. for the first 72-hours.
 - 2. The use of calcium chloride shall not be permitted.
 - 3. In general, the Contractor shall adhere to the recommendations as outlined in ACI Standard 306 for cold weather concreting, except as required herein.

3.5 PUMPING OF CONCRETE

- A. Pumping of concrete will be permitted only with the Engineer's approval. The pumping equipment must have two (2) cylinders and be designed to operate with one (1) cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor shall have a standby pump or crane and concrete bucket on site during pumping to provide assurance the concrete will be placed without cold joints in the event of pumping equipment breakdown. The minimum diameter of the hose (conduits) shall be 4-inches. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced. Aluminum conduits for conveying the concrete will not be permitted.
- B. Concrete samples for slump and test cylinders will be taken at the discharge end of the pumping conduit.

3.6 ORDER OF PLACING CONCRETE

- A. The order of placing concrete in all parts of the work shall be acceptable to the Engineer. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 7-days before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the two (2) adjacent wall panels have cured at least 14-days.
- B. The surface of the concrete shall be level whenever a run of concrete is stopped. To ensure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one (1) hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel.

3.7 TAMPING AND VIBRATING

- A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets and bringing only a slight excess of water to be exposed surface of concrete during placement. Vibrators shall be high speed power vibrators (8,000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.
- B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are horizontal, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

- C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred or worked with suitable appliances, tamping bars, shovels or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified with fifteen (15) minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner than causes segregation of its constituents.

3.8 FINISHING CONCRETE SURFACES

- A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles and dimensions shown are defined as tolerances and are specified in Paragraph 1.5, herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.
- B. Unformed Surfaces: After placing and consolidating concrete, all unformed top surfaces of slabs, walls, curbs, gutter and steps, shall be brought to a uniform finished surface. The classes of finish specified for unformed concrete surfaces are defined as follows:
1. Finish U1: Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
 2. Finish U2: After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where shown or as determined by the Engineer.
 3. Finish U3: After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples and trowel marks. The finish shall be smooth and free of all irregularities.
 4. Finish U4: Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a non-skid finish.
- C. The schedule for finished unformed surfaces shall be as follows:

Unformed Concrete Surface Schedule

<u>Area</u>	<u>Finish</u>
Grade slabs and foundations to be covered with concrete or fill material.	U1
Floor slabs to be covered with grouted tile or topping grout and slabs to be covered with built-up roofing.	U2
All building and machine room floors, basin floors not receiving a grout topping, channel floors, top of interior walls, top of interior curbs, steps and walkways. Grout Surfaces in Bottom of Clarifier and DAF.	U3
Exterior walkways, curb, gutter, sidewalk, and steps, top of valve or meter vaults, electrical pull boxes and catch basins. Grout surface in Clarifier and DAF Launderers.	U4
D. Floor Sealer Hardener (Surface Applied):	
1. Floor hardener shall be applied where shown or noted on the drawings.	
2. Floors to receive hardener shall be cured, cleaned and dry with all work above them completed. Apply zinc and/or magnesium fluosilicate evenly, using three (3) coats, allowing 24-hours between coats.	
3. The first coat shall be 1/3 strength, second coat 1/2 strength and third coat shall be 2/3 strength. Each coat shall be applied so as to remain set on the concrete surface for fifteen (15) minutes. If sodium silicate is used, it shall be applied evenly, using three (3) coats, allowing twenty-four (24) hours between coats, and the material shall be applied full strength at the rate of one (1) gallon per 300 square feet. Approved proprietary hardeners shall be applied in conformance with the manufacturers instruction. After the final coat is completed and dry, surplus hardener shall be removed from the surface by scrubbing and mopping with water.	
E. Formed Surfaces: Immediately following the removal of forms, the concrete shall be inspected for defects such as rock pockets, grout loss, damage from stripping forms, surface defects such as fins, offsets, bulges, excessive bug-holes and stains. All defective concrete work shall be removed and replaced or repaired to the satisfaction of the Engineer. Any work which has not been constructed in accordance with the plans and specifications will be considered defective.	
Correction of defective work shall be as directed by the Engineer and specified herein. No defective work shall be patched, repaired, or covered without prior inspection and approval of the Engineer.	

Holes left by tie-rod cones or taper ties shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with non-metallic grout.

The classes of formed concrete surfaces are defined as follows:

1. Finish F1: No special treatment is required after form removal except for curing, repair of defective concrete treatment of surface defects, removal of fins and projections, filling of tie holes and filling of depressions and bug-holes 3/8-inch or larger in width or depth with mortar.
2. Finish F2: All defective concrete shall be repaired, all fins, offsets, bulges and projections ground smooth, filling of tie holes and filling of depressions and bug-holes 1/4-inch or larger in width or depth with mortar.
3. Finish F3: All defective concrete shall be repaired, all fins, offsets, bulges and projections ground smooth and tie holes filled with grout. The entire surface shall then receive a light stoning or grinding using a No. 50 or No. 60 grit carborundum stone or grinding wheel to remove any laitance and curing film and to open up bug-holes hidden beneath the thin surface grout film. The surface shall then be given a stoned-sand type architectural finish as follows:
 - a. The concrete surface shall be pre-wet for several hours or overnight before treatment.
 - b. While the surface is still damp, spread a sand mix, consisting of one (1) part of Type II Cement and one to one and a half (1 to 1-1/2) parts of fine sand passing the No. 70 screen mixed with enough water and an emulsified bonding agent to have the consistency of thick cream. The sand mix should be spread thinly over the damp surface with a rubber float and rubbed in over the entire area leaving only a minimum amount of material on the surface necessary to produce a sand texture, approximately 1/32-inch in thickness.
 - c. The surface shall be kept continually damp for seventy-two (72) hours following this finish treatment.

F. The schedule for formed surface finish shall be as follows:

<u>Area</u>	<u>Formed Concrete Surface Schedule</u>	<u>Finish</u>
	Formed concrete surfaces to be covered by backfill or coated with below grade waterproofing systems.	F1
	Formed concrete surfaces in water channels, below water surface of basins, inside meter and valve vaults, inside cells of hydraulic splitter boxes and weirs.	F2
	Formed concrete surfaces inside buildings and machine rooms and all exposed exterior surfaces of foundations, basins, vaults, hydraulic structures and curbs.	F3

3.9 CURING AND DAMPPROOFING

- A. General: All concrete shall be cured for not less than ten (10) days in warm to hot weather and fourteen (14) days in cold weather after placing, unless otherwise indicated by the Engineer, in accordance with the methods specified herein for the different parts of the Work, and described in detail as follows:
1. Water Curing: Keep the concrete structures thoroughly and continuously wet and covered for at least 7 days. Place and anchor covers, mats, and sheeting to ensure continuous contact with the concrete surfaces. Use one of the water curing methods as detailed in ACI 308R-01.
 2. Curing Compound: The surface shall be sprayed with a liquid membrane-forming curing compound applied in accordance with the manufacturers printed instructions.
 - a. Care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
 - b. Curing compound specified shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within one (1) hour after removal of forms from contact with formed surfaces. Repairs to formed surfaces shall be made within the said one (1) hour period. If repairs cannot be made with the one (1) hour period they shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be sandblasted to remove the curing compound, following which repairs shall be made as specified herein.
 3. Cold weather is defined as when the temperature reaches or goes below 35 degrees F for one (1) hour during any 24-hour period during the curing period.
- B. Method 2 shall be used for wall sections with forms removed, encasement concrete and all concrete surfaces where Method 1 is not feasible.

3.10 PROTECTION

- A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damage to finish surfaces.
- B. Finished floor slabs in buildings and machine rooms shall be suitably protected from wear or damage from construction operations. The Contractor shall not use newly finished floors or buildings for machine assembly, fabrication, pipefitting, curing or welding operations without covering the working area with plastic sheets and/or plywood. Any concrete found to be damaged or which may have been originally defective or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the Contractor's expense.

- C. Immediately following the first frost in the fall, the Contractor shall be prepared to protect all concrete against freezing.

3.11 CURING IN COLD WEATHER

- A. After the first frost, and until the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one (1) day, the concrete shall be protected against freezing temperatures for not less than forty-eight (48) hours after it is placed. After the mean daily temperature in the vicinity of the worksite falls below 40 degrees F. for more than one (1) day, the concrete shall be maintained at a temperature not lower than 50 degrees F. for at least seventy-two (72) hours after it is placed.
- B. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F. over a (3) three day duration.
- C. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected from drying and excessive carbon dioxide atmosphere by application of curing Method 2 or Method 3, as specified under Article 3.9, Paragraph A herein.

3.12 REPAIR OF DEFECTIVE CONCRETE

- A. No concrete repairs shall be made until after inspection and approval of the method of repair by the Engineer. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing extensive voids, holes, honeycombing or similar depression defects shall be completely removed and replaced. Concrete containing minor voids, holes, honeycombing or similar depression defects shall be repaired as specified herein. All concrete repairs and replacements shall be promptly executed by the Contractor at its own expense.
- B. Prior to filling any structure with water, all cracks that may have developed shall be "vee'd" as shown on the Drawings and filled with construction joint sealant conforming to the requirements under Section 03 29 00 - Joints In Concrete. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane shall also have cracks repaired as specified herein.
- C. The repair of holes left by rock pockets, penetrations, tie rods or other reasons will require the use of non-shrink, non-metallic grout material.

END OF SECTION

SECTION 03 40 00

PRECAST CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Work Includes:
 - 1. Provide plant-cast, utility vaults and associated accessories as shown on the Drawings or specified herein, or as required to complete the work.
 - 2. Work includes, but is not necessarily limited to:
 - a. Precast Utility Vaults
- B. Related Sections:
 - 1. Section 01 00 00 - Basic Concrete Materials and Methods.
 - 2. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
 - 3. Section 31 23 17 - Trenching.
 - 4. Section 31 23 23 - Backfill.
 - 5. Section 32 12 16 - Asphalt Paving.
 - 6. Section 33 05 23.16 - Trenchless Utility Installation.
 - 7. Section 33 11 00 - Water Utility Distribution Piping.
 - 8. Section 33 12 16 - Water Utility Distribution Valves.
- C. Related Documents:
 - 1. Drawings, General and Supplementary Conditions, and applicable provisions of Division 1 Sections apply to this Section.
 - 2. Additional information concerning structural precast concrete is contained in the Structural Drawings. In the event of conflict between this Section and the Structural Drawings, the more stringent requirements shall take precedence.

1.2 REFERENCES

- A. Comply with the requirements of the reference standards noted herein, except where requirements that are more stringent are listed herein or otherwise required by the Contract Documents.
- B. American Concrete Institute (ACI):
 - 1. ACI 301 - Specifications for Structural Concrete in Buildings.
 - 2. ACI 318 - Building Code Requirements for Reinforced Concrete
- C. Concrete Reinforcing Steel Institute (CRSI):
 - 1. CRSI Manual of Standard Practice
- D. American Society for Testing and Materials (ASTM)
 - 1. ASTM A48 - Specification for Gray Iron Castings
 - 2. ASTM C150 - Specification for Portland Cement
 - 3. ASTM C478 - Precast Reinforced Concrete Manhole Sections

4. ASTM C443 - Rubber Gaskets
 5. ASTM C270 - Cement Mortar
- E. Precast Prestressed Concrete Institute (PCI):
1. PCI MNL-120 PCI Design Handbook - Precast and Prestressed Concrete, as applicable to types of precast concrete units indicated.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
1. Design precast units to support H-20 live loads and dead loads as required by local building codes.
 2. Design units exposed to weather to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal or cyclic day/night temperature ranges and exposure to moisture in any form.

1.4 SUBMITTALS

- A. Submittal Procedures: Refer to Section 01 00 00.
- B. Shop Drawings:
1. Submit complete shop drawings bearing the seal and signature of a professional structural engineer registered in the state of New Mexico.
 2. Include a layout plan; connection and anchorage details; size and location of reinforcing steel; location of all blockouts 8" or larger in any dimension; and identification marks which will appear on manufactured units to facilitate correct field placement and sequencing of work.
 3. Reproductions of Contract Document Drawings will not be acceptable for shop drawings.
- C. Design Calculations: Submit two sets of design calculations for each component of precast concrete structural system. Calculations to include all parts necessary for fabrication, erection and permanent attachment of each precast member. Calculations shall bear seal and signature of an engineer registered in the state of New Mexico.
- D. Reports: Submit design mixes and laboratory test reports for concrete used in precast members, in accordance with the applicable mix design requirements of Section 03 30 00.
- E. Certificates:
1. Proof of erector's experience, with listing or projects of similar size and scope, including names of architects/engineers and general contractors.
 2. Certification for each welder for required welds.
 3. Materials certificates for concrete materials.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer shall be a producer member in good standing of PCI and/or participate in the PCI Plant Certification Program, a member in good standing of CPA, and shall be approved by the Owner prior to bidding.
 - 2. Manufacturer shall assume undivided responsibility for engineering structural precast concrete units by employing a qualified professional engineer to prepare design calculations, fire-resistance calculations, shop drawings, and other structural data.
- B. Erector Qualifications: Erector shall be qualified with minimum five years experience in this type and scale of work.
- C. Welder Qualifications: Welds shall be made only by welders, tackers, and welding operators who have been qualified and certified by tests prescribed in AWS D1.1 to perform type of work required. Certification shall be dated within one year preceding the Contract Date.
- D. Production Procedures: Comply with the applicable requirements of PCI MNL-116, Manual for Quality Control for Plants and Production of Precast Concrete Products, including manufacturing and testing procedures, quality-control recommendations, and camber and dimensional tolerances for types of units required.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Permits: Apply and pay for any permit that may be required by local authorities for passage on public streets, including barricades and police for traffic controls.
- B. Delivery: Deliver precast concrete units to project site in such quantities and at such times to ensure continuity of installation.
- C. Storage and Handling:
 - 1. Store units at project site to prevent cracking, distorting, warping, staining, or other physical damage, and so that markings are visible.
 - 2. Hoist and store units in such a manner as to prevent excessive stresses, spalling, chipping or cracking. Lift units by means of suitable lift rings or devices as shown on shop drawings. Damaged units are subject to rejection.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Forms: provide forms and, where required, form fanning materials of metal, plastic, wood, or another acceptable material that is nonreactive with concrete and will produce required finish surfaces.

- B. Portland Cement: ASTM C150, Type I, without integral air-entrainment; color - gray. Use only one brand and type of cement throughout project, unless otherwise acceptable to Engineer.
- C. Aggregates: Maintain fines modulus of aggregates within plus/minus 0.20 of gradations used in reviewed design mixes.
 - 1. Fine Aggregate: Washed sand, ASTM C33 for material and gradation.
 - 2. Coarse Aggregate: Washed gravel or stone, ASTM C33 for materials and gradation, suitable for severe weathering regions.
- D. Admixtures:
 - 1. General: provide admixtures for concrete that contain not more than 0.1 percent chloride ions by mass of Portland cement or cementitious material.
 - 2. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
 - 3. Other Admixtures: Use only with prior review by Engineer. Admixtures shall be certified in writing by manufacturer to be in compliance with ASTM C494.
- E. Reinforcement:
 - 1. Deformed Bars: ASTM A615, grade 60, except ties and stirrups #4 and smaller to be grade 40.
 - 2. Wire Mesh: Welded steel wire fabric, ASTM A185.
 - 3. Tie Wires: ASTM A82.
 - 4. Supports for Reinforcement:
 - a. Provide supports for reinforcement, including bolsters, chairs, spacers and other devices for spacing, supporting, and fastening reinforcing, complying with CRSI recommendations.
 - b. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are protected with plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).
- F. Embedments and Connectors:
 - 1. Steel Shapes and Plates: ASTM A36.
 - 2. Malleable Iron Castings: ASTM A47
 - 3. Bolts and Studs: ASTM A307, Grade A (ASTM F568, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.
 - 4. Welded Headed Studs: AWS D1.1, Type B headed studs, cold-finished carbon-steel bars. Deformed-Steel Wire Bar Anchors: ASTM A496.
 - 5. Accessories: Provide clips, hangers, shims, and other accessories required to install precast concrete units.
 - 6. Hot-Dip Galvanized Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by the hot-dip process in accordance with the following:
 - a. ASTM A123 for galvanizing rolled, pressed, and forged shapes, plates, bars, and strips.
 - b. ASTM A153 for galvanizing iron and steel hardware.

- G. Lifting Devices: Provide appropriate lifting devices for each precast member, based on Contractor's design calculations and approved shop drawings. Remove lifting devices after permanent installation.
- H. Bearing Pads: Provide bearing pads for precast concrete units as follows:
 - 1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer, minimum tensile strength 2250 psi per ASTM D4122.
 - 2. Random, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.
 - 3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric, bonded in elastomer. Surface hardness of 80 to 100 Shore A durometer.
 - 4. Frictionless Pads: Tetrafluoroethylene (TFE), glass-fiber-reinforced, bonded to mid-steel plate, of type required in-service stress.
 - 5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.
- I. Welding Materials: Conform to AWS code and AWS filler metal specifications. Select materials which are suitable for use with types of steel to be joined.
- J. Castings for manhole frames and covers shall be non-rocking and shall conform to the requirements of ASTM A48, Class 30. Unless otherwise shown, cast iron covers and frames shall be heavy duty, traffic weight rated as manufactured by NEENAH Foundry Company, meeting NEENAH R-1924, or equal, with embossed lettering to meet the requirements of the OWNER. Frame and cover shall be designed for H-20 traffic loading.
- K. When required, steps shall be steel reinforced plastic, reinforcing shall be 3/8-inch diameter. Plastic shall be copolymer polypropylene meeting requirements of ASTM D4101, Grade 49108.

2.2 FABRICATION

- A. Design Deviations: Permitted only after Engineer's review and written approval.
- B. Production Methods: Conform to PCIU MNL-116 and PA Specifications.
- C. Structural Design:
 - 1. Design units for superimposed live and dead loads as indicated or required by applicable codes.
 - 2. Design precast concrete in accordance with latest provisions of ACI 318, for a compressive strength of 4000 psi at 28 days.
 - 3. Provide additional reinforcement to resist transportation and erection stresses.

- D. Formwork:
1. Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete placing operations, and temperature changes,. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL-116.
 2. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.
- E. Built-in Anchorages:
1. Coordinate with other trades for installation of cast-in items.
 2. Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect the position of the main reinforcement or placing of concrete. Do not relocate bearing plates in units, unless acceptable to Engineer.
- F. Cast-in Openings: Cast-in openings larger than 6" in diameter or 6" square according to final shop drawings. Other smaller holes may be field cut by trades requiring them, as acceptable to Engineer.
- G. Reinforcement:
1. Comply with the recommendations of CRSI Manual of Standard Practice for fabricating, placing, and supporting reinforcement.
 2. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 3. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers and hangers, as required.
 4. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- H. Concrete Mixing: Comply with requirements and with ASTM C94. Following concrete batching, no additional water may be added.
- I. Concrete Placement:
1. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast units. Comply with requirements of ACI 304R for measuring, mixing, transporting and placing concrete.

2. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with ACI 309R.
 3. Comply with ACI 306R procedures for cold-weather concrete placement.
 4. Comply with ACI 305R procedures for hot-weather concrete placement.
- J. Concrete Finish:
1. Unless otherwise indicated, finish formed surfaces of precast concrete with standard or normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, and form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.
 2. Finish unformed surfaces by trowel, unless otherwise indicated. Consolidate concrete; bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
 3. Apply scratch finish to precast concrete units that will receive concrete topping after installation. Following initial strike-off, transversely scarify surface to provide ridges approximately 1/4" deep.
- K. Curing: Cure concrete according to the requirements of PCI MNL-116 by moisture retention without heat or by accelerated heat curing, using low-pressure live steam or radiant heat and moisture.
- L. Identification:
1. Mark all precast pieces with identification marks to facilitate correct field placement. Place identification marks in a location that will not be visible after erection is complete.
 2. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on final shop drawings.
 3. Imprint casting date on each precast unit.
- M. Fabrication Tolerances:
1. Except as otherwise specified by PCI MNL-116, produce precast concrete members to dimensions shown on drawings within tolerances listed below. Tolerances are maximum allowable dimensional departure from planes and points established.
 2. Allowable Tolerances:
 - a. Length $\pm 1/2''$
 - b. Width $\pm 1/4''$
 - c. Depth (thickness) $\pm 1/8''$
 - d. Squareness $\pm 1/4''$ max., $\pm 1/8''$ in 10 ft
 - e. Openings $\pm 1/4''$
 - f. Cross Section Dimensions $\pm 1/4''$
 - g. Inserts (from centerline) $\pm 1/2''$
 - h. Haunches $\pm 1/8''$
 - i. Alignment (sweep) $\pm 3/4''$ in 40 ft.
 - j. Blockouts (from centerline) $\pm 1''$
 - k. Warpage $3/8''$ max. in 10 ft.

- l. Handling Devices $\pm 6''$
- m. Weld Plates $\pm 1/2''$

N. Damage and Repair: Patching in plant will be acceptable provided structural adequacy of product and appearance are not impaired.

2.3 SOURCE QUALITY CONTROL

- A. Material Source: Obtain concrete materials only from same sources used for preparation of design mixes, and use same sources continuously throughout the work.
- B. Materials Testing and Certification: Materials certificates prepared by precast concrete manufacturer's in-house or consulting testing agency will be accepted as evidence of compliance with the requirements of the Contract Documents; however, the Owner and the Engineer reserve the right to require additional testing by an independent testing agency if either has reason to believe materials or products are not in compliance. Responsibility for payment of additional tests will be determined in accordance with the procedures in Section 01 00 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the work of this section will be performed. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

3.2 PREPARATION

- A. Bearing Surfaces: Clean bearing surfaces prior to erection of precast units. Remove rust, dirt, concrete or mortar droppings, and other substances that might interfere with proper bearing of precast members.

3.3 INSTALLATION

- A. General: Set precast unit in place in accordance with approved shop drawings. Precast units shall be properly aligned and leveled within specified tolerances.
- B. Bench Marks: Provide accurate bench marks for use during erection. Promptly correct errors or inconsistencies.
- C. Temporary Shoring and Bracing: Provide temporary shoring and bracing of precast concrete units as required to maintain location, stability, and alignment until permanent connections are installed.

- D. Grouting: After precast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints in accordance with the requirements of Section 03 05 00.

3.4 FIELD QUALITY CONTROL

- A. Testing and Inspections: The testing and inspection agency will test and inspect welded connections of precast members, in accordance with applicable provisions of Section 01 00 00.

3.5 CLEANING AND REPAIRS

- A. Cleaning:
 - 1. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
 - 2. Wash and rinse according to precast concrete manufacturer's recommendations. Protect other work from staining or damage due to cleaning operations.
 - 3. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.
- B. Repairs to Damaged Work: Repair minor damages or replace structurally damaged members. Completed work shall be structurally sound and ready to receive subsequent loads and finishes.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing surface debris.
 - 2. Removing designated paving, curbs, and other obstructions.
 - 3. Removing designated trees, shrubs, and other plant life.
 - 4. Removing abandoned utilities.
 - 5. Excavating topsoil.

- B. Related Sections:
 - 1. Section 31 23 18 - Rock Removal
 - 2. Section 31 23 17 - Trenching
 - 3. Section 31 23 23 - Backfill

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with the most recent edition of the New Mexico Standard Specifications for Public Works Construction, with latest revisions.

- B. Perform Work in accordance with the most recent edition of the NMDOT Standard Specifications for Road and Bridge Construction, with latest revisions.

- C. Conform to applicable State of New Mexico code for environmental requirements, disposal of debris, burning debris on site, use of herbicides.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Quality Requirements: Examination of existing conditions before starting work.

- B. Verify existing plant life designated to remain is tagged or identified.

- C. Identify waste area and/or salvage area for placing removed materials.

3.2 PREPARATION

- A. Call New Mexico “One Call” at 811 and/or local utility companies at least three (3) days before performing Work.
 - 1. Request that underground utilities be located and marked within and surrounding construction areas.

3.3 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain, from damage.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping.
- C. Protect benchmarks, survey control points, and existing structures from damage or displacement.

3.4 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees and shrubs within indicated areas. Remove stumps and surface rock.
- C. Clear undergrowth and deadwood, without disturbing subsoil.
- D. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Partially remove paving, curbs, and other obstructions as indicated on Drawings. Neatly saw cut edges at right angle to surface.
- C. Remove abandoned utilities as directed by Owner and/or Engineer. Indicate removal termination point for underground utilities on Record Documents.
- D. Continuously clean up and remove waste materials from site. Do not allow materials to accumulate on site.
- E. The Engineer will indicate to the Contractor, which obstructions are to be removed, disposed of, or salvaged, and will require special documentation.
- F. All existing fences crossed by the Work, or are within the construction area, are to be removed and rebuilt to original condition or better. Fence materials resulting from such removal are to be stored or disposed of as directed by the Engineer. Fence materials suitable for reuse or salvage that are damaged, lost or destroyed due to the Contractor's negligence or carelessness are to be replaced at the Contractor's expense.
- G. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material and cover over with same material, until disposal.
- D. Remove excess topsoil not intended for reuse, from site.
- E. All equipment shall be properly maintained and with proper safety devices.
- F. Contractor must maintain control of dust and minimize blowing debris.

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating trenches for utilities.
 - 2. Compacted fill from top of utility bedding to finished grade.
 - 3. Backfilling and compaction.

- B. Related Sections:
 - 1. Section 03 05 00 - Basic Concrete Materials and Methods: Concrete materials.
 - 2. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
 - 3. Section 31 23 18 - Rock Removal: Removal of rock during excavating.
 - 4. Section 31 23 23 - Backfill: General backfilling.
 - 5. Section 33 11 00 - Water Utility Distribution Piping.

1.2 REFERENCES

- A. Geotechnical Report
 - 1. Report dated April 14, 2011, prepared by Souder, Miller & Associates, entitled: Results of Field and Laboratory Testing for Alto Lakes W&SD – Ph. A Waterline Project, Alto, New Mexico, consisting of 2 pages.

- B. NMSSPWC
 - 1. NMSSPWC Sections 701, 801 & 802 “Trenching, Excavation and Backfill”.

- C. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.

- D. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D422 - Particle -Size Analysis of Soils.
 - 3. ASTM D653 - Terminology Relating to Soil, Rock, and Contained Fluids.
 - 4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - 5. ASTM D1140 - Amount of Material in Soils Finer than the No. 200 Sieve.
 - 6. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 7. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³).
 - 8. ASTM D1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.

9. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
10. ASTM D2216 - Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
11. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
12. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedure).
13. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
14. ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement.
15. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
16. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
17. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
18. ASTM D4254 - Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
19. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
20. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
21. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
22. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
23. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
24. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
25. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
26. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
27. ASTM D5080 - Rapid Determination of Percent Compaction.
28. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

- A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
- B. Materials Source: Submit name of imported fill materials suppliers.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with applicable New Mexico state standards and specifications of the utility provider.
- B. Perform Work in accordance with applicable OSHA trench safety standards.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.6 COORDINATION

- A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Pipe Bedding and Embedment: As specified in Section 31 23 23.
- B. Pipe Backfill: As specified in Section 31 23 23.
- C. Structural Fill: As specified in Section 31 23 23.
- D. Granular Fill: As specified in Section 31 23 23.
- E. Concrete: Structural concrete, as specified in Section 03 30 00, with minimum compressive strength of 4,000 psi. Concrete for thrust blocking with minimum compressive strength of 3,000 psi.

PART 3 EXECUTION

3.1 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
 - 1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

3.2 PREPARATION

- A. Call New Mexico "One Call" at 811 and local utilities not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect plant life, lawns, and other features remaining as portion of final landscaping.
- D. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.

- F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 LINES, GRADES AND DIMENSIONS

- A. Excavate trench to lines and grades indicated on Drawings.
 - 1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required based on field conditions.
 - 2. Deviations from horizontal and vertical pipe line and grade by Contractor per Section 33 11 00 - Water Utility Distribution Piping.
 - 3. When bottom of trench is rocky, over-excavate and fill as specified in Section 31 23 23.
- B. Excavate trench to minimum width as indicated on Drawings.
 - 1. Cut trenches to width indicated on Drawings, providing at least 6 inches of clear space between the trench face and the outside diameter of the pipe. The maximum permissible width of the trench shall be the outside diameter of the pipe (or distance between pipes plus pipe diameters in the event that two pipes are buried in the same trench) plus 24 inches, unless otherwise indicated on the Drawings, permission in writing to use a greater width is obtained from the Engineer.
 - 2. Increase trench width as required to meet required clearances between pipe and trench wall, to avoid voids in the haunch areas of the pipe and to meet embedment compaction requirements or minimum soil cement slurry layer thickness. Increased trench width, if needed to meet these requirements, shall be provided at no additional cost to the Owner.

3.4 TRENCHING

- A. Excavate subsoil required for utilities.
- B. Remove lumped subsoil, boulders, and rock up to the size that would require special equipment beyond conventional machinery used for trenching, in which case the Engineer should be notified immediately.
- C. Allowable Open Trench: Trenches may be opened in advance of pipe placement and backfill operations under the following conditions:
 - 1. In developed areas and along traveled roadways, no more than 50 feet of trench shall be opened in advance of pipe laying operations. This distance may be reduced due to traffic control considerations. Backfilling shall begin as soon as pipe is laid and inspected and shall keep pace with the pipe laying. In undeveloped areas outside of roadway rights-of-way and away from any vehicular or pedestrian traffic, open trench shall not be advanced more than 50 feet ahead of installed pipe. Whenever local, county, state, or federal regulations impose stricter limitations, such regulations will take precedence.
 - 2. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by traffic weight steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plates may be waived in undeveloped areas, such as where the trench is located further

- than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights, or escape ramps and earthen trench plugs for wildlife, shall be provided and maintained to meet applicable safety requirements. In no case shall more than 100 feet of trench be left open at end of working day.
3. Do not block vehicular traffic or impede access to homes or businesses.
 4. Protect open trench to protect the public, livestock, wildlife, and the environment.
 5. Contractor is solely responsible for safety of all open trenches and bears sole liability for any incidents or accidents arising from open trenches.
 6. The Owner may restrict the amount of open trench as needed due to safety, land use or environmental considerations.
- D. Intercept and divert surface drainage and precipitation away from excavation through use of dikes, curb walls, ditches, pipes, or other means.
- E. Dewater and maintain substantially dry subgrade during pipe installation.
1. Remove groundwater by pumping to keep excavations dry.
 2. Comply with New Mexico state standards and requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.
 3. If a separate bid item is not included on the Bid Form for dewatering, the cost thereof will be considered incidental to the cost of trenching and utility installation.
- F. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.
- G. Do not interfere with 45 degree bearing splay of foundations. Any excavation in this area shall be backfilled and compacted using the same materials and methods as structural fill for new buildings. Refer to Section 31 23 23.
- H. Slope or shore trench as needed to meet safety requirements. When sidewalls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.
- I. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered. Backfill and compact to reach specified or directed line and grade. Refer to specifications for overexcavation backfill, as set forth in Section 31 23 23.
- J. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to specified or directed line and grade. Refer to specifications for overexcavation backfill, as set forth in Section 31 23 23.
- K. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- L. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.
- M. Remove excess subsoil not intended for reuse, from site.

- N. Protect open trench at all times to prevent danger to the public and to wildlife. Any safety requirements imposed by agencies or entities with jurisdiction must be met.

3.5 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
- C. Design sheeting and shoring to be removed at completion of excavation work. If the Engineer orders the sheeting to be left in place for the protection of the work, a payment will be allowed only for the actual cost of the timber left in place.
- D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.6 BACKFILLING OF TRENCHES

- A. See Section 31 23 23 - Backfill, Articles 3.3, and 3.4 for general backfill requirements, as well as trench backfill and bedding requirements around pipelines.

3.7 DISPOSAL OF EXCAVATED MATERIALS

- A. Excess excavation waste shall be legally disposed of off-site. Cost of haulage and disposal is intrinsic to the unit pricing for pipe in trench.
- B. Do not dispose of waste material by dumping from tops of slopes.
- C. Do not dispose of excess material within 15 feet of any wash, drainage or waterway.

3.8 TOLERANCES

- A. Section 01 00 00 - Quality Requirements: Tolerances.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.9 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.
- B. Determine compaction characteristics of materials in accordance with ASTM D698.
- C. Classify soils in accordance with ASTM D2487.
- D. Perform laboratory material tests in accordance with ASTM D1557.

- E. Refer to compaction testing requirements in Section 31 22 13 - Rough Grading and/or Section 31 23 23 - Backfill, Field Quality Control, as applicable.

3.10 PROTECTION OF FINISHED WORK

- A. Section 01 00 00 - Execution Requirements: Protecting installed construction.
- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 23 18

ROCK REMOVAL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing identified and discovered rock during excavation.
 - 2. Expansive tools to assist rock removal.
- B. Related Sections:
 - 1. Section 31 23 17 - Trenching
 - 2. Section 31 23 23 - Backfill

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Trench Rock Removal:
 - 1. Basis of Measurement: By linear foot of trench excavation.
 - 2. Basis of Payment: Includes preparation of rock for removal, mechanical disintegration of rock, removal from position, loading and removing from site. Each linear foot of trench rock removal includes all material, both loose and rock, removed to reach required depth. For over-excavation, payment will not be made for over-excavated work nor for replacement materials.
 - 3. Where trench rock removal is required, additional pipe bedding material will be needed, as stipulated in Article 3.5.G of Section 31 23 17 - Trenching.

1.3 REFERENCES

- A. Not used.

1.4 SUBMITTALS

- A. Section 01 00 00 - Submittals: Submittal procedures.
- B. Shop Drawings: Indicate proposed method of intended rock removal method.

1.5 QUALITY ASSURANCE

- A. Not used.

1.6 PROJECT CONDITIONS

- A. Conduct survey and document conditions of buildings near locations of rock removal, and photograph existing conditions identifying existing irregularities.
- B. Advise owners of adjacent buildings or structures in writing, prior to executing seismographic survey. Explain planned seismic operations.

- C. Obtain seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

1.7 SCHEDULING

- A. Section 01 00 00 - Administrative Requirements: Coordination.
- B. Schedule Work to avoid disruption to occupied buildings nearby.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Not used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Administrative Requirements: Coordination.
- B. Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

- A. Excavate and remove rock by mechanical method.
 - 1. Drill holes and use expansive tools to fracture rock.
- B. Cut away rock at bottom of excavation to form level bearing.
- C. Remove shaled layers to provide sound and unshattered base for footings.
- D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- E. Remove excavated materials from site.

3.4 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.
- B. Request visual inspection of foundation bearing surfaces by Engineer before installing subsequent work.

END OF SECTION

SECTION 31 23 23

BACKFILL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backfilling building perimeter to subgrade elevations.
 - 2. Backfilling site structures to subgrade elevations.
 - 3. Fill under slabs-on-grade.
 - 4. Fill under paving.
 - 5. Fill for over-excavation.
 - 6. Pipe bedding material.

- B. Related Sections:
 - 1. Section 03 05 00 - Basic Concrete Materials and Methods: Concrete materials.
 - 2. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
 - 3. Section 31 23 17 - Trenching
 - 4. Section 31 23 18 - Rock Removal.
 - 5. Section 33 11 00 - Water Utility Distribution Piping.

- C. Geotechnical Report
 - 1. Report dated April 14, 2011, prepared by Souder, Miller & Associates, entitled: Results of Field and Laboratory Testing for Alto Lakes W&SD – Ph. A Waterline Project, Alto, New Mexico, consisting of 2 pages.

- D. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T99 - Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 3050mm (12-in.) Drop.
 - 2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- E. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D422 - Particle -Size Analysis of Soils.
 - 3. ASTM D653 - Terminology Relating to Soil, Rock, and Contained Fluids.
 - 4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 5. ASTM D1140 - Amount of Material in Soils Finer than the No. 200 Sieve.
 - 6. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 7. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 8. ASTM D1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.

9. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
10. ASTM D2216 - Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
11. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
12. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedure).
13. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
14. ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement.
15. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
16. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
17. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
18. ASTM D4254 - Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
19. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
20. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
21. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
22. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
23. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
24. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
25. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
26. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
27. ASTM D5080 - Rapid Determination of Percent Compaction.
28. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.2 DEFINITIONS

- A. Percentage Compaction: Ratio, expressed as percentage, of actual density of material compared with maximum dry density based on Standard Proctor (ASTM D698).
- B. Optimum Moisture Content: Based on Standard Proctor (ASTM D698).
- C. Unified Soil Classification System: Based on ASTM D2487.

1.3 SUBMITTALS

- A. Section 01 00 00 - Submittal Procedures.

- B. Submit samples and certified test documentation of all materials to be used.
- C. Materials Source: Submit name of imported fill materials suppliers.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- E. Submit field soil test on material in place as backfill and pipe bedding material.
- F. Submit construction drawings with compaction test locations marked and labeled with station, date, test number, depth of test below ground surface, and test result.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Suitable materials may be processed on-site, or may be imported. If imported materials are required to meet the quantity requirements of the project, it will be provided at no additional expense to the Owner, unless a unit price item is included for imported materials in the bidding schedule. The following types of materials are defined as suitable:

- 1. Type A (three-quarters inch minus aggregate backfill): Crushed rock or gravel, and sand with the gradation requirements below.

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/4-inch	100
No. 4	30 – 50
No.200	0 – 12

- 2. Type B (Class I crushed stone): Manufactured angular, crushed stone, crushed rock, or crushed slag with the following gradation requirements. The material shall have a minimum sand equivalent value of 75.

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/4-inch	100
No. 4	30 – 50
No. 200	0 - 5

- 3. Type C (sand backfill): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a No. 4 sieve, and a sand equivalent value not less than 30.

- a. This material to be used only when approved by Engineer.

- 4. Type D: (pipe bedding material):

- a. Crusher fines shall consist of inert materials that are hard, durable, with stone free from surface coatings and deleterious materials.

<u>Sieve Size</u>	<u>Percentage Passing</u>
½ inch	100
¾ inch	100
No. 4	65-80
No. 8	48-63

No. 50	20-27
No. 200	10-12

5. Type E (pea gravel backfill): Crushed rock or gravel with 100 percent passing a 1/2-inch sieve and not more than 10 percent passing a No. 4 sieve.

6. Type F (coarse drain rock): Crushed rock or gravel meeting the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
2-inch	100
1-1/2-inch	90- 100
1-inch	20 – 55
3/4-inch	0 – 15
No. 200	0 – 3

7. Type G (aggregate base, base course) as follows:

<u>Sieve Size</u>	<u>Percentage Passing</u>
1-inch	100
3/4 inch	80-100
No.4	30-60
No.10	20-45
No. 200	3-10

8. Type H (graded drain rock): Drain rock shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
1-inch	100
3/4-inch	90 - 100
3/8-inch	40 - 100
No. 4	25 – 40
No. 8	18 – 33
No. 30	5 – 15
No. 50	0 – 7
No. 200	0 – 3

9. Type I Not Used

10. Type J (cement-treated backfill): Material which consists of Type H material, or any mixture of Types B, C, G, and H materials which has been cement-treated so that the cement content of the material is not less than 5 percent by weight when tested in accordance with ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement. The ultimate compressive strength at 28 days shall be not less than 400 psi when tested in accordance with ASTM D1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.

11. Type K (topsoil): Stockpiled topsoil material which has been obtained at the site by removing soil to a depth not exceeding 2 feet. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris.
12. Type L (controlled low strength material): Controlled low strength material, also referred to as 'soil cement slurry' or 'flowable fill' shall meet the following requirements:
 - a. Slurry shall have a 7-day compressive strength of not less than 50 psi and not more than 150 psi. The compressive strength shall be determined in accordance with ASTM D4832.
 - b. Typical cement content: 3 to 10 percent by dry weight of soil to obtain specified compressive strength.
 - c. The water-cement ratio of the mix shall not exceed 3.5:1. The water content shall not exceed that required to provide a mix that will flow and can be pumped.
 - d. The consistency of the slurry shall be such that the slurry flows easily into all openings between the pipe and the lower portion of the trench.
13. Type M (aggregate sub-base, structural fill). Well-graded crushed rock or natural gravel meeting the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
4-inch	100
3-inch	95 100
No. 200	3 - 15

- B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, the Engineer shall be immediately notified. In case of conflict between types of pipe embedment backfills, the Contractor is to use the agency-specified backfill material if that material provides a greater degree of structural support to the pipe, as determined by the Engineer. In case of conflict between types of trench or final backfill types, the Contractor shall use the agency-specified backfill material if that material provides the greater in-place density after compaction.
- C. Fill and backfill types, including use of native soil, shall be used in accordance with the following provisions. Native soil used for fill and backfill must meet the requirements of the type of material specified below and as shown for the corresponding type of material shown in 2.1.A above.
 1. Embankment fills shall be constructed of Type M material, as defined herein, or other material approved by the Project Engineer. Drainage structures embankments shall be backfilled with materials used in original construction.
 2. Pipe zone backfill shall consist of the following materials for each pipe material listed below. All pipe bedding material shall receive prior approval by the Engineer before use.
 - a. Concrete pipe, shall be provided Type A or B pipe bedding and embedment backfill material, or native material that meets the criteria described below, and is acceptable to the Engineer.

- b. Plastic pipe shall be provided Type D bedding and embedment zone material, or native material that meets the criteria described below, and is acceptable to the Engineer.
 - 1) In trenches where dewatering is required, the pipe bedding material and embankment backfill shall be Type A or B as directed by the Engineer.
 - c. Excavated native material will be allowed, provided that it is free draining and contains no organic materials, no rocks larger than 1/2-inch, clods or frozen lumps. A proctor of this material shall be submitted to the Engineer for review and approval before use. If native backfill material is approved, on-site screening may be required by Engineer to remove any rock material larger than 1/2-inch at no additional expense to the Owner. The location of such sites must be coordinated with the Owner.
3. Trench zone backfill for pipelines shall be any of Types A through H backfill materials or any mixture thereof.
 4. Final backfill material for pipelines under paved areas shall be Type G backfill material.
 5. Final backfill under areas not paved shall be the same material as that used for trench backfill, unless otherwise indicated.
 6. Trench backfill and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.
 7. Aggregate base materials under pavements, curb and gutter, and sidewalk shall be Type G material constructed to the thickness indicated.
 8. Aggregate sub-base shall be Type M material.
 9. Backfill around structures shall be Types A through Type H materials, or any mixture thereof.
 10. Under structures where groundwater must be removed to allow placement of concrete, Type F material shall be used. Before the Type F material is placed, filter fabric shall be placed over the exposed foundation. Filter fabric shall be Mirafi 140 N, Mirafi 700X, or equal.
 11. Under all other structures, Type G or H material shall be used.
 12. Backfill used to replace pipeline trench over-excavation shall be a layer of Type F material with a 6-inch top filter layer of Type E material or filter fabric to prevent migration of fines for wet trench conditions or the same material as used for the pipe zone backfill if the trench conditions are not wet.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

- D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify subgrade surface to depth of 8 inches.
- D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING FOR STRUCTURES, SITE WORK AND APPURTENANCES

- A. Refer to geotechnical data regarding any issues not specifically addressed in these technical specifications. In the event of any discrepancies or differences in requirements between the geotechnical report and the technical specifications, the more stringent requirement shall apply.
- B. Backfill areas to contours and elevations with unfrozen materials as indicated on the Drawings or as directed by the Engineer.
- C. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- D. Each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer.
- E. Place material in continuous layers as follows:
 - 1. Subsoil Fill: Maximum 8 inches compacted depth.
 - 2. Structural Fill: Maximum 6 inches compacted depth.
 - 3. Granular Fill: Maximum 6 inches compacted depth.
- F. Employ placement method that does not disturb or damage other work.
- G. Maintain optimum moisture content of backfill materials to attain required compaction density.
- H. Slope grade away from building minimum 6 inches in 10 ft, unless noted otherwise.
- I. Make gradual grade changes. Blend slope into level areas.
- J. Shape and drain embankments and excavations, maintain ditches and drains to provide drainage at all times. Protect graded areas against action of elements prior to acceptance of work, and reestablish grade where settlement or erosion occurs.

- K. Bench hillside slopes or fills to key the embankment. Remove and re-compact a minimum of 12 inches normal to the slope of the hillside or fill as the embankment or fill is brought up in layers.
- L. Remove surplus backfill materials from site.
- M. Leave fill material stockpile areas free of excess fill materials.
- N. Repair or replace remaining items damaged by excavation or filling.

3.4 BACKFILLING OF TRENCHES

- A. Pipe zone backfill materials shall be manually spread around the pipe so that, when compacted, the pipe zone backfill will provide uniform bearing and side support.
- B. A 4-inch thickness of granular bedding material shall be placed in the ditch and compacted before the pipe is laid and the joint made. Pipe bedding material shall be placed on both sides of the pipe and on top to a depth of 12 inches over the top of the pipe, 15 inches over the top of the pipe in paved or traffic areas, and compacted by hand held compacting tools before other backfilling is done.
- C. In especially rocky areas where there is concern that settling rocks in the surrounding material may rupture the pipeline, the amount of bedding material below and above the pipe shall be increased. In these cases there will be 8 inches of bedding material below the pipe and 15 inches above. The Resident Project Representative shall indicate where this special bedding specification shall apply.
- D. When the bottom of the trench is unstable, an additional 4 inches shall be over-excavated and filled with bedding material before laying of pipe.
- E. Employ a placement method that does not disturb or damage utilities in the trench. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Where the backfill material moisture content is too high to permit the specified degree of compaction, the material shall be dried until the moisture content is satisfactory.
- G. Backfill around sides and to top of pipe with cover fill in maximum lifts of 12 inches compacted depth, tamp in place and compact to 90 percent. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.
- H. No backfilling by machine methods permitted until a minimum of one foot of material has been placed by hand over the top of the pipe.

3.5 COMPACTION

- A. Do not place and compact soil under the following conditions:
 - 1. Ambient air temperature below freezing.
 - 2. Rain that creates puddles in clayey or silty materials.
 - 3. Ice or snow pockets visible in material being placed.

- B. Surface Preparation:
 - 1. Prepare surface so that first compacted lift will be placed on firm, stable base. Compact surface to specified percent compaction, if necessary.
 - 2. For water-retaining compacted fill, scarify and moisten surface to provide satisfactory bonding surface before placing first layer of material to be compacted.
 - 3. Do not place material to be compacted on frozen surface.
- C. Compact material in trenches in layers having approximately the same top elevation on both sides of the pipeline to avoid unequal loading and displacement of the pipe.
- D. Placement:
 - 1. Place soil to be compacted in horizontal layers.
 - 2. Blend materials as needed to ensure compacted fill is homogenous and free from lenses, pockets, streaks, voids, laminations and other imperfections.
- E. Compaction Procedures:
 - 1. Silty or Clayey Material:
 - a. Compact with mechanical impact tampers, tamping rollers, vibrating pad foot rollers, rubber tire rollers or other suitable compaction equipment.
 - b. Uniformly distribute equipment passes.
 - c. Compact in horizontal layers to compacted thickness of 6 inches or less.
 - 2. Cohesionless Free-Draining Material: Compact in horizontal layers to maximum compacted thickness of:
 - a. Tampers and rollers: 6 inches
 - b. Crawler-type tractors, vibrating drum rollers, surface vibrators or similar equipment: 12 inches
 - c. Saturation and internal vibration: Penetrating depth of vibrator.
 - 3. When compacting pipe embedment material, exercise care not to damage the pipe or appurtenances with compaction equipment. Do not apply compaction equipment directly above the pipe.
 - 4. Demonstration: Lift thicknesses may vary depending on equipment and methods. Field adjustments to the specified lift thicknesses may be allowed or required. Contractor shall demonstrate that proposed equipment and methods will meet required compaction for the proposed lift thickness.
 - 5. Flooding and jetting is not allowed unless specifically approved by the Engineer.
- F. Moisture Content:
 - 1. Optimum moisture content for each soil type, whether native soil or imported material, shall be determined by the Standard Proctor method, ASTM D698.
 - 2. Moisture content during compaction shall be no more than 2 percentage points wet or dry of optimum moisture content.
 - 3. Moisten or aerate material, as necessary, to provide specified moisture content. Add water to soil in increments that will permit moisture content to be uniform and homogenous through each layer after mixing.
 - 4. Add no more than 2 percent water to fill by sprinkling just prior to compaction when fill is clayey and contains dry clods of clay.

- a. If clayey soil is more than 2 percent below optimum moisture, pre-conditioning and curing may be required to obtain uniform and homogenous distribution of moisture in clods.
 - b. Use of disks, harrows or rakes may be required to blend moisture prior to placement and compaction.
 5. For cohesionless soils, add water as necessary during compaction, as these soils are free-draining.
- G. Minimum Percent Compaction:
1. Overexcavation: Backfill of overexcavation to specified or directed lines shall be compacted to same percent compaction as embedment material or undisturbed foundation material, whichever is greater. If the in-place compaction of the undisturbed foundation material is greater than 95%, the overexcavation backfill may be compacted to 95%.
 2. Embedment: Compact pipe embedment material to percent compaction as indicated on Drawings for given soil classification, pipe wall thickness, and depth of cover. For trenches within driving surfaces of roads, driveways or parking areas (both paved and unpaved), compact to 95%.
 3. Initial and Final Backfill: For trenches outside of roads, driveways, parking areas or wash crossings, compact to 90%, or to a density equal to that of the adjacent undisturbed soil, as directed by the Engineer. For trenches within the driving surfaces of roads, driveways or parking areas (both paved and unpaved) or within wash crossings, compact to 95%.
 4. Embankments: Compact to same requirements as Final Backfill.
 5. Under buildings, tanks, slabs and other structures: Compact in accordance with Geotechnical reports provided in Exhibit A.
 6. Note that all Percent Compaction values in these Technical Specifications and Drawings are based on Standard Proctor, ASTM D698.
- H. Soil Cement Slurry may be used in trenches, at Contractor's option and expense, to replace bedding, embedment, or backfill materials where it is not practical to reach minimum compaction requirements using select material.
1. If soil cement slurry is to be used in lieu of embedment material, soil cement slurry shall also replace the bedding material. Do not use soil cement slurry for embedment on top of select material bedding.

3.6 TOLERANCES

- A. Section 01 00 00 - Quality Requirements: Tolerances.
- B. Top Surface of Backfilling within Building Areas: Plus or minus 1 inch from required elevations.
- C. Top Surface of Backfilling under Paved Areas: Plus or minus 1 inch from required elevations.
- D. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

- E. Percent Compaction: Shall meet minimum required compaction as set forth in these specifications
- F. Moisture Content: As set forth in these specifications.

3.7 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Testing, Adjusting, and Balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557.
- C. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
 - 2. Moisture Tests: ASTM D3017.
- D. PVC pipe embedment shall be compacted to 95% standard proctor or AASHTO T-99.
- E. Acceptable backfill material shall be compacted to 95% standard proctor AASHTO T-99 or 90% modified proctor T-180 as determined by the material testing provider.
- F. When tests indicate Work does not meet specified requirements, remove material, replace, compact, and retest.
- G. Provide test trenches and excavations including excavation, trench support, and groundwater removal for the soils testing operations, at the locations and depths required. The cost of all work associated with accessing, preparing, or time delays for testing to be included in the unit price of the applicable pay item being tested.
- H. Compaction testing shall be done to the extent such that the Owner and Engineer can be reasonably assured that the backfill has been placed in accordance with the requirements of the Contract Documents, or as required by the utility for which the trenching is being provided, whichever is the more stringent. When a testing allowance is established on the Bid Form, the Owner and Engineer will determine the testing frequency to be used throughout the project. If no allowance is included, the frequency of testing shall be at least once every 400 linear feet of trenching, or at least once every 200 square feet below structural slabs.
- I. Correction of Substandard Work: All fill and backfill represented by tests that fail to meet compaction, moisture content, soil classification or other specifications shall be uncovered as needed, replaced as needed, re-compacted and re-tested until all specifications are met, at no additional expense to the Owner.
 - 1. Elevations, lines and grades of replaced material, as well as of pipe and other structures resting against such material, shall be re-surveyed at the direction of the Engineer. Contractor shall correct elevations, lines and grades as needed.

3.8 PROTECTION OF FINISHED WORK

- A. Section 01 00 00 - Execution Requirements: Protecting Installed Construction.
- B. Reshape and re-compact fills subjected to vehicular traffic.

3.9 SCHEDULE

- A. Pipe Bedding for waterlines:
 - 1. Fill Type D, to limits shown on project trenching detail, compact uniformly to 95 percent of maximum density.

- B. Fill Under Asphalt and Concrete Paving:
 - 1. Compact subsoil to 95 percent of its maximum dry density.
 - 2. Fill Type G, to 2 inches below finish paving elevation, or to match existing conditions, whichever is greater, compact uniformly to 95 percent of maximum density.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aggregate base course.
- B. Related Sections:
 - 1. Section 31 23 17 - Trenching: Compacted fill under base course.
 - 2. Section 31 23 23 - Backfill: Compacted fill under base course.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Aggregate Base Course Fill Type G:
 - 1. Basis of Measurement: By the square yard to elevations indicated on Drawings.
 - 2. Basis of Payment: Includes supplying fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.3 REFERENCES

- A. New Mexico Department of Transportation (NMDOT) Standard Specifications for Highway and Bridge Construction.
- B. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.
- C. ASTM International:
 - 1. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³).
 - 2. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 3. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

- A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
- B. Materials Source: Submit name of imported materials suppliers.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with NMDOT standards.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Base course material and gradation shall have a percent passing sieve sizes as shown in TABLE 304, SECTION 304 - BASE COURSE, New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction, latest edition.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.
- C. Subgrade surface shall be kept at all times in such manner that it will drain readily and effectively.
- D. Mix aggregate material to provide a homogenous mixture of uniformly dispersed materials as placed in position for compacting.

3.3 AGGREGATE PLACEMENT

- A. Spread aggregate over prepared substrate in layers that will permit the required density be obtained. Density requirements will be determined by AASHTO T-180.
- B. Compact each layer of material full width with: (1) two passes of a 50 ton compression type roller, or (2) two passes of a vibratory roller having a minimum dynamic force of 40,000 pounds impact per vibration and a minimum frequency of 1,000 vibrations per minute, or (3) eight passes of a 10 ton compression-type roller, or (4) eight passes of a vibratory roller having a minimum dynamic force of 30,000 pounds impact per vibration and a minimum frequency of 1,000 vibrations per minute.

- C. No displacement (pumping) of subgrade soils shall be visually observed when loaded by heavy equipment traffic.
- D. Level and contour surfaces to elevations and gradients indicated.
- E. Incorporate only suitable roadway excavation material into embankments. Compact material placed in all embankment layers and the material scarified in cut sections to a uniform density of not less than 95% of the maximum density.
- F. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

- A. Section 01 00 00 - Quality Requirements: Tolerances.
- B. Maximum Variation From Flat Surface: 3/8 inch measured with 10-foot straight edge in any direction.
- C. Maximum Variation From Thickness: 1/2 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.
- B. Compaction testing will be performed in accordance with ASTM D2922.
- C. Field control of moisture content of in-place material will be performed in accordance with Nuclear Method, ASTM D3017.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- E. Frequency of Tests: One test every 250 linear feet of trench or portion thereof, at locations directed by Engineer.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Asphaltic concrete paving, wearing, binder and base course.
 - 2. Surface sealer.
 - 3. Aggregate subbase course.
- B. Related Sections:
 - 1. Section 31 22 13 - Rough Grading: Preparation of site for paving [and base].
 - 2. Section 31 23 23 - Backfill: Compacted subbase for paving.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Aggregate Base Course:
 - 1. Basis of Measurement: By square yards.
 - 2. Basis of Payment: Includes supplying fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.
- B. Asphalt Pavement Mix (Complete):
 - 1. Basis of Measurement: By square yards.
 - 2. Basis of Payment: Includes primer, tack-coating surfaces, placing, compacting and rolling, and transition milling. Includes mix design, supplying to site, and testing.

1.3 REFERENCES

- A. New Mexico Department of Transportation (NMDOT) Standard Specifications for Highway and Bridge Construction.
- B. Asphalt Institute:
 - 1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
 - 2. AI MS-19 - Basic Asphalt Emulsion Manual.
- C. American Association of State Highway and Transportation Officials:
 - 1. AASHTO M-82 - Cutback Asphalt (Medium Curing Type).
 - 2. AASHTO M-140 - Emulsified Asphalt.
 - 3. AASHTO M-208 - Cationic Emulsified Asphalt.
 - 4. AASHTO M-226 - Viscosity Graded Asphalt Cement.
- D. ASTM International:
 - 1. ASTM D242 - Mineral Filler for Bituminous Paving Mixtures.
 - 2. ASTM D692 - Coarse Aggregate for Bituminous Paving Mixtures.

3. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
4. ASTM D977 - Emulsified Asphalt.
5. ASTM D1073 - Fine Aggregate for Bituminous Paving Mixtures.
6. ASTM D1188 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
7. ASTM D1557 - Moisture-Density Relations of Soils and Soil - Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in (457-mm) Drop.
8. ASTM D1560 - Test Methods for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
9. ASTM D2027 - Cutback Asphalt (Medium Curing Type).
10. ASTM D2397 - Cationic Emulsified Asphalt.
11. ASTM D2726 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures using Saturated Surface-Dry Specimens.
12. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
13. ASTM D3515 - Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

1.4 SUBMITTALS

- A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit product information and mix design.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction.
- B. Mixing Plant: Conform to New Mexico Department of Transportation standards.
- C. Obtain materials from same source throughout.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum 5 years experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 00 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not place asphalt when ambient air or base surface temperature is less than 50 degrees F, or surface is wet or frozen.
- C. Place bitumen mixture when temperature is not more than 15 degrees F below temperature when initially mixed and not more than maximum specified temperature.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Asphalt Cement: ASTM D3381. In accordance with New Mexico Department of Transportation standards.
- B. Asphalt-Aggregate Mixture: The job-mix formula for the asphalt-concrete mixture shall conform to Grading SP, of the New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction, latest edition. Asphalt content shall be between 3 and 9 percent by weight of total mix.
- C. Mineral Aggregate: Crushed stone, crushed slag, crushed gravel, natural gravel, sand, mineral filler, or a combination of two or more of these materials. Coarse and fine aggregates shall comply with all the quality requirements of the Standard Specifications for Road and Bridge Construction, New Mexico Department of Transportation.
- D. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
- E. Primer: In accordance with New Mexico Department of Transportation standards.
- F. Tack Coat: Emulsified asphalt Grade SS-1 or SS-1h, CSS-1 or CSS-1h diluted with one part water to one part emulsified asphalt, undiluted asphalt Grade RS-1 or CRS-1, or paving asphalt Grade AR-1000. Emulsified asphalt shall comply with the requirements of AASHTO M-140 (ASTM D977) or M-208 (ASTM D2397); paving asphalt shall comply with the requirements of AASHTO M-226 (ASTM D3381).
- G. Reclaimed Asphalt Pavement (RAP): Processed material obtained by milling or full depth removal of existing asphalt concrete pavements.
- H. Oil: In accordance with New Mexico Department of Transportation standards.
- I. Pavement Marking Paint: Specifically formulated for use on asphalt concrete pavement and with proven record of performance and durability, meeting the requirements of the New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction, latest edition.

2.2 ASPHALT PAVING MIX

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Prepare in accordance with New Mexico Department of Transportation standards.
- C. Asphaltic-concrete related to new construction shall be as specified in Section 423 of the New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction and Section 417 for asphalt patching, except that hydrated lime need not be used. The mineral aggregate shall be 3/4-inch gradation. The bituminous material for the surface course shall be asphalt cement conforming to the requirements of ASTM M-

226 and New Mexico Department of Transportation standards. Regardless of the bituminous content, there shall not be more than three percent (3%) voids in the aggregate.

- D. Mix Temperature at Time of Delivery to Work Site: Not lower than 260 degrees F nor higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather. Temperature of each load shall be tested at the time of delivery. Loads with temperatures not meeting this specification may be rejected.

2.3 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01 00 00 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Submit a job-mix formula for asphalt mixture for review and approval prior to beginning of Work.
- C. A Marshall Mix Report shall be submitted for the Engineer's review to verify the percentage of voids of the asphalt-concrete mix.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify compacted subgrade subbase is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.
- D. Verify gutter drainage grilles and frames and manhole frames are installed in correct position and elevation.

3.2 REMOVAL OF EXISTING MATERIAL

- A. Asphaltic and Concrete Paving Material:
 - 1. Cut lines using a wheel or saw, straight and parallel, vertical to the surface.
 - 2. Broken out and removed entirely. Rubble to be wasted at an legal off-site location.
- B. Sidewalks and Curb-and-Gutter:
 - 1. Cuts at existing joints only.
 - 2. Broken out and removed entirely. Rubble to be wasted at an approved location.
- C. Gravel Surface and Subgrade Material:
 - 1. Removed entirely.
 - 2. May be stockpiled and reused for replacement, or removed and wasted at an approved location.

3. Material for reuse must be clean, containing no debris, organic and/or deleterious substances, and used only with the approval of the Engineer.

3.3 SUBBASE

- A. Prepare subbase in accordance with New Mexico Department of Transportation standards.
- B. Prepare subgrade as specified and applicable to roadways and embankments. The surface of the subgrade after compaction shall be hard, uniform, smooth and true to grade and cross-section. Subgrade for pavement shall not vary more than 0.02-foot from the specified grade and cross section. Subgrade for base material shall not vary more than 0.04-foot from the specified grade and cross section.
- C. Provide aggregate base where shown and to the thickness indicated. Imported aggregate bases shall be delivered to the job site as uniform mixtures and each layer shall be spread in one operation. Segregation shall be avoided and the base shall be free of pockets of coarse or fine material. Where the required thickness is more than 6 inches, the base material shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed 6 inches. The relative compaction of each layer of aggregate base shall be not less than as specified in these Specifications. The compacted surface of the finished aggregate shall be hard, uniform, and smooth, and at any point shall not vary more than 0.02 foot from the specified grade or cross section.

3.4 PREPARATION - PRIMER

- A. Apply primer in accordance with New Mexico Department of Transportation standards.
- B. Use clean sand to blot excess primer.

3.5 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with New Mexico Department of Transportation standards.
- B. Apply tack coat to existing paved surfaces where new asphalt concrete is to be placed on existing pavement. Apply also to the contact surfaces of all cold pavement joints, curbs, gutters, manholes and the like immediately before the adjoining asphalt pavement is placed.
- C. Care shall be taken to prevent the application of tack coat material to surfaces that will not be in contact with the new asphalt concrete pavement.
- D. Apply tack coat on asphalt and concrete surfaces over subgrade surface at uniform rate.
 1. Diluted emulsified asphalt: 0.05 to 0.15 gal/sq yd.
 2. Undiluted emulsified asphalt: 0.025 to 0.075 gal/sq yd.
 3. Paving asphalt: approximately 0.05 gal/sq yd.

- E. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.6 PLACING ASPHALT PAVEMENT

- A. Install Work in accordance with New Mexico Department of Transportation standards.
- B. Place asphalt within 24 hours of applying primer or tack coat.
- C. Evenly spread asphalt concrete upon the subgrade or base to such a depth that, after rolling, it will be of the specified cross section and grade of the course being constructed.
- D. The depositing, distributing, and spreading of the asphalt concrete shall be accomplished in a single, continuous operation by means of a self-propelled mechanical spreading and finishing machine designed specially for that purpose. The machine shall be equipped with a screed or strike-off assembly capable of being accurately regulated and adjusted to distribute a layer of the material to a definite pre-determined thickness. When paving is of a size or in a location that use of a self-propelled machine is impractical the Engineer may waive the self-propelled requirement.
- E. Spreading, once commenced, must be continued without interruption.
- F. The mix shall be compacted immediately after placing. Initial rolling with a steel-wheeled tandem roller, steel three-wheeled roller, vibratory roller, or a pneumatic-tired roller shall follow the paver as closely as possible. If needed, intermediate rolling with a pneumatic-tired roller shall be done immediately behind the initial rolling. Final rolling shall eliminate marks from previous rolling. In areas too small for the roller, a vibrating plate compactor or a hand tamper shall be used to achieve thorough compaction.

3.7 PAVEMENT MARKING

- A. Pavement marking paint shall be applied where shown only when the pavement surface is dry and clear, and when the air temperature is above 40 degrees F. All equipment used in the application of pavement marking shall produce stripes and markings of uniform quality with clean and well-defined edges that conform to the details and dimensions shown. Drips, overspray, improper markings and paint material tracked by traffic shall be immediately removed from the pavement surface by methods previously reviewed by the Engineer.

3.8 WORK INSIDE COUNTY ROAD RIGHT-OF-WAY

- A. All road widening and lane development work completed inside County right-of-way will be completed in accordance with the County's Road Department requirements. Contractor will coordinate with the County Road Department to insure all requirements are being met.

3.9 TOLERANCES

- A. Section 01 00 00 - Quality Requirements: Tolerances.

- B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- C. Scheduled Compacted Thickness: Within 1/4 inch.
- D. Variation from Indicated Elevation: Within 1/2 inch.

3.10 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Upon completion the pavement shall be true to grade and cross-section. When a 10-ft straightedge is laid on the finished surface parallel to the center of the roadway, the surface shall not vary from the edge of the straightedge more than 1/8 inch except at intersections or changes of grade. In the transverse direction, the surface shall not vary from the edge of the straightedge more than 1/4-inch.
- C. The relative density after compaction shall be 95 percent of the density obtained by using ASTM D1560. A properly calibrated nuclear asphalt-testing device shall be used for determining the field density of compacted asphalt concrete, or slabs or cores may be laboratory tested in accordance with ASTM D1188.

3.11 PROTECTION OF FINISHED WORK

- A. Section 01 00 00 - Execution Requirements: Protecting finished work.
- B. Immediately after placement, protect pavement from mechanical injury for until surface temperature is less than 140 degrees F.

3.12 SCHEDULES

- A. Pavement at Driveways: Match existing pavement and base course thicknesses, but no less than 3-inches for each layer.
- B. Pavement at Open Cut Roads: Thickness and compaction of subbase to support vehicles up to 30,000 lb.

END OF SECTION

SECTION 33 05 23.13

HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavation for approach trenches and pits.
 - 2. Horizontal directional drilling.
 - 3. Pipe.

- B. Related Sections:
 - 1. Section 03 05 00 - Basic Concrete Materials and Methods.
 - 2. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
 - 3. Section 03 40 00 - Pre-Cast Concrete
 - 4. Section 31 23 17 - Trenching.
 - 5. Section 31 23 23 - Backfill.
 - 6. Section 33 11 00 - Water Utility Distribution Piping.
 - 7. Section 33 13 00 - Disinfection of Water Utility Distribution.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Horizontal Directional Drilling:
 - 1. Basis of Measurement: Inclusive in Bid Item #14.
 - 2. Basis of Payment: Includes excavation, drilling, HDPE carrier pipe, accessories, tests, and backfill.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m<sup>3 - 2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m<sup>3 - 3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - 5. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
 - 6. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.</sup></sup>

7. ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
 8. ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.
 9. ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings.
 10. ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
- C. Plastics Pipe Institute (PPI):
1. Technical Report TR-33 - Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.
- D. National Utility Contractors Association:
1. NUCA - HDD Installation Guidelines.

1.4 DESIGN REQUIREMENTS

- A. Design Criteria:
1. Drilling Steering System: Remote with continuous electronic monitoring of boring depth and location.
 2. Directional Change Capability: 90 degree with 35-foot radius curve.
 3. Ratio of Reaming Diameter to Pipe Outside Diameter:
 - a. Nominal Pipe Diameter of 6 Inches and Smaller: 1.5 maximum.
 - b. Nominal pipe diameter larger than 6 Inches: Submit recommended ratio and reaming procedures for review.

1.5 SUBMITTALS

- A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings:
1. Submit technical data for equipment, method of installation, proposed horizontal and vertical alignment and beginning and end points (if different than those shown on the plans), and proposed sequence of construction, including project schedule.
 2. Include information pertaining to pits, dewatering, method of spoils removal, equipment size and capacity, equipment capabilities including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade and detection of surface movement, name plate data for drilling equipment and mobile spoils removal unit.
- C. Installer Qualifications: Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel and references for work completed.
- D. Manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of the new pipe and fittings. Manufacturer's

recommendations for transport, handling, and storage of pipe and fittings shall be included.

- E. Submit necessary occupancy permit for installations along or under public thoroughways and lands, and railroad right of way, if not already obtained by the Engineer.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Contingency plans for the following potential conditions:
 - 1. Unforeseen subsurface conditions.
 - 2. Damage to other existing utilities.
 - 3. Soil heaving or settlement.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 00 00 - Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of casing or tunnel liner, carrier pipe, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Record actual depth of pipe at 25 feet intervals.
- E. Record actual horizontal location of installed pipe.
- F. Show depth and location of abandoned bores.
- G. Record depth and location of drill bits and drill stems not removed from bore.

1.7 QUALITY ASSURANCE

- A. Perform work in accordance with the following:
 - 1. Applicable New Mexico state standards
 - 2. NUCA HDD Installation Guidelines.
 - 3. ASTM F1962.

1.8 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.
- B. The Contractor must be certified by the HDD system manufacturer as a fully trained user of the HDD system. Operation of the HDD system shall be performed by trained personnel. Such training shall be conducted by a qualified representative of the HDD system manufacturer.

- C. Polyethylene or fusible PVC pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment. Personnel directly involved with installing the new pipe shall receive training in the proper methods for joining the pipe. Such training shall be conducted by a qualified representative of the fusion equipment manufacturer. Installation of other materials shall be performed by personnel qualified by the specific product manufacturer.

1.9 PRE-INSTALLATION MEETINGS

- A. Section 01 00 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 00 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. The Contractor shall transport, handle, and store pipe and fittings as recommended by the manufacturer.
- C. New pipe and fittings that are damaged before or during installation shall be repaired or replaced, as recommended by the manufacturer or required by the Engineer. The costs of such repair or replacement shall be borne by the Contractor and be accomplished prior to proceeding with the project.
- D. The Contractor shall deliver, store and handle other materials as required to prevent damage. Materials that are damaged or lost shall be repaired or replaced by the Contractor at no additional expense to the Owner.
- E. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- F. Protect piping system pieces from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.
- G. Accept products on site in manufacturer's original containers or configuration. Inspect for damage.
- H. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature of 60 to 85 degrees F.
- I. Support pipes with nylon slings during handling.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 00 00 - Product Requirements: Environmental conditions affecting products on site.

- B. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.
- C. The Contractor shall comply with all other Federal, State, and local environmental requirements including, but not limited to, storm water runoff, construction dewatering, disposal of drilling fluid, and hazardous waste management, and disposal.

1.12 COORDINATION

- A. Section 01 00 00 - Administrative Requirements: Requirements for coordination.
- B. Coordinate work with the New Mexico Department of Transportation (NMDOT), local Municipal Public Works Department (if applicable), and utilities within construction area.

PART 2 PRODUCTS

2.1 DRILLING FLUID

- A. Drilling Fluid: Liquid bentonite clay slurry; totally inert with no environmental risk.

2.2 POLYETHYLENE PLASTIC PIPE

- A. High density polyethylene material for pipe shall conform to ASTM D3350 for PE3408 material with a cell classification of 345464C, or better. Pipe shall meet the requirements of ASTM F714/AWWA C906 with cast iron outside diameter (CIOD) or iron pipe size (IPS) outside diameter pipe. The dimension ratio shall be as recommended by the pipe manufacturer for HDD water main applications.
- B. The pipe shall be manufactured with 100% virgin resin.
- C. The pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.
- D. The external material color of the pipe shall be blue or contain blue striping.

2.3 PIPE TRANSITION COUPLINGS

- A. Pipe transition couplings from HDPE to PVC pipe shall provide a fully restrained joint suitable for underground installation. Pipe transition couplings shall be Central Plastics PE MJ Adapter, ISCO HDPE to PVC Standard Coupling, or approved equal.

2.4 FILL MATERIALS

- A. Excavated and reused soil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.5 WATER SOURCE

- A. Water: Potable, obtained from utility source.

2.6 UNDERGROUND PIPE MARKERS

- A. Tracer Wire: Magnetic detectable conductor insulated with high-density polyethylene (HDPE) or UF- XHHW in accordance with physical and electrical properties per ASTM D-1248.
 - 1. Tracer wire shall be rated for “Direct Burial”, 30 volts, and be appropriate for installation in Horizontal Directional Drill (HDD) applications,
 - 2. Tracer wire shall be constructed of copper clad hard drawn extra high strength (EHS) tracer wire with a steel core or engineer approved equal, and
 - 3. Tracer wire must be appropriately sized and installed to be compatible with the pullback rating of the equipment being used.
- B. Splice Connectors: Model LV 9500 Blazing Snap-locking waterproof connectors pre-filled with silicone or engineer approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify connection to existing piping system size, location, and invert elevations are in accordance with Drawings.

3.2 PREPARATION

- A. Call Local Utility Line Information service at not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Locate, identify, and protect utilities indicated to remain from damage.
- C. Identify required lines, levels, contours, and datum locations.
- D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 DEWATERING

- A. Intercept and divert surface drainage, precipitation, and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps, or other means.

- B. Develop and maintain substantially dry subgrade during drilling and pipe installation.
- C. Comply with New Mexico state standards and requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.4 EXISTING WORK

- A. Maintain access to existing community facilities and homes as well as other remaining active installations requiring access. Modify installation as necessary to maintain access.

3.5 EXCAVATION

- A. Excavate approach trenches and pits in accordance with shop drawings and as site conditions require. Minimize number of access pits.
- B. Provide sump areas to contain drilling fluids.
- C. Install excavation supports as specified in Section 31 23 17.
- D. Restore areas after completion of drilling and carrier pipe installation.

3.6 DRILLING

- A. Drill pilot bore with vertical and horizontal alignment as indicated on Drawings.
- B. Guide drill remotely from ground surface to maintain alignment by monitoring signals transmitted from drill bit.
 - 1. Monitor depth, pitch, and position.
 - 2. Adjust drill head orientation to maintain correct alignment.
- C. Inject drilling fluid into bore to stabilize hole, remove cuttings, and lubricate drill bit and pipe.
- D. Continuously monitor drilling fluid pumping rate, pressure, viscosity, and density while drilling pilot bore, back reaming, and installing pipe to ensure adequate removal of soil cuttings and stabilization of bore.
 - 1. Provide relief holes when required to relieve excess pressure.
 - 2. Minimize heaving during pullback.
- E. Calibrate and verify electronic monitor accuracy during first 50 feet of bore in presence of Engineer before proceeding with other drilling. Excavate minimum of four test pits spaced along first 50 feet bore to verify required accuracy. When required accuracy is not met, adjust equipment or provide new equipment capable of meeting required accuracy.
- F. After completing pilot bore, remove drill bit.

3.7 DRILLING OBSTRUCTIONS

- A. When obstructions are encountered during drilling, notify Engineer immediately. Do not proceed around obstruction without Engineer's approval.
- B. Maintain adjusted bore alignment within easement or right-of-way.

3.8 PIPE INSTALLATION

- A. After completing pilot bore, remove drill bit. Install reamer and pipe pulling head.
 - 1. Select reamer with minimum bore diameter required for pipe installation.
- B. Attach pipe to pipe pulling head. Pull reamer and pipe to entry pit along pilot bore.
- C. Inject drilling fluid through reamer to stabilize bore and lubricate pipe.
- D. Install piping with horizontal and vertical alignment as shown on Drawings.
- E. Protect and support pipe being pulled into bore so pipe moves freely and is not damaged during installation.
- F. Do not exceed pipe manufacturer's recommended pullback forces.
- G. Install trace wire continuous with each bore. Splice trace wire only at intermediate bore pits. Tape or insulate trace wire to prevent corrosion and maintain integrity of pipe detection.
 - 1. Terminate trace wire for each pipe run at structures along pipe system.
 - 2. Provide extra length of trace wire at each structure, so trace wire can be pulled 3 feet out top of structure for connection to detection equipment.
 - 3. Test trace wire for continuity for each bore before acceptance.
- H. Provide sufficient length of carrier pipe to extend past termination point to allow connection to other pipe sections.
- I. Allow minimum of 24 hours for stabilization after installing pipe before making connections to pipe.
- J. Mark location and depth of bore with spray paint on paved surfaces, and wooden stakes on non-paved surfaces at 25-foot intervals.

3.9 SLURRY REMOVAL AND DISPOSAL

- A. Contain excess drilling fluids at entry and exit points until recycled or removed from site. Provide recovery system to remove drilling spoils from access pits.
- B. Remove, transport, and legally dispose of drilling spoils.
 - 1. Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.

2. When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.
 - C. When drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.
 - D. Complete cleanup of drilling fluid at end of each workday.
- 3.10 DISINFECTION AND FLUSHING
- A. Disinfection and flushing shall be conducted in accordance with Section 33 13 00.
- 3.11 PRESSURE AND LEAKAGE TESTING
- A. Pressure and leakage testing shall be conducted in accordance with Section 33 11 00 as applicable.
- 3.12 BACKFILL
- A. Install backfill as specified in Section 31 23 17 and 31 23 23.
 - B. Backfill approach trenches and pits with subsoil fill to contours and elevations of surrounding existing grade.
 - C. Compact subsoil fill as specified in Section 31 23 23 to minimum 95 percent of maximum density.
- 3.13 INSTALLATION TOLERANCES
- A. Section 01 00 00 - Quality Requirements: Tolerances.
 - B. Maximum Variation From Horizontal Position: 12 inches.
 - C. Maximum Variation From Vertical Elevation: 6 inches.
 - D. Minimum Horizontal and Vertical Clearance from Other Utilities: 12 inches.
 - E. When pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, re-bore, and reinstall pipe in correct alignment.
 - F. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.
- 3.14 FIELD QUALITY CONTROL
- A. Section 01 00 00 - Execution Requirements: Testing, adjusting, and balancing.
 - B. Compaction Testing: As specified in Section 31 23 23.

- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.15 MANUFACTURER'S FIELD SERVICES

- A. Section 01 00 00 - Quality Requirements: Requirements for manufacturer's field services.
- B. Furnish field technical assistance during following periods of casing installation:
 - 1. Unloading of casing materials and components.
 - 2. Prior to commencing excavation and during excavation as requested.
- C. Certify that equipment for drilling has been properly set-up and is ready for drilling.

3.16 CLEAN-UP

- A. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits. Clean up excess slurry from ground.
- B. Restore approach trenches and pits to original condition.
- C. Remove temporary facilities for drilling operations in accordance with Section 01 00 00.

END OF SECTION

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings for public line including potable water line.
 - 2. Tapping Sleeves, Tees, and Valves.
 - 3. Underground and Aboveground Pipe Markers.
 - 4. Bedding and Cover Materials.

- B. Related Sections:
 - 1. Section 03 05 00 - Basic Concrete Materials and Methods: Thrust restraints.
 - 2. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
 - 3. Section 31 23 17 - Trenching: Execution requirements for trenching.
 - 4. Section 31 23 23 - Backfill: Requirements for backfill to be placed.
 - 5. Section 33 05 23.13 – Horizontal Directional Drilling
 - 6. Section 33 12 13 - Water Service Connections
 - 7. Section 33 12 16 - Water Utility Distribution Valves.
 - 8. Section 33 12 19 - Hydrants.
 - 9. Section 33 13 00 - Disinfection of Water Utility Distribution.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Pipe and Fittings:
 - 1. Basis of Measurement: By the linear foot.
 - 2. Basis of Payment: Includes hand trimming excavation, piping and fittings, underground pipe markers, all valves and appurtenances not listed separately on the Bid Form, bedding, concrete thrust restraints, connection to public utility water source.
 - 3. The cost of laboratory testing for water quality and the cost of compaction testing shall be reimbursed to the Contractor, upon submittal of invoices. The cost of work associated with hydrostatic pressure testing and testing of material welds, etc. shall be considered incidental to related work and not be reimbursed. Work shall be coordinated and directed by Engineer. Contractor shall pay for all failed tests.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. American Society of Mechanical Engineers (ASME):
 - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

- C. American Society for Testing and Materials International (ASTM):
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 5. ASTM A449 - Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated 120/105/90 ksi minimum tensile strength General Use.
 6. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 7. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 8. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 9. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 10. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
 11. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
 12. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 13. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
 14. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 15. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 16. ASTM F2164 - Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
 17. ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
 18. ASTM F2634 - Standard Test Method for Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method.
- D. American Water Works Association (AWWA):
1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 2. AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 3. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. (76 mm through 1,219 mm), for Water.
 4. AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

5. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 6. AWWA C116 - ANSI Standard for Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
 7. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
 8. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
 9. AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger.
 10. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied.
 11. AWWA C206 - Field Welding of Steel Water Pipe.
 12. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In. (100 mm through 3,600 mm).
 13. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
 14. AWWA C209 - Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
 15. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
 16. AWWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances.
 17. AWWA C605 - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
 18. AWWA C606 - Grooved and Shouldered Joints.
 19. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution.
 20. AWWA C901 - Polyethylene Pressure Pipe and Tubing, 1/2 In. through 3 In. (13 mm through 76 mm), for Water Service.
 21. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. through 48 In. (350 mm through 1,200 mm), for Water Transmission and Distribution.
 22. AWWA C906 - Polyethylene Pressure Pipe and Fittings, 4 In. through 63 In. (100 mm through 1,575 mm), for Water Distribution and Transmission).
- E. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.
- F. Manufacturer's Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.
- G. National Fire Protection Agency
1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- H. National Sanitation Foundation (NSF):
1. NSF-14 - Plastics Piping System Components and Related Materials
 2. NSF-61 - Drinking Water System Components-Health Effects

- I. Plastic Pipe Institute (PPI):
 - 1. TR-33 - Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.

1.4 SUBMITTALS

- A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings and accessories.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- D. Testing Plan: Contractor must submit proposed testing procedure and equipment to be employed for hydrostatic testing of lines, as well as continuity testing for tracer wire, for approval by Engineer.
- E. Contractor shall submit a joint restraint table for all types of restrained joints to be used for the project based on the manufacturer's specifications and calculations.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 00 00 - Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 00 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Block individual and stockpiled pipe lengths to prevent moving.
- C. Do not place pipe or pipe materials on private property without prior authorization, or in areas obstructing pedestrian or vehicular traffic.
- D. Store polyethylene materials out of sunlight.
- E. Flexible pipe shall be braced as required to maintain roundness of +/- 1% during shipping and handling.

- F. Prior to shipment and again prior to installation, all materials shall be visually inspected for damage, including coatings and surfaces. Any damaged materials shall be repaired to original standards or replaced.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

- A. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, with Dimension Ratio (DR) of DR25 for C900 pipe and DR21 for C905 pipe, unless otherwise identified on the Drawings or on the Bid Form, for all PVC pipe of 4" diameter and greater; ASTM D2241, IPS Gasketed Pipe, NSF approved, SDR21 with Pressure Rating of 200 psi, or as scheduled, for all PVC pipe with a diameter of 2" and greater but less than 4" diameter; ASTM D2241, PVC 1120 or 1220, NSF approved, Schedule 40, or as scheduled, for all PVC pipe less than 2" diameter:
 - 1. Fittings: Ductile iron, Compact MJ fittings AWWA C153, on all PVC pipe 4" diameter and greater.
 - a. Interior/Exterior Lining: AWWA C116, epoxy coating, minimum 8 mil thickness.
 - b. Pressure rating of at least 250 psi.
 - c. Marked with pressure rating, nominal diameter of opening, manufacturers' identification, country where cast, and degree of bend.
 - d. ASTM D2241, Schedule 40, for all PVC pipe less than 4" diameter.
 - 2. All gaskets shall be constructed of Nitrile/Buna-N or Viton material.
 - 3. Joint Restraints: "EBAA Iron, Megalug®", or approved equal, for all pipe 4" diameter and greater, "EBAA Iron, Series 6500 and 7500", or approved equal, for all pipe from 2" to 3-1/2" diameter, installation and spacing as per manufacturer's specifications; or concrete thrust blocking.
 - 4. All buried metallic components shall be wrapped in 8-mil polyethylene. All buried bolts, other than stainless steel bolts, shall be coated with field-applied coal tar epoxy.
- B. Polyethylene Pipe: AWWA C901-08 and ASTM D3035 for sizes up to 3" diameter; AWWA C906-07 and ASTM F714 for sizes 4" diameter and above.
 - 1. Each production lot of pipe shall be tested for melt index, density, percent carbon, dimensions and ring tensile strength.
 - 2. Polyethylene pipe and fittings shall be PE 3408 high-density polyethylene meeting ASTM D3350 cell classification 345464C. The material shall be listed and approved for potable water in accordance with NSF Standard 61.
 - 3. Four permanent co-extruded, equally spaced, blue color stripes in outside surface of pipe.
 - 4. Molded fittings in accordance with ASTM D3261, and tested in accordance with AWWA C906.

5. Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings; rated for internal pressure service at least equal to the full service pressure rating of the mating pipe; and tested in accordance with AWWA C906.
6. Polyethylene flange adapters made with sufficient through-bore to be clamped in a butt fusion-joining machine without use of a stub-end holder, as per pipe manufacturer's instructions.

2.2 CASING PIPE MATERIALS

- A. Furnish materials in accordance with New Mexico state standards.
- B. Steel Casing Pipe: ASTM A53/A53M, 35,000-psi minimum yield strength, casing diameter and minimum wall thickness as indicated on Drawings. Full circumference welded joints in accordance with AWS D1.1 to withstand excavation forces.

2.3 TAPPING SLEEVES, TEES AND VALVES

- A. Manufacturers:
 - a. Mueller Co. - H300, H304, T-28
 - b. Romac - SSTMJ
 - c. Substitutions: Section 01 00 00 - Product Requirements.
- B. Ductile iron or stainless steel, conforming to AWWA C223, dual compression type capable of sustaining pressures up to 250 psi.
- C. Outlet Flange Dimensions and Drilling: ASME B16.1, Class 125 and MSS SP-60.
- D. Refer to Section 31 12 16 for specification on gate valve to install as tapping valve on sleeve.

2.4 UNDERGROUND PIPE MARKERS

- A. Furnish materials in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions the details and specifications of the utility provider.
- B. Tracer Wire: 12 AWG, Solid Copper, Single Conductor, 30 volts, UF-XHHW wire or equal, for underground installation.
- C. Tracer Wire Access Box installed in each concrete valve box collar:
 1. Water Tracer Wire Access Box by C.P. Test Services - Valvco, Inc., 4-inch diameter, 24-inch length, cast iron tracer wire access box at each valve location next to valve box, with access box lid labeled "WATER".
 2. SnakePit Magnetized Tracer Box by Copperhead Industries, LLC, Test and Monitoring Station (blue color) with box type to meet application.
 3. Approved equal.

- D. Underground Utility Marking Tape: Bright colored, continuously printed, minimum 6 inches wide by 4-mil thick, manufactured for direct burial service, imprinted with "BURIED WATER SERVICE" (or similar wording) in large letters, on blue tape in conformance with APWA color code specifications for underground tape systems. The tape shall be constructed of material that is impervious to alkalis, acids, chemical reagents, and solvents found in the soils.
- E. Splice Connectors: Model LV 9500 Blazing Snap-locking waterproof connectors pre-filled with silicone or engineer approved equal.

2.5 PIPE SUPPORTS AND ANCHORING

- A. Metal for pipe support brackets: ASTM A123/A123M, galvanized structural steel thoroughly coated with bituminous paint.
- B. Metal tie rods and clamps or lugs: Galvanized steel sized in accordance with NFPA 24 thoroughly coated with bituminous paint.

2.6 BEDDING AND BACKFILL MATERIALS

- A. Bedding: Fill Type as specified in Section 31 23 23.
- B. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Section 31 23 23. Subsoil with no rocks over 2 inches in diameter, frozen earth or foreign matter.

2.7 BOLTS AND NUTS

- A. Zinc-plated or fluoropolymer coated bolts and nuts shall be used for the installation of pipelines up to 500 mm (20") diameter and shall be carbon steel conforming to ASTM A307, Grade A, unless otherwise indicated on the approved drawings. Bolts and nuts shall have standard ANSI B1.1, Class 2A coarse threads.
- B. Stainless steel bolts and nuts shall be used for the installation of pipelines 600 mm (24") diameter and larger and for submerged flanges. Bolts and nuts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts, and Grade 8M for nuts.
- C. All bolt heads and nuts shall be hexagonal, except where special shapes are required. Bolts shall be of such length that not less than 6.4 mm (¼") or more than 12.7 mm (½") shall project past the nut in tightened position.

2.8 ACCESSORIES – WATER PIPING AND FITTINGS

- A. Joint Restraints: "EBAA Iron, Megalug®", or approved equal, for all pipe 4" diameter and greater, "EBAA Iron, Series 6500 and 7500", or approved equal, for all pipe from 2" to 3-1/2" diameter, installation and spacing as per manufacturer's specifications.
- B. Concrete for Thrust Restraints: Conform to Section 03 05 00, with minimum compressive strength of 3,000 psi.

- C. Steel rods, bolt, lugs, and brackets: ASTM A36/A36M or ASTM A307 carbon steel.

2.9 ACCESSORIES – CASING PIPE MATERIALS

- A. Pipe Casing End Seals: Seamless, vulcanized edge, pull-on casing end seals composed of a minimum 1/8” thick 60 durometer synthetic neoprene rubber. Includes 1/2” wide T304 stainless steel bandings with 100% non-magnetic worm gear mechanism.
- B. Pipe Casing Spacers: Constructed of heavy duty, two piece, 8” wide 14-gauge stainless steel bands, or hot rolled 14-gauge circular carbon steel with thermoplastic powder coating for extra corrosion protection, as identified on the Drawings or on the Bid Form. Bands bolt together to form a shell around the carrier pipe, with 10-gauge stainless steel or carbon steel risers (material to match bands) and glass filled polymer runners to support the carrier pipe within the casing pipe maintaining a minimum clearance of 1” between the casing ID and the spacer OD.
- C. Pressure Grout Mix: One part portland cement, and 6 parts mortar sand mixed with water to consistency applicable for pressure grouting.
- D. Mortar Sand: ASTM C404.
- E. Portland Cement: ASTM C150, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify existing utility water main size, location, and invert, are as indicated on Drawings.

3.2 PREPARATION

- A. Pre-Construction Site Photos:
 - 1. If required in the Contract Documents, take photographs, or videotape along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.
 - 2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing site features that may potentially be impacted by the construction work.
 - 3. Include project description, date taken and sequential number on back of each photograph.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.
- C. Remove scale and dirt on inside and outside before assembly.

- D. Prepare pipe connections to equipment with flanges or unions.
- E. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.

3.3 DEWATERING

- A. Intercept and divert surface drainage precipitation and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Develop substantially dry subgrade for prosecution of subsequent operations.
- C. Comply with New Mexico state standards and requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.4 EXISTING WORK

- A. Maintain access to existing community facilities and homes as well as other remaining active installations requiring access. Modify installation as necessary to maintain access.

3.5 PITS OR APPROACH TRENCHES

- A. Excavate approach trenches or pits in accordance with installation plan and as site conditions require.
- B. Ensure casing entrance face as near perpendicular to alignment as conditions permit.
- C. Establish vertical entrance face at least 1 foot above top of casing.
- D. Install dewatering measures and excavation supports as specified in Section 31 23 17.

3.6 PRESSURE GROUTING

- A. Pressure grout annular space between casing pipe and surrounding earth.

3.7 BEDDING

- A. Dewater excavations in accordance with Section 31 23 17, as required, to maintain dry conditions and preserve final grades at bottom of excavation.
- B. Provide sheeting and shoring in accordance with Section 31 23 17.
- C. Place bedding material in accordance with Section 31 23 23.

3.8 INSTALLATION – PIPE

- A. Install PVC pipe in accordance with AWWA C605.

- B. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings.
- C. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
- D. Maintain 10 ft horizontal separation of water main from sewer piping in accordance with local code.
- E. Install pipe to indicated elevation to within tolerance of 3 inches.
- F. Route pipe in straight line. Relay pipe that is out of alignment or grade.
- G. Twenty-foot lengths (20') of PVC pipe shall not be deflected more than 2% of their length (5") either horizontally or vertically. Any sections of pipe less than twenty feet (20') in length shall not be deflected.
- H. PVC pipe deflections may be made either at joints or by pipe bending.
 - 1. Deflection both at joints and by pipe bending shall not exceed maximum deflection recommendations by the pipe manufacturer or AWWA C605. In the case of a discrepancy between these recommendations, the smaller maximum deflection value shall apply.
- I. Install ductile iron piping and fittings to AWWA C600Weld pipe in accordance with AWWA C206. Weld joints in accordance with AWWA C205.
- J. Flanged Joints: Not to be used in underground installations except within structures.
- K. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, increase pipe bury depth or install air release valves as directed by Engineer.
- L. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.
- M. Prevent foreign material from entering pipe during placement.
- N. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- O. Close pipe openings with watertight plugs during work stoppages.
- P. Install access fittings to permit disinfection of water system performed under Section 33 13 00.
- Q. Establish elevations of buried piping with not less than 3 foot of cover. Measure depth of cover from final surface grade to top of pipe barrel.
- R. Install tracer wire continuous, taped to top of pipeline at regular intervals not exceeding 24"; coordinate with Sections 31 23 17 and 31 23 23. Continuity of tracer wire shall be tested periodically as indicated by Engineer, and prior to final acceptance of work. Any

segment of tracer wire that fails the continuity test shall be repaired or replaced by Contractor at no additional cost to Owner.

- S. Expose tracer wire at every surface penetration (i.e. valves, hydrants, vaults, etc.). Protect wire ends with wire caps and protect from corrosion. Provide extra length of tracer wire at each structure, so tracer wire can be pulled 3 feet out top of structure for connection to detection equipment. Install cast iron tracer wire access box at each valve location next to valve box and within concrete collar, but not at intervals surpassing manufacturer's recommendations to ensure proper detection. Concentration of multiple proposed valves near pipe intersections (i.e. tees or crosses) may require more than one access point assembly in each concrete valve box collar. Tracer wire access points shall be within public right-of-way or public utility easements.
- T. Install underground utility marking tape continuous, buried 12 inches directly above pipe. Coordinate with Section 31 23 17 and 31 23 23.

3.9 CARRIER PIPE INSTALLATION

- A. Clean, inspect, and handle pipe in accordance with Section 33 11 00.
- B. Place carrier pipe in accordance with Section 33 11 00. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.
- C. Support pipeline within casing on spacers at intervals identified on Drawings or according to manufacturer's instructions if interval is not identified on Drawings, so no external loads are transmitted to carrier pipe. Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.
- D. Install pipe casing end seals at ends of casing.

3.10 INSTALLATION - TAPPING SLEEVES AND GAUGES

- A. Install tapping sleeves and gauges in accordance with Drawings and in accordance with manufacturer's instructions.

3.11 THRUST RESTRAINTS

- A. Install tie rods, clamps, setscrew retainer glands, or restrained joints. Protect metal restrained joint components against corrosion by applying a bituminous coating, or by concrete mortar encasement of metal area. Do not encase pipe and fitting joints to flanges.
- B. Install thrust blocks or restrained fittings in accordance with Drawings and in accordance with manufacturer's instruction.
- C. Install thrust blocks, tie rods, and joint restraint at dead ends of water main.

3.12 BACKFILLING

- A. Backfill trenches for piping in accordance with Section 31 23 23.

3.13 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

3.14 TOLERANCES

- A. Do not over cut excavation by more than 1 inch greater than outside diameter of casing pipe.
- B. Install casing pipe to vertical and horizontal alignment on Drawings within plus or minus 3 inches prior to installation of carrier pipe.
- C. Install pipe bells with minimum ½-inch clearance to casing.

3.15 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform pressure test on potable water distribution system in accordance with applicable standards:
 - 1. PVC Pipe: AWWA C605.
 - 2. Ductile Iron Pipe: AWWA C600.
 - 3. HDPE Pipe: ASTM F2164.
 - 4. Steel Pipe: AWWA C200.
- C. Hydrostatic pressure for testing shall be 1.5 times the designed working pressure at the lowest point in the line section being tested, or 150 psi minimum pressure, whichever is greater. In the event it is not possible to measure the pressure at the lowest point directly, this pressure may be calculated by measuring the pressure elsewhere within the section and calculating the pressure based on elevation difference.
 - 1. Warning: Safety is of paramount importance when conducting hydrostatic pressure leak test due to possibility of sudden violent rupture or failure.
 - 2. In no case shall the test pressure exceed the manufacturers' recommended maximum safe test pressure for the pipe or fittings.
 - 3. No observable leakage is allowed. Measurable leakage must be within the maximum allowable limits set forth by applicable AWWA and ASTM standards.
 - 4. Any leaks detected during testing shall be repaired. After repairs are completed, another full duration test shall be performed on the section of the pipeline to which the repairs were made.
 - 5. HDPE pipe: Add make-up water as necessary to maintain maximum test pressure for 4 hours.
 - 6. HDPE test phase: Pressurize pipe and reduce pressure by 10 psi and monitor pressure for 1 hour. Do not increase pressure or add make-up water.

7. HDPE pass/fail criteria: If no visual leakage is observed and pressure during the test phase remains steady (within 25% of test pressure) for the 1 hour test phase period, a passing test is indicated.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Owner.
- E. Tolerances: Lay pipe to lines and grades shown on Drawings or as indicated by the Engineer, to the following tolerances:
 1. Total departure from vertical grade not to exceed 1 inch.
 2. Departure from vertical slope not to exceed 1/16 inch per foot.
- F. Contractor shall not connect to existing system until all testing and disinfection is complete and shall obtain written permission from the Engineer to proceed with connection to the existing system.

3.16 MANUFACTURER'S FIELD SERVICES

- A. Section 01 00 00 - Quality Requirements: Requirements for manufacturer's field services.
- B. Furnish field technical assistance during following periods of casing installation:
 1. Unloading of casing materials and components.
 2. Prior to commencing excavation and during excavation as requested.

3.17 REMOVAL OF FACILITIES AND CONTROLS

- A. Remove temporary facilities for casing installation operation in accordance with Section 01 00 00.

END OF SECTION

SECTION 33 12 13

WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings for domestic water service connections to buildings.
 - 2. Corporation stop assembly.
 - 3. Curb stop assembly.
 - 4. Meter setting equipment.
 - 5. Residential water meters.
 - 6. Commercial water meters.
 - 7. Backflow preventers.
 - 8. Pressure reducing valves.
 - 9. Underground pipe markers.
 - 10. Meter cans and vaults.
 - 11. Bedding and cover materials.

- B. Related Sections:
 - 1. Section 03 05 00 - Basic Concrete Materials and Methods.
 - 2. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
 - 3. Section 31 23 17 - Trenching.
 - 4. Section 31 23 23 - Backfill.
 - 5. Section 33 11 00 - Water Utility Distribution Piping.
 - 6. Section 33 13 00 - Disinfection of Water Utility Distribution.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Water Meter Assemblies:
 - 1. Basis of Measurement: By the unit.
 - 2. Basis of Payment: Includes entire meter assembly: Double strap saddle, corporation stop assembly, pipe and all associated fittings from corporation stop to meter, curb stop assembly (if included in design), meter, meter box, meter setting equipment, fittings and accessories, backflow preventer, pressure reducing valve (if included in design), connection to service line from home or business (if existing), 10 foot polyethylene pipe pig tail from meter (if corresponding home or business is not currently served by the system), excavation, bedding, backfill and disinfection.

1.3 REFERENCES

- A. New Mexico Standard Specification for Public Works Construction (NMSSPWC), 1987 edition.
 - 1. NMSSPWC - Section 802 - Installation of Water Service Lines.

2. NMSSPWC - Section 801 - Installation of Water Transmission, Collector, and Distribution Lines.
- B. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- C. American Society of Mechanical Engineers (ASME):
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. American Society of Sanitary Engineering (AMSE):
1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
 2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.
- E. American Society for Testing and Materials International (ASTM):
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
 2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
 3. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
 4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 5. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 6. ASTM D1785 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 7. ASTM D2241 - Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
 8. ASTM D2466 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
 9. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 10. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 11. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- F. American Welding Society (AWS):
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
- G. American Water Works Association (AWWA):
1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
 3. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
 4. AWWA C800 - Underground Service Line Valves and Fittings.

5. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
6. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

1.4 SUBMITTALS

- A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 00 00 - Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, curb stops (if applicable), connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 00 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.
- C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

1.8 MAINTENANCE MATERIALS

- A. Furnish two (2) meter keys to Owner (required length) for each meter type.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

- A. PVC Pipe: SDR-21 for 200 psig rating:
 1. Fittings: ASTM D2466, PVC.

2. Joints: ASTM D2855, solvent weld.

B. Polyethylene Pipe: ASTM D3035, for 160 psig pressure rating:

1. Fittings: AWWA C901, molded or fabricated.
2. Joints: Compression.

2.2 CORPORATION STOP ASSEMBLY

A. Manufacturers (acceptable model numbers as indicated on Drawings):

1. Mueller Company.
2. Ford Company.
3. Substitutions: Section 01 00 00 - Product Requirements.

B. Corporation Stops:

1. Brass or red brass alloy body conforming to ASTM B62.
2. Inlet end threaded for tapping according to AWWA C800.
3. Outlet end suitable for service pipe specified.

C. Service Saddles:

1. Double strap type, designed to hold pressures in excess of pipe working pressure.
2. .

2.3 UNDERGROUND PIPE MARKERS:

A. Underground Pipe Markers: Conform to Section 33 11 00.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Section 31 23 23.

B. Cover: Fill Type as specified in Section 31 23 23.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Section 31 23 23. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.5 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03 05 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify building service connection and municipal utility water main size, location, and invert elevation are as indicated on Drawings.

- C. Water meter assemblies shall be installed at the locations indicated by the Owner's Representative. The Owner's Representative will identify location of existing system components and assist the Contractor with location and verification of the existing system in the field.

3.2 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

- A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Engineer.
- B. Provide service clamps for mains other than of cast iron or ductile iron mains.
- C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.
- D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.
- E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Engineer.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section.
- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact to 95 percent.

3.5 INSTALLATION - PIPE AND FITTINGS

- A. Maintain separation of water main from sewer piping in accordance with New Mexico Public Work Standards.
- B. Group piping with other site piping work whenever practical.

- C. Route pipe in straight line, as much as possible. Do not crimp polyethylene pipe during installation or at any other time.
- D. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- E. Install access fittings to permit disinfection of water system performed under Section 33 13 00.
- F. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.
- G. Establish elevations of buried piping with not less than 4 ft of cover. Install tracer wire continuous, taped to top of pipe at regular intervals not exceeding 24", and plastic warning tape directly above buried piping, all in accordance with Section 33 11 00. Coordinate with Sections 31 23 17 and 31 23 23. Contractor shall test tracer wire for continuity periodically when instructed by Engineer, and prior to final acceptance of work.
- H. Backfill trench in accordance with Section 31 23 23.

3.6 SERVICE CONNECTIONS

- A. Connect existing water meter assembly to new service line from each home or business. If no service line exists from the corresponding home or business to be served by the new meter assembly, leave a 10-foot length of polyethylene pipe at the outlet side of the meter assembly, unless otherwise indicated on the Drawings.
- B. Install Work in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

3.8 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. During testing of the materials at the above ambient temperatures, no visual cracking, checking, blistering, surface pitting or deformation shall be noted.
- C. Perform pressure test on domestic site water distribution system in accordance with AWWA C600. Compaction Testing for Bedding: In accordance with ASTM D1557.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

- E. Compaction testing shall be done to the extent such that the Owner and Engineer can be reasonably assured that the backfill has been placed in accordance with the requirements of the Contract Documents. When a testing allowance is established on the Bid Form, the Owner and Engineer will determine the testing frequency to be used throughout the project. If no allowance is included, the frequency of testing shall be at least once every 400 linear feet of trenching.

END OF SECTION

SECTION 33 12 16

WATER UTILITY DISTRIBUTION VALVES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Valves.
 - 2. Pressure Reducing Valves.
 - 3. Combination Air Valves.
 - 4. Water Pressure Gauges.
 - 5. Valve boxes.

- B. Related Sections:
 - 1. Section 03 05 00 - Basic Concrete Materials and Methods.
 - 2. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
 - 3. Section 03 40 00 – Pre-Cast Concrete
 - 4. Section 31 22 13 - Rough Grading.
 - 5. Section 31 23 23 - Backfill.
 - 6. Section 33 11 00 - Water Utility Distribution Piping.
 - 7. Section 33 12 19 - Hydrants.
 - 8. Section 33 13 00 - Disinfection of Water Utility Distribution.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Valves:
 - 1. Basis of Measurement: Each.
 - 2. Basis of Payment: Includes excavation, valve, valve box, valve riser and collar, accessories, tests, backfill and compaction.

- B. Pressure Reducing Valve Assemblies:
 - 1. Basis of Measurement: By the unit.
 - 2. Basis of Payment: Includes excavation, vault, pressure reducing valve, fittings and accessories, backfill and compaction.

- C. Combination Air Valves:
 - 1. Basis of Measurement: By the unit.
 - 2. Basis of Payment: Includes excavation, vault, combination air valve, fittings, accessories, backfill and compaction.

1.3 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
 - 2. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
 - 3. AWWA C515 - Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service.

4. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.

- B. National Sanitation Foundation (NSF):
1. NSF/ANSI Standard 61 - Drinking Water Components - Health Effects.

1.4 SUBMITTALS

- A. Design Data: Submit manufacturer's latest published literature. Include illustrations, installation instructions, maintenance instructions and parts lists.
- B. Manufacturer's Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessories provided meet or exceed AWWA Standards and specification requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of all valves. Provide completed Water Valve Cards for each valve installed.
- B. Provide Operation and Maintenance Data for each type of valve installed.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with applicable New Mexico Standards and the National Fire Protection Act (NFPA).
- B. Valves: Mark valve body with manufacturer's name and pressure rating.

1.7 QUALIFICATIONS

- A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years experience.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Prepare valves and accessories for shipment according to AWWA Standards and seal valve ends to prevent entry of foreign matter into product body.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.
- D. Coated valves and appurtenances shall be shipped on bunks and secured with nylon belt tie down straps or padded banding over braces, and shall be stored on padded skids or other suitable means to prevent damage to coating.
- E. Coated valves shall be handled with wide belt slings, padded forks or other means to prevent damage to coating. Chains, cables or other equipment likely to damage coating or valves shall not be used.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.10 COORDINATION

- A. Coordinate work with Alto Lakes Water and Sanitation District, the local fire department, and utilities within construction area.

1.11 MAINTENANCE MATERIALS

- A. Furnish two (2) tee wrenches to Owner (required length) for each valve type.

PART 2 PRODUCTS

2.1 RESILIENT WEDGE GATE VALVES

- A. Manufacturers:
 - 1. American Flow Control, Series 2500
 - 2. American AVK, Series 45
 - 3. East Jordan Iron Works, FlowMaster
 - 4. J&S Valve, Model 6800 and 6900
 - 5. Mueller Company
 - 6. Southern Valve and Fitting USA Inc., Series 801 and 806
 - 7. United Water Products, Model 2010
 - 8. US Pipe, MetroSeal
 - 9. Substitutions: Section 01 00 00 – Product Requirements.
- B. Resilient Wedge Gate Valves: AWWA C509/C515, NSF 61.
 - 1. Body, Bonnet, Gland Flange and Stuffing Box: Ductile Iron ASTM A536.
 - 2. Stem and Stem Nut; Low Zinc (<15%) Bronze or Stainless Steel.
 - a. Stem: Non-rising stem (NRS), Minimum yield strength of 40,000 psi and elongation of 12%.
 - b. Stem Nut: Minimum yield strength of 30,000 psi.
 - 3. Wedge: Ductile Iron ASTM A536 fully encapsulated with EPDM rubber.
 - 4. Bolts and Nuts: Stainless Steel.
 - 5. Operating Nut: Square; open counterclockwise unless otherwise indicated.
 - 6. Ends: Flanged or mechanical joint as directed by the Engineer.
 - 7. Coating: Fusion bonded epoxy conforming to AWWA C550 with 10 mil or greater thickness; interior/exterior.
 - 8. Sizes 12 inch diameter and smaller: 250 psig.
 - 9. Sizes 16 inch diameter and larger: 200 psig.
- C. Where waterline is buried at a depth greater than 4 feet, provide valve stem extensions, complete with extension stem stabilizers, until depth of extension nut at least matches depth of operating nuts on valves installed at four-foot depth.

2.2 PRESSURE REDUCING VALVE ASSEMBLIES

- A. Manufacturers:
 - 1. Ames, Model 905GD
 - 2. Cla-Val, Model 90-01 Globe-type Valve with Adjustable Range.
 - 3. Substitutions: Section 01 00 00 - Product Requirements.
- B. Refer to Standard Detail in Plan set for dimensions and specifications for concrete vault that houses the unit.
- C. Each valve assembly shall include:
 - 1. One (1) pressure reducing valve assembly capable of:
 - a. Max Continuous Flow as shown in Table below.
 - b. Max Intermittent Flow as shown in Table below.
 - c. 30 to 300 psi adjustment range

Size (in.)	Max. Continuous Flow (gpm)	Max. Intermittent Flow (gpm)
1.5	125	160
2	210	260
3	460	580
4	800	990
6	1800	2250
8	3100	3900
10	4900	6150

- 2. One (1) bypass assembly with PRV valve sized as shown in Drawings
- 3. Each PRV assembly with appropriate unions, tees, spigots, gate valves, isolation valves, pressure gauges, etc., as shown in the Standard Detail Drawing
- 4. Pressure gauge ranges shall be 0-200 psi.
- D. Contractor must construct the above according to most recent edition of the New Mexico Standard Specifications for Public Works Construction, with latest revisions.
- E. Piping in vault shall be flanged ductile iron or galvanized, as shown in Drawings.
- F. Supply 25 feet of garden hose to connect to water source.

2.3 COMBINATION AIR VALVES

- A. Manufacturers:
 - 1. APCO Willamette Valve and Primer Corporation.
 - 2. A.R.I. Flow Control Accessories, Ltd.
 - 3. Danfoss Flowmatic.
 - 4. Val-Matic.
 - 5. Substitutions: Section 01 00 00 - Product Requirements.

- B. Valve to perform function of both air release and air/vacuum valves, and be furnished as a single body or dual body type, as indicated on the Design Drawings. Valve shall conform to AWWA C512.
- C. Working pressure for all air valve assembly wetted components shall be not less than the working pressure rating of the pipe on which they are installed.
- D. Air valve assemblies must be rated to withstand working, test and surge pressures. In the event that tapping saddles with adequate pressure rating are not available, the Contractor shall submit substitute materials that meet the pressure rating requirements, such as tees with tapping plugs, for Engineer's approval.
- E. Cast iron body, cover and baffle; stainless steel trim and float.
 - 1. Sized for up to 800 gpm; 0 - 250 psi.
 - 2. Seat: Buna-N.
 - 3. 3" and smaller: NPT threaded outlet.
 - 4. 4" and larger: Plain outlet with steel protector hood.
- F. Coating: Fusion bonded epoxy conforming to AWWA C550 and NSF 61; interior/exterior.

2.4 WATER PRESSURE GAUGES

- A. Manufacturers:
 - 1. Winters Instruments.
 - 2. WIKA.
 - 3. Ashcroft.
 - 4. Substitutions: Section 01 00 00 - Product Requirements.
- B. Must conform to ANSI B40.1 and have the following characteristics:
 - 1. Liquid filled, altitude/psi process gauge.
 - 2. Accuracy: 0.5% of full scale.
 - 3. Wetted materials: 316 SS.
 - 4. Case material: Polypropylene; safety glass window.
 - 5. Connection: 1/4" NPT(M), bottom.
 - 6. Dial Size: 4-1/2".
 - 7. Mounting: Stem or surface.
 - 8. Range: 0-160 psi, 0-370 feet.

2.5 VALVE BOXES

- A. Manufacturers:
 - 1. East Jordan Iron Works.
 - 2. Tyler Pipe.
 - 3. DL Foundry.
 - 4. SIP Industries.
 - 5. Substitutions: Section 01 00 00 – Product Requirements.
- B. 12-inch diameter Valves and Smaller: Domestic cast iron, three-piece, slip type.

- C. Valves larger than 12-inch diameter: Domestic cast iron, three-piece, screw type; round base.
- D. Where waterline is buried at a depth greater than 4 feet, provide valve box extensions as required.
- E. Cast iron lid marked "Water."
- F. Valve Box Alignment Device (VBAD): All buried gate valves 3-inch through 12-inch requiring a valve box or any valve boxes that are set on a 3-inch to 12-inch buried gate valve shall be furnished with a valve box alignment device. The device shall be of HDPE and colored white. It shall be furnished in two pieces that will lock together under the operating nut without requiring the removal of the operating nut. The device shall not affect the operation of the valve. No one-piece device will be accepted. The device shall be the BOXLOK as manufactured by Emma Sales, LLC, or approved equal.

2.6 ACCESSORIES

- A. Joint Restraints: "EBAA Iron, Megalug®", or approved equal, for all pipe 4" diameter and greater, "EBAA Iron, Series 6500 and 7500", or approved equal, for all pipe from 2" to 3-1/2" diameter, installation and spacing as per manufacturer's specifications.
- B. Concrete for Thrust Restraints: Concrete type specified in Section 03 05 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Determine exact location and size of valves from Drawings; obtain clarification and directions from Engineer prior to execution of work.
- B. Verify invert elevations prior to excavation and installation of valves.

3.2 PREPARATION

- A. Identify required lines, levels, contours and datum locations.
- B. Locate, identify, and protect utilities to remain from damage.
- C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
 - 1. Notify Engineer not less than 48 hours in advance of proposed utility interruption.
 - 2. Do not proceed without written permission from the Engineer.
- D. Perform trench excavation, backfilling and compaction in accordance with Sections 31 23 17 and 31 23 23.

3.3 INSTALLATION

A. Gate Valves:

1. Install valves in conjunction with pipe laying; set valves plumb.
2. Provide buried valves with valve boxes installed flush with finished grade.
3. Install valve stem risers and collars, and valve box extensions as required to match finished grade.
4. All valve boxes must be centered over the operating nut. When valve key in use, key shall be centered in valve box.
5. Valves shall require the same joint restraint lengths as dead-ends of similar size and pipe material.
- 6.

B. Specialty Valves and Gauges:

1. Install pressure reducing valves, combination air valves, and gauges in accordance with Drawings and in accordance with manufacturer's instructions, and the following sections of NNMSSPWC, in total or in part, except where amended by these Technical Specifications:
 - a. Section 801 – Installation of Water Transmission, Collector, and Distribution Lines.
 - b. Section 802 – Installation of Water Service Lines.

C. Combination Air Valves:

1. Install valves at locations verified by Engineer. Valves shall be installed at system high points in the vertical position with the inlet down.
2. Provide precast concrete vault with concrete collar to match finished grade.
3. If unforeseen field conditions arise which necessitate the installation of additional air release valves, such valves shall be installed as directed by the Engineer.
 - a. Additional air valves required due to unforeseen field conditions not the fault of the Contractor shall be paid for at established unit prices.
 - b. Additional air valves required due to high points caused through fault of the Contractor shall be provided at no additional cost to the Owner.

D. Tracer Wire:

1. For direct buried valves, tape tracer wire to outside of valve box up to last section of box. Bring tracer wire into the valve box above the operating nut. Protect wire ends with wire caps and protect from corrosion. Provide extra length of tracer wire at each structure, so tracer wire can be pulled 3 feet out top of structure for connection to detection equipment.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

3.5 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

- B. Perform pressure test on domestic site water distribution system in accordance with AWWA C605.
- C. All valves, including butterfly valves, gate valves, check valves and air valves shall be manually actuated through their full cycle to ensure proper operation prior to installation.

END OF SECTION

SECTION 33 12 19

HYDRANTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire hydrants.

- B. Related Sections:
 - 1. Section 03 05 00 - Basic Concrete Materials and Methods.
 - 2. Section 03 30 00 - Cast-in-Place Concrete: Concrete materials.
 - 3. Section 31 22 13 - Rough Grading.
 - 4. Section 31 23 23 - Backfill.
 - 5. Section 33 11 00 - Water Utility Distribution Piping.
 - 6. Section 33 12 13 - Water Service Connections.
 - 7. Section 33 12 16 - Water Utility Distribution Valves.
 - 8. Section 33 13 00 - Disinfection of Water Utility Distribution.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Fire and Flush Hydrants Assemblies:
 - 1. Basis of Measurement: Each.
 - 2. Basis of Payment: Includes complete installation as shown in the standard detail: excavation, tee on mainline, waterline between tee and gate valve and between the gate valve and hydrant, hydrant, gate valve, valve riser and collar, all associated MJ fittings, thrust block installation or megalugs, gravel for drain, pipe bollards, tracer wire and locate tape, all other fittings and accessories necessary for a complete installation, and testing and backfill.

1.3 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
 - 2. AWWA C502 - Dry-Barrel Fire Hydrants.
 - 3. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.

- B. National Sanitation Foundation (NSF):
 - 1. NSF/ANSI Standard 61 - Drinking Water Components - Health Effects.

- C. National Fire Protection Association (NFPA):
 - 1. NFPA 291 - Recommended Practice for Fire Flow Testing and Marking Hydrants.

1.4 SUBMITTALS

- A. Design Data: Submit manufacturer's latest published literature. Include illustrations, installation instructions, maintenance instructions and parts lists.
- B. Manufacturer's Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves, hydrants, and accessories provided meet or exceed AWWA Standards and specification requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of hydrants.
- B. Provide Operation and Maintenance Data for hydrants.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with applicable New Mexico Standards and the National Fire Protection Act (NFPA).
- B. Provide uniform color scheme for fire hydrants in accordance with NFPA 291.

1.7 QUALIFICATIONS

- A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years experience.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Prepare valves, hydrants, and accessories for shipment according to AWWA Standards and seal valve, hydrant and ends to prevent entry of foreign matter into product body.
- B. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.10 COORDINATION

- A. Coordinate work with Alto Lakes Water and Sanitation District, the local fire department, and utilities within construction area.

1.11 MAINTENANCE MATERIALS

- A. Furnish two (2) hydrant wrenches to Owner for each hydrant type.

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

- A. Fire hydrant assembly includes the tee off the mainline, waterline between the tee and gate valve, gate valve, valve box, waterline between the valve and hydrant, fire hydrant, and all appurtenances including fittings, thrust blocking and joint restraints required for a complete installation, as indicated on the design drawings. The waterline material used must match that called for in Section 33 11 00.
- B. Manufacturers:
 - 1. Mueller Company
 - 2. American Flow Control
 - 3. Clow Medallion
 - 4. Kennedy Guardian
 - 5. Substitutions: Only with prior approval of Engineer.
- C. Dry-barrel Break-away Type: AWWA C502; cast-iron body, compression type valve.
 - 1. Bury Depth: As indicated on the Drawings.
 - 2. Inlet Connection: 6 inches.
 - 3. Main Valve Opening: 5-1/4 inches diameter minimum.
 - 4. Ends: Mechanical Joint or Bell End.
 - 5. Bolts and Nuts: Corrosion resistant.
 - 6. Coating: AWWA C550; interior.
 - 7. Direction of Opening: Counterclockwise unless otherwise indicated.
- D. One pumper, two hose nozzles.
 - 1. Obtain thread type and size from local fire department.
 - 2. Attach nozzle caps by separate chains.
- E. Finish: Primer and two coats of enamel, color in accordance with fire department requirements.
- F. Final selection of fire hydrant to be coordinated with local fire department for consistency with existing operating and emergency equipment.

2.2 ACCESSORIES

- A. Joint Restraints: "EBAA Iron, Megalug®", or approved equal, for all pipe 4" diameter and greater, "EBAA Iron, Series 6500 and 7500", or approved equal, for all pipe from 2" to 3-1/2" diameter, installation and spacing as per manufacturer's specifications.
- B. Concrete for Thrust Restraints: Concrete type specified in Section 03 05 00.

- C. Aggregate: Aggregate for hydrant drainage specified on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Determine exact location and size of valves and hydrants from Drawings; obtain clarification and directions from Engineer prior to execution of work.
- B. Verify invert elevations prior to excavation and installation of valves and hydrants.

3.2 PREPARATION

- A. Identify required lines, levels, contours and datum locations.
- B. Locate, identify, and protect utilities to remain from damage.
- C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
 - 1. Notify Engineer not less than 48 hours in advance of proposed utility interruption.
 - 2. Do not proceed without written permission from the Engineer.
- D. Perform trench excavation, backfilling and compaction in accordance with Sections 31 23 17 and 31 23 23.

3.3 INSTALLATION

- A. Install hydrants in accordance with Drawings, manufacturer's instructions.
- B. Fire and Flush Hydrants:
 - 1. Install hydrants; provide support blocking and drainage gravel; do not block drain hole.
 - 2. Set hydrants plumb with pumper nozzle facing roadway; set hydrants with centerline of pumper nozzle 18 inches above finished grade and safety flange not more than 6 inches or less than 2 inches above grade.
 - 3. Fire hydrant locations shall be no further than 10 feet from the edge of the approved access roadways with the steamer connections facing towards the driving surface. Final placement of the fire hydrants shall be coordinated and approved by the Owner prior to installation.
 - 4. Final fire hydrant locations shall be located in full view for incoming emergency responders. Landscape vegetation, utility pedestals, walls, fences, poles, and the like shall not be located within a three foot radius of the hydrant per Article 10, Sections 1001.7.1 and 1001.7.2 of the 1997 Uniform Fire Code.
 - 5. Fire hydrants subject to possible vehicular damage shall be adequately protected with guard posts in accordance with Section 8001.11.3 of the 1997 Uniform Fire Code.
 - 6. Paint hydrants in accordance with local color scheme.

7. After hydrostatic testing, flush hydrants and check for proper drainage.

C. Yards Hydrants:

1. Thoroughly flush waterline prior to installation.
2. Install hydrants; provide support blocking and drainage gravel.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.5 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform pressure test on domestic site water distribution system in accordance with AWWA C605.

END OF SECTION

SECTION 33 13 00

DISINFECTION OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.
- B. Related Sections:
 - 1. Section 33 11 00 - Water Utility Distribution Piping
 - 2. Section 33 12 13 - Water Service Connections.
 - 3. Section 33 12 16 - Water Utility Distribution Valves.

1.2 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. AWWA B300 - Hypochlorites.
 - 2. AWWA B301 - Liquid Chlorine.
 - 3. AWWA B302 - Ammonium Sulfate.
 - 4. AWWA B303 - Sodium Chlorite.
 - 5. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - 6. AWWA C651 - Disinfecting Water Mains.
- B. New Mexico Administrative Code (NMAC) - Title 20, Chapter 7, Part 10:
 - 1. Section 201: Application for Public Water System Project Approval.
 - 2. Section 400: General Operating Requirements.

1.3 SUBMITTALS

- A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.
- C. Test Reports: Indicate results comparative to specified requirements.
- D. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 00 00 - Execution Requirements: Requirements for submittals.
- B. Disinfection Report:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.

3. Test locations.
 4. Name of person collecting samples.
 5. Initial and 24 hour disinfectant residuals in treated water in ppm for each outlet tested.
 6. Date and time of flushing start and completion.
 7. Disinfectant residual after flushing in ppm for each outlet tested.
- C. Bacteriological Report:
1. Date issued, project name, and testing laboratory name, address, and telephone number.
 2. Time and date of water sample collection.
 3. Name of person collecting samples.
 4. Test locations.
 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 6. Coliform bacteria test results for each outlet tested.
 7. Certify water conforms, or fails to conform, to bacterial standards of authority having jurisdiction.
- D. Water Quality Certificate: Certify water conforms to quality standards of authority having jurisdiction, suitable for human consumption.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

1.6 QUALIFICATIONS

- A. Testing Firm: Company specializing in testing potable water systems, certified by State of New Mexico.
- B. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify piping system has been cleaned, inspected, and pressure tested.

- C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

- A. Provide and attach required equipment to perform the Work of this section.
- B. Prior to disinfection, thoroughly flush the system with potable, disinfected water. Flushing may be accomplished either by gravity or by pumping, provided the pump is not damaged due to insufficient head. Any damage to the pump during flushing shall be the responsibility of the Contractor and shall be repaired or replaced at no additional expense to the Owner. A minimum flow velocity of 3 feet per second (fps) is required.
- C. Perform installation of system and pressure testing. Refer to Section 33 11 00.
- D. Introduce treatment into piping system and perform disinfection in accordance with AWWA C651.
- E. Maintain disinfectant in system for 24 hours, or 48 hours if the temperature is less than 41 degrees Fahrenheit.”
- F. Flush, circulate, and clean until required cleanliness is achieved; use domestic water.
- G. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

- A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Disinfection, Flushing, and Sampling:
 - 1. Disinfect and test pipeline installation in accordance with AWWA C651.
 - 2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
 - 3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
 - 4. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory, approved by the Engineer, to sample, test and certify water quality suitable for human consumption.
 - 5. Contractor shall be reimbursed for the cost of laboratory tests upon submittal of invoice(s). The laboratory results of all tests shall be submitted directly to the Engineer. Contractor shall pay for all failed tests.
 - 6. Contractor shall not connect to existing system until all testing and disinfection is complete and shall obtain written permission from the Engineer to proceed with connection to the existing system.

- C. Re-Disinfection:
 - 1. In the event the performed water quality testing fails, the Contractor will disinfect the affected portions of the system again, and the approved testing laboratory shall sample, test and certify water quality as described in these specifications. Re-disinfection shall be performed at no additional cost to the Owner.

END OF SECTION