Technical Specifications

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BASIC REQUIREMENTS

PART 1 GENERAL

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1.2 CONTRACT DESCRIPTION

A. Work of the Project includes construction of approximately 5,422 linear feet of 6-inch and 5,811 linear feet of 2-inch waterlines with associated service lines and appurtenances.

B. Perform Work of Contract under a stipulated price basis with Owner in accordance with Conditions of Contract.

1.3 SPECIAL CONSIDERATIONS

A. Contractor shall obtain written verification from the Engineer Right-of-Way for the project has been secured prior to commencing any ground disturbing activities.

B. Owner has purchased 5,500 linear feet of 6-inch C-900 and 4,000 linear feet of 2-inch SDR21 PVC water pipe for the project for use by the Contractor. The pipe is stored near the project site and the Contractor is responsible for delivery of the Owner provided pipe to the project site. The amount of pipe provided is not sufficient for the entire project's scope of work and Contractor is responsible for supplying all additional pipe required for completion of the project. No additional materials will be provided by the Owner.

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

D. 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. Safety fencing to be installed around open trench when left unattended.

E. Contractor is advised that there is tree clearing required to install piping and a tree clearing permit from the Ramah Navajo Chapter Department of Natural Resources and Forestry is required to be obtained by the Contractor prior to any field work. Tree clearing/permit does not have a separate pay item and Contractor shall include this work in the cost of pipeline installation. The Engineer will aid the Contractor in obtaining the permit. Felled brush and trees shall be chipped and spread over disturbed areas within the project's right-of-way limits. Stumps and other debris not able to be chipped shall be removed from the project site and properly disposed of by the Contractor.
   1. Ramah Navajo Chapter Department of Natural Resources and Forestry contact for this project is Michael Heino and he can be reached at 505-775-7123.

F. Contractor shall coordinate with Ramah Navajo Utility Authority for tie-in to existing water system. Contractor shall notify Engineer prior to performing the respective activities.

G. Contractor must maintain a full set of Drawings and Technical Specifications at the construction site at all times throughout the construction process. All subcontractors must possess at least all Drawings and Technical Specifications pertaining to their portion of the work while on the construction site at all times.

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. An up to date set of the record drawings shall be required to be provided at each project progress meeting.

I. Contractor shall be responsible for notifying residents of construction. Access to driveways must be maintained at all times.

J. Written documentation of utility notifications, including New Mexico "One Call" at 811, Ramah Navajo Utility Authority and any other local utility companies shall be provided to the Engineer prior to commencing ground disturbing activities.

K. Contractor shall abide by all permit stipulations and requirements, including but not necessarily limited to BIA and Navajo Nation environmental and archaeological stipulations, Continental Divide Electric utility pipeline encroachment agreement, and BIA Department of Transportation road crossing permits, regardless of whether such permits are obtained by the Owner, Engineer or Contractor.

1. Environmental and cultural stipulations for the pipeline are provided in Appendix C. Encroachment agreement is provided in Appendix D. Road crossing permits are included in Appendix E. Contractor shall comply with these stipulations, terms and conditions. Said compliance shall be considered incidental to the cost of the project.
2. Final acceptance of ROW restoration on all lands, including but not limited to re-seeding, erosion controls, permanent traffic berms or barricades, and finished grading, shall be subject to approval by the Owner.

L. It is the Contractor's responsibility to apply for and obtain all permits required for the Work that have not already been obtained by the Owner or Engineer. No additional compensation will be provided for obtaining permits and all costs will be considered incidental to the Project. Contractor is wholly responsible to determine what additional permits may be required.

M. Contractor is responsible for notifying the Engineer at least 30 working days prior to any construction activities at utility or road crossings. Contractor shall adhere to all requirements and any special notes provided on Drawings, including notification requirements. Contractor is advised that the exact depth, location and diameter of some of these utility lines are unknown, and must be determined by the Contractor in the presence of the corresponding utility company representatives. Furthermore, any depth, location or diameter information provided in the Drawings regarding existing utility lines are only approximations and the Contractor shall be responsible to verify such information in the presence of the corresponding utility company representatives.

N. Encroachment agreements from power line company is included in Appendix D to the Contract Documents. Contractor is responsible for compliance, including notifying Owner, Engineer and utility company prior to crossings and shall adhere to all requirements.

O. Cultural Resources Requirements:

1. Contractor must be familiar with and abide by the cultural resource stipulations included in Appendix C of the Contract Documents.
2. Contractor must allow archaeologist and/or Owner's representative to have access to the project site for examination of cultural resources. Contractor must allow archaeologist and/or Owner's representative to halt work, as necessary, to examine cultural resources in spoils and/or trenches. Contractor may move equipment to another location while archaeologist completes his/ her examination of cultural resources. Contractor shall not request additional compensation for any delays caused by archaeological examinations. However, such delays may be considered excused delays and not count toward Contractor's deadline for substantial

completion, provided Contractor requests additional time within one (1) week of the delay.

3. Contractor is advised of the presence of designated "Culturally Sensitive Area" in the project area, which are indicated on the Drawings. Contractor shall notify the Engineer at least 5 working days prior to any ground disturbing activity within 100 feet of any designated "culturally sensitive area" to allow time for a permitted archaeological monitor to be scheduled on-site, if needed. No ground disturbing activities include equipment mobilization/ storage, vehicular traffic or vegetation removal is allowed in these areas. Any archaeological monitoring required will be provided by the Owner at no cost to the Contractor.
   a. Site indicated on the Drawings requires temporary flagging to be installed prior to any ground disturbing activities. The flagging will be installed by the Contractor's surveyor and must remain in place during the life of the project. No vehicular traffic, personnel or construction activities shall be allowed past the flagging limits.
   b. In addition to the flagging, the site indicated on the Drawings may require archaeological monitoring. Contractor shall not perform any ground disturbing activities within 100 ft of these areas at any time without the Owner's archaeologist physically present at the site.
   c. Archaeological Discovery in the Presence or Absence of Archaeological Monitoring: If the contractor discovers any previously unidentified historic or prehistoric cultural resources, then all work within 100 feet of the discovery will be suspended and the discovery promptly reported to the Engineer. The Navajo Nation Historic Preservation Department will then specify what action is to be taken. If the discovery is evaluated as being significant, treatment of the discovery may be required prior to allowing the project to proceed. Further damage to significant cultural resources will not be allowed until any required treatment is completed.

P. Storm Water Pollution Prevention Plan (SWPPP): Contractor shall be wholly responsible for the preparation and implementation of the SWPPP, and any erosion/ sediment practices described therein. Such implementation shall include, but not necessarily be limited to, obtaining any required NPDES permit(s) and submitting a Notice of Intent (NOI) to competent agencies prior to construction, implementation and maintenance of all Best Management Practices (BMPs) specified in the SWPPP, inspection of entire project site as specified in the SWPPP, maintaining and providing all documentation required in the SWPPP (including keeping up-to-date project maps and as-builts before, during and after construction), filing of a Notice of Termination (NOT) upon completion of the project and removal of BMPs upon the required time interval after completion of the project.

Q. No reports or drawings relating to Hazardous Environmental Conditions at the site are known to the Owner.

R. Contractor is solely responsible for providing all water for the construction of the project and no guarantees are made by the Owner or Engineer as to the availability of any particular water sources. All costs associated with purchase, permits, hauling, etc. for construction water shall be considered incidental,

1. As a convenience only, Contractor is advised that possible sources of construction water have been identified. Neither the Owner nor the Engineer makes any representations regarding the quantity, quality, accessibility, availability, or price

of this water. Contractor remains wholly responsible to make all arrangements for water.

S. Contractor is advised that compaction requirements shall be strictly enforced. If the contractor is unable to meet compaction requirements for pipe embedment using select material, the Contractor shall have the option to use soil cement at no additional cost to the Owner.

T. Contractor is advised that the trench widths shown in the Drawings are minimum widths only. In the event that the Contractor is unable to meet pipe embedment and compaction specifications using the minimum trench width and needs to increase trench width in order to meet these specifications, such increase in trench width shall be provided at no additional cost to the Owner.

U. Contractor is advised that pipeline line and grade specifications will be strictly enforced. See Section 33 11 13 for specifications on horizontal and vertical pipe line and grade.

V. Contractor must coordinate use of Ramah Navajo Utility Authority (RNUA) potable water for filling and flushing the pipeline, with RNUA and Engineer at least 2 weeks prior to using RNUA water. Contractor must provide RNUA and Engineer with key information, such as desired maximum instantaneous flow rate (gpm), desired maximum daily flow rate (gpd), desired schedule of water use, and other information as required by RNUA.

W. Contractor must not infringe on RNUA's ability to serve its existing customers by excessive water use. RNUA water shall not be used for compaction, dust abatement or similar activities without express written permission by RNUA. Note that RNUA and/or Engineer may limit the maximum allowable instantaneous flow rate, daily flow rate, water usage days, etc. RNUA will not charge for water going into the pipeline.

1. Contractor is advised that the actual flow rate of RNUA water available for line filling and flushing may be less than the flow rate specified in the Technical Specifications. Contractor shall allow adequate time in construction schedule to fill and flush the pipeline given the amount of water available at the time of construction, and shall not request additional compensation due to water shortages for filling and flushing the pipeline.

X. Contractor may use the flush valves designed in the proposed pipeline to flush water out of the system. Flushed water may be disposed of in the natural waterways adjacent to the flush valves and drains, provided the rate of flushing does not damage the surrounding environment (i.e. by flooding, erosion, etc.). Water chlorinated to levels above those normally associated with drinking water shall be neutralized prior to discharge.

1. Contractor shall obtain Clean Water Act 402 permits from U.S. EPA, as required, and shall abide by all stipulations of said permits.

Y. Contractor is advised that a 40' wide permanent right-of-way easement is established along the proposed pipeline alignment, 20' to each side of the centerline, to which the Contractor must limit all construction activities.

1. Contractor is permitted to use any area within the approved right-of-way for staging and storage provided such use does not disturb other land users or areas outside the ROW and that the staging areas are restored to their original condition prior to final completion.

a. Contractor is wholly responsible for location, set-up, security, and any required temporary utilities associated with staging and storage areas.
b. All staging and storage areas within the project area must be approved in advance by the Owner.

2. All areas disturbed during construction shall be reclaimed in accordance with the Contract Documents, regardless of whether they are part of the permanent ROW.

Z. Contractor shall restore fences to original condition or better. Contractor shall repair all gates and fences in a timely manner to prevent livestock ingress/ egress.

AA. Restore all open-cut driving surfaces, including driveways, to original condition or better, including replacement of base course, gravel or pavement as needed. Dirt roads and driveways shall be restored with compacted backfill as indicated in the drawings and specifications, plus surface material as specified. All restoration work for which no bid item is given shall be considered incidental.

BB. Contractor is responsible for providing schedule and plans with locations for lane and shoulder closures to the Engineer and BIA-NRO Department of Transportation prior to starting work. Contractor shall obtain any required supplemental permits from the relevant agencies.

CC. Excess dirt from cutting may be disposed of on-site, provided the finished grade and compaction meet specifications and are approved by the Engineer.

DD. For the present Project, Bidding Documents in electronic media format may be furnished to bidding contractors for the sole purpose of preparing bids, and not for construction. The selected construction Contractor shall not rely on files provided in electronic media format for construction but rather hard copies of such data provided by the Engineer or Owner upon award of the Contract.

EE. Prior to beginning construction activities, the Contractor will furnish full-coverage photo or video documentation of the entire construction site per requirements set forth in Article 3.2.A of Section 33 11 13 of the Technical Specifications.

1.4 WORK BY OWNER

A. None. Note materials however are provided by Owner. Refer to previous section: Special Consideration, Section 1.3, for details.

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
NNEPA	Navajo Nation Environmental Protection Agency
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Department of Environment
NMSSPWC	New Mexico Standard Specifications for Public Works Construction
OSHA	Occupational Safety and Health Administration
SSPC	Steel Structure Painting Council
UL	Underwriters Laboratories, Inc.

1.7 MINIMUM WAGE RATE DETERMINATION

A. This project will also entail a minimum wage rate determination on the part of the Navajo Nation Office of Labor Relations (NNOLR). The wage rate determination by the NNOLR for the present project can also be found in the same appendix to the Contract Documents.

B. The Davis-Bacon Act does not apply to this project.

C. The Contractor warrants and agrees that he and all subcontractors shall comply with all applicable provisions of the Navajo Nation Wage Rate Determination. The Minimum Wage Rate Determinations 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. Contractor shall submit details regarding the proposed testing laboratory or inspection firm, including a statement of qualifications and a proposed schedule of unit price costs for testing and inspection to be completed under the allowance. Any additional costs, such as travel time, shall also be detailed. Engineer may require the Contractor to solicit additional quotes if the proposed costs are not competitive.

C. Costs Included in Allowance: Cost of engaging testing or inspection firm, execution of tests or inspection, and reporting of results.

D. Costs Not Included in Allowance:

1. Incidental labor and facilities required to assist testing or inspection firm.
2. Cost of disinfection of waterlines (covered under separate bid item).
3. Costs of hydrostatic pressure testing (covered under separate bid item).
4. Costs of failed tests.

E. Costs will be drawn from testing allowance and paid based on invoice(s) submitted to Contractor by testing or inspection firm(s), and reimbursed at cost, with no markup by Contractor. 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 Progress Estimate sheet within the Application for Payment forms (EJCDC Form C-620, 2007 Edition), 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 five [5] 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 until 45 days after receipt of the bill 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 11 - Amending the Contract Documents; Changes in the Work, of the Standard General Conditions and Navajo Nation Supplemental 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 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, so as to permit the reasonable passage of passenger vehicles, and shall be kept graded and smooth and watered several times daily, as needed, to control dust.

D. Permit from the BIA has been obtained for boring under BIA Route 114 in three locations. The Contractor is responsible for obtaining any additional permits required, including any applicable local, county or state 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.

1.14 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.

1.15 FIELD ENGINEERING

A. Establish elevations, lines, and levels and 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.

1.16 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.

1.17 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, as applicable.

C. During each meeting, the Contractor is required to present any issues which may impact 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.

1.18 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.

1.19 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 promptly report inability to comply with requirements.

H. Prior to commencing construction activities, Contractor shall provide two (2) copies of the corresponding Project safety plan to the Engineer, per SC-7.12.I of EJCDC C-800 Supplementary Conditions.

1.20 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.

1.21 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.

1.22 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.

1.23 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.

1.24 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.

1.25 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.

1.26 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 more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.27 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.

1.28 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.

1.29 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.

1.30 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.

1.31 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.

1.32 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.

1.33 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.

1.34 PROJECT IDENTIFICATION

A. No project sign is required.

1.35 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.

1.36 PROTECTION OF INSTALLED WORK

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

1.37 SECURITY

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

1.38 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 Engineer a Storm Water Pollution Prevention Plan (SWPPP) that will address all construction phases and the proposed pollution prevention and sediment control measures. This shall be done in accordance with the National Pollution Discharge Elimination System (NPDES) general permit requirements for all construction activities, and shall include all required reporting.

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.

1.39 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) 476-6025 during business hours. If there is no emergency situation the Contractor can leave a message regarding the nature of the spill, location and contact information. For emergencies that require immediate attention and mitigation, and there is no response at the NMED Emergency Response Team number above, call (505) 827-9329. For emergencies that pose immediate danger to public health or property, call 911. For any and all spills, Contractor shall also immediately contact the Owner's Representative.

E. The Contractor shall clean up any unreported spills associated with project construction identified after construction.

1.40 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.

1.41 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.

1.42 DELIVERY, HANDLING, STORAGE, AND PROTECTION

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

1.43 SUBSTITUTIONS

A. Substitutions will only be considered when Product becomes unavailable through no fault of Contractor, or where an "approved equal" is specifically allowed elsewhere in the Technical Specifications or noted on the Drawings.

B. Specific manufacturers are required for certain items in order to maintain consistency with the Owner's existing inventory. In such cases, substitutions will not be allowed as indicated in each specification section where applicable.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. Submit three [3] copies of request for Substitution to the Engineer for consideration. Limit each request to one proposed Substitution item.

1.44 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. Among required closeout submittals include: Release of Liens, Consent of Surety, and Certification of Labor Standards.

1.45 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.

1.46 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.

1.47 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.

1.48 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.

1.49 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.

1.50 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 every 100 feet and at all fittings, valves and transitions and other appurtenances. Final As-Built Record Drawings shall be stamped by a Licensed Professional Surveyor, tied to established control monuments and other reference points on the datum shown on the survey control sheet of the drawings, 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.

1.51 OPERATION AND MAINTENANCE DATA

A. Submit 3 sets prior to final inspection, bound on 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: Project documents and certificates.

   a. All warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

1.52 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.

1.53 WARRANTIES

A. Contractor shall provide a one year warranty on all work starting on the date Substantial Completion is issued.

B. Execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers for all products with extended warranties beyond one (1) year.

C. Submit prior to final Application for Payment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 22 00

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SUMMARY

A. Measurement and payment shall be as specified in this Section.

B. Work to be performed under this contract will be paid for on a unit price basis under the appropriate Bid Items on the Bid Form. All costs for work shown on Drawings or described in Specifications shall be incidental to the Contract and shall be included in the Contract Price. A claim by the Contractor for extra compensation for an item shown on the Drawings or described in the Specifications will not be considered for any reason, including but not limited to, the claim that it does not fall within the scope of one of the Bid Items.

C. Contractor shall, within 10 days of receipt of Notice to Proceed, submit a complete breakdown of any lump sum bid items showing value assigned to each part of work including overhead and profit. Payment for materials delivered but not fully incorporated in work will be made only if such materials are listed and assigned a value in Contractor's submittal.

D. General Scope of Work under each Bid item includes labor and materials required for construction of a completely functional and operational water system.

E. Water for this project will be supplied by the Contractor. Contractor is responsible for acquiring a suitable water source and the cost of water is incidental to the contract. There is no water currently available on site. A recommendation for a water source location is being researched and if one is found, information will be provided at the pre-bid meeting.

1.2 BID ITEM DESCRIPTIONS

A. Item numbers listed below correspond directly to Bid Item numbers on the Bid Form.

General and Miscellaneous

Item No. 1 - Materials Testing and Bacterial Laboratory Tests
Payment as an allowance, based upon actual invoices, for direct laboratory or on-site testing costs only. Includes laboratory testing costs for material testing, on-site testing for proper compaction and laboratory testing costs for bacterial testing of potable water. All work performed by Contractor related to such testing shall be considered incidental and shall not be reimbursable from testing allowance. This item will include payment for all successful tests and for only tests required by the Drawings and Specifications or as requested by the Engineer. The laboratory must be approved by the Engineer. All invoices must be provided to the Engineer for review and payment. Hydrostatic pressure testing is not included in this allowance but is included as a separate bid item.

The cost of laboratory testing, such as fill material analysis testing, bacterial testing of water and on-site testing, such as trench compaction testing, shall be reimbursed to the Contractor, upon submittal of invoices from the laboratory testing firm, as specified in this Section. All work performed by Contractor related to such testing shall be considered incidental and shall not be

reimbursable from testing allowance. Work shall be coordinated and directed by Engineer. Contractor shall pay for all failed tests.

Item No. 2 – Mobilization (75%)/Demobilization (25%)
Payment as a lump sum, with measurement based on percentage completed, and shall include all costs for Contractor's mobilization and demobilization.

Item No. 3 – Construction Staking/Surveying
Payment as a lump sum for field survey work/field staking and as built surveying only, as approved by the Engineer.

Item No. 4 – Storm Water Pollution Prevention Plan (SWPPP) Preparation
Payment as a lump sum and shall include all labor, materials, equipment, and incidentals required for the preparation and modification of the construction SWPPP. This includes but is not limited to compliance with all tribal, federal, state, and local agencies regarding the SWPPP plan.

Item No. 5 – Storm Water Pollution Prevention Plan (SWPPP) Implementation, Complete in Place (CIP)
Payment as a lump sum, with measurement based on percentage completed, and shall include all labor, materials, equipment, and incidentals required for the implementation and modification of the construction SWPPP. This includes but is not limited to compliance with all tribal, federal, state, and local agencies regarding the SWPPP plan implementation, filing of notices, implementation, documentation and maintenance of records including up-to-date as-built maps related to stormwater controls, inspections, and any other requirements incidental to compliance with EPA and NNEPA regulations. Implementation includes but is not limited to installation, modification, inspection, monitoring, and continuous maintenance of all permanent and temporary Best Management Practices (BMPs) for erosion and sediment control.

Item No. 6 - Traffic Control Preparation, CIP
Payment as a lump sum and shall include all components required for preparation of a traffic control plan approved by the Engineer, provided by the contractor.

Item No. 7 - Traffic Control Implementation, CIP
Payment as a lump sum, with measurement based on percentage completed, and shall include all components required for implementation of traffic control.

Item No. 8 – Re-seeding, CIP
Payment and measurement for re-seeding shall be based on the cost per linear foot of ROW as shown on the bid form. Re-seeding shall cover all disturbed areas. The cost of the re-seeding shall include all labor, materials, equipment, and incidentals required for the installation, inspection, monitoring, and maintenance of the seeded area. See appendix for seed mixture and additional information.

Item No. 9 – Hydrostatic Pressure Testing
Payment and measurement for hydrostatic testing shall be based on the cost per linear foot as shown on the bid form. Cost for work including materials, equipment, tools, labor, and incidentals necessary to complete the work shall be included. Repeat hydrostatic testing due to nonconforming or incomplete construction is incidental and will not be paid for.

Item No. 10 - Flushing, Disinfection, and Bacteriological Field Sampling
Payment and measurement for flushing, disinfection, and obtaining bacteriological water samples in the field shall be based on the cost per linear foot as shown on the bid form. Cost for work including materials, equipment, tools, labor, and incidentals necessary to complete the work shall

be included. Repeat disinfection, flushing, and bacteriological testing due to nonconforming or incomplete construction is incidental and will not be paid for. Direct laboratory expenses shall be reimbursed from the testing allowance.

Item No. 11 – Spare Parts Allowance
Payment as an allowance, based upon actual invoices, for spare parts/materials (such as gate valves) or additional equipment (such as remote meter reading equipment), as requested by the Owner. Contractor shall provide three quotes from material suppliers for the requested items for approval/selection by the Owner and will be allowed a five percent (5%) markup for overhead, profit and delivery of the items to the project site.

Main Water Lines

Item No. 12 - 2-inch ASTM D2241 Class 200 PVC pipe, CIP
Payment and measurement will be based upon linear foot installed. This price shall be full compensation for pipe, all fittings and appurtenances not listed separately on the bid form (including but not limited to: saddles, tees, reducers, end caps), all earthwork (including site clearing, preparation, excavation, trenching, bedding, backfill, compaction, construction water, shoring, and disposal of surplus or unsuitable material) not separately listed on the bid form, hand trimming, concrete joint restraints (where applicable), mechanical joint restraints (where applicable), working around existing drains and structures encountered, connection to existing system, restoration of property including driveways, aboveground pipe markers, tracer wire, detectable warning tape, connection to existing public water source, and all materials, labor, tools, equipment and incidentals necessary to satisfactorily complete the work, CIP. Soil cement, if used, shall be considered incidental to the cost of the pipe installation.

Item No. 13 - 6-inch C900 DR18 PVC pipe, CIP
Payment and measurement will be based upon linear foot installed. This price shall be full compensation for pipe, all fittings and appurtenances not listed separately on the bid form (including but not limited to: saddles, tees, reducers, end caps), all earthwork (including site clearing, preparation, excavation, trenching, bedding, backfill, compaction, construction water, shoring, and disposal of surplus or unsuitable material) not separately listed on the bid form, hand trimming, concrete joint restraints (where applicable), mechanical joint restraints (where applicable), working around existing drains and structures encountered, connection to existing system, restoration of property including driveways, aboveground pipe markers, tracer wire, detectable warning tape, connection to existing public water source, and all materials, labor, tools, equipment and incidentals necessary to satisfactorily complete the work, CIP. Soil cement, if used, shall be considered incidental to the cost of the pipe installation.

Item No. 14 - Trench Excavation - Rock, CIP
Payment and measurement will be based upon vertical linear foot removed. The unit of measurement, "vertical linear foot", is defined as the product of depth of rock removed (in vertical feet), multiplied by linear feet of trench and is independent of the width of the trench. This price shall be full compensation for all materials, labor, tools, equipment and incidentals necessary to satisfactorily complete the work, including permits. This price includes preparation of rock for removal, mechanical disintegration of rock, removal from position, and loading and hauling from trench to a site designated by the Engineer, and any required import or borrow of bedding, embedment or backfill material from designated locations. Excavation of uncontaminated soil is incidental to pipe and is excluded from this pay item. Payment will not be made for over excavation, trench width in excess of that shown in trench detail, or replacement materials required due to over excavation without Engineer's approval. Any deviations from the pipe cover depth

shown on the plans must be approved in advance by the Engineer in order for additional payment to be made. This item covers rock encountered for both main and service lines.

Item No. 15 - 1-inch Combination Air Release Valve Assembly, CIP
Includes complete installation as shown on Drawings: excavation, vault, valves, fittings, accessories, concrete, backfill, compaction, tests, and connection to system, CIP.

Item No. 16 – 6-inch Bollards protecting Combination Air Valve, CIP
Includes complete installation as shown on Drawings: excavation, bollard, concrete, backfill, compaction, and painting, CIP.

Item No. 17 - 2-inch flush valve assembly, CIP
Includes complete installation as shown on Drawings: excavation, pipe, valves, fittings, accessories, concrete, backfill, compaction, tests, and connection to system , CIP.

Item No. 18 - 2-inch Gate Valve, CIP
Includes complete installation as shown on Drawings: excavation, valve box, riser, valves, fittings, accessories, concrete, backfill, compaction, tests, and connection to system, CIP.

Item No. 19 - 6-inch Gate Valve, CIP
Includes complete installation as shown on Drawings: excavation, valve box, riser, valves, fittings, accessories, concrete, backfill, compaction, tests, and connection to system, CIP.

Casing for Road Crossings

Item No. 20 - Road Crossings Installed via Open Cut, 12-inch steel casing (0.25" wall thickness), CIP
Payment and measurement will be based upon linear foot installed. This price shall be full compensation for steel casing, all fittings and appurtenances not listed separately on the bid form (including but not limited to spacers and end seals), all earthwork (including but not limited to site clearing, preparation, excavation, trenching, bedding, backfill, compaction, construction water, shoring, and disposal of surplus or unsuitable material) not separately listed on the bid form, shop and field welding, working around existing drains and structures encountered, restoration of property including chipsealed and graveled roads and driveways, tracer wire, detectable warning tape, and all materials, labor, tools, equipment and incidentals necessary to satisfactorily complete the work, CIP. Soil cement, if used, shall be considered incidental to the cost of the casing installation. Excludes carrier pipe, which is covered under separate bid items.

Service Lines

Item No. 21 - 1-inch PE SIDR 7 Service Line, CIP
Payment and measurement will be based upon linear foot installed. This price shall be full compensation for pipe, all fittings and appurtenances not listed separately on the bid form (including but not limited to: saddles, tees, reducers, end caps), all earthwork (including site clearing, preparation, excavation, trenching, bedding, backfill, compaction, construction water, shoring, and disposal of surplus or unsuitable material) not separately listed on the bid form, hand trimming, concrete joint restraints (where applicable), mechanical joint restraints (where applicable), working around existing drains and structures encountered, connection to existing system, restoration of property including driveways, aboveground pipe markers, tracer wire, detectable warning tape, connection to existing public water source, and all materials, labor, tools, equipment and incidentals necessary to satisfactorily complete the work, CIP. Soil cement, if used, shall be considered incidental to the cost of the pipe installation.

Item No. 22 - Residential Service Connection, CIP

Includes complete installation as shown on drawings: all components shown in the water meter and box assembly drawing, site clearing, preparation, excavation, backfill, compaction, disinfection, and testing, including remote read water meters, complete in place. Item includes excavation of existing cistern tanks/systems, which are to be provided to the homeowner. Item does not include one inch service line (covered under separate bid item).

1.3 PAYMENT FOR TESTING

A. The cost of laboratory testing, such as fill material analysis testing, and on-site testing, such as trench compaction testing, shall be reimbursed to the Contractor, upon submittal of invoices from the laboratory testing firm, as specified in this Section.

1. All work performed by Contractor related to such testing shall be considered incidental and shall not be reimbursable from testing allowance.
2. The allowance shall not cover laboratory personnel's stand-by time in the field, nor any other costs incurred by the laboratory due to delays caused by the Contractor.
3. Contactor shall take reasonable measures to minimize laboratory's trips to the site by having multiple sites ready for testing for each trip to the site by the laboratory field personnel.
4. Engineer will direct frequency and location of tests
5. Contractor shall pay for all failed tests.

B. The cost of field work associated with hydrostatic pressure, disinfection and bacteriological testing for pipeline shall be paid via a separate bid item, as specified in this Section.

C. The cost of work associated with testing for any other facilities for which a separate bid item is not provided shall be considered incidental to their respective bid items.

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 nor fence posts.

2. Hold fifth cylinder for future considerations.

Quantity	Number of Samples
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 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 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.

2.3 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.)
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.

2.4 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 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.

3.4 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.

3.5 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.

3.6 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.

3.7 DEFECTIVE CONCRETE

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

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 22 13 - Rough Grading.
2. Section 31 23 18 - Rock Removal.

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 Navajo Nation and 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, Ramah Navajo Utility Authority, and any other 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.

B. Notify Engineer in writing at least five (5) working days prior to commencing work within 100 feet of any designated culturally sensitive area, as shown on Plans. Do not commence work unless barricades are in place and/or archaeological monitor is present, as required. Refer to Section 01 00 00 for site-specific requirements.

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, landscaped, 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 22 13

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating subsoil.
2. Cutting, grading, filling, rough contouring, and compacting site for site structures and building pads.

B. Related Sections:

1. Section 31 10 00 - Site Clearing: Excavating topsoil.
2. Section 31 23 17 - Trenching: Trenching and backfilling for utilities.
3. Section 31 23 18 - Rock Removal.
4. Section 31 23 23 - Backfill: General building area backfilling.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. All rough grading work shall be considered incidental to those items which require grading.

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 10-lb Rammer and an 18-in. Drop.

B. American Society for Testing and Materials International (ASTM):

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 56,000 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 D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
12. ASTM D2434 - Standard Test Method for Permeability of Granular Soils Constant Head.
13. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
14. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedure).
15. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
16. ASTM D2901 - Test Method for Cement Content of Freshly Mixed Soil Cement.
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 Sols 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).

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures.

B. Samples: Submit, in airtight containers, 10 lb. sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

B. Perform Work in accordance with applicable New Mexico State Standards.

PART 2 PRODUCTS

2.1 MATERIALS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call New Mexico "One Call" at 811, Ramah Navajo Utility Authority, and any other local utility companies at least three (3) days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Notify Engineer at least five (5) working days prior to commencing work within 100 feet of any designated culturally sensitive area, as shown on Plans. Do not commence work unless barricades are in place and/or archaeological monitor is present, as required. Refer to Section 01 00 00 for site-specific requirements.

C. Identify required lines, levels, contours, and datum.

D. Notify utility company to remove and relocate utilities.

E. Protect remaining utilities from damage.

F. Protect plant life, lawns, and other features remaining as portion of final landscaping.

G. Protect benchmarks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, relandscaped, or regraded.

B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

C. Remove excess subsoil not intended for reuse, from site.

D. Benching Slopes: Horizontally bench existing slopes greater than 1: 4 to key placed fill material to slope to provide firm bearing.

E. Stability: Replace damaged or displaced subsoil as specified for fill.

F. Notify Owner of any utility damage at once so emergency measures can be taken. The Contractor will pay for any required repairs.

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

H. Remove and exclude water, including storm water, groundwater, irrigation water, and/or other waters, from all excavations. Dewatering wells, well-points, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level below the bottom of excavations. Water shall be removed and excluded until backfilling is complete and all field soils testing have been completed.

I. Comply with New Mexico state standards and requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

J. Excavation below Fills and Embankments: The subgrade areas beneath embankments shall be excavated to remove not less than the top 1 foot of native material and, where such sub-grade is sloped, the native material shall be benched. After the required excavation or over-excavation has been completed, the top 12 inches of material shall be scarified and moisture added or material dried to optimum moisture and the exposed surface shall be proof rolled.

K. Excavation under areas to be paved shall extend to the bottom of the sub-base. After the required excavation has been completed, the area shall be scarified a minimum of 12 inches below the subgrade surface and recompacted prior to the placement of the sub-base aggregate and/or base course aggregate. The finished sub-grade shall be even, self-draining, and in conformance with the slope of the finished pavement. Areas that could accumulate standing water shall be regraded to provide a self-draining subgrade.

L. Material beyond prescribed lines which is loosened by the Contractor's operations shall be removed, replaced and/or compacted, as directed by the Engineer, at no additional cost to the Owner.

3.4 FILLING

A. See Section 31 23 23 - Backfill.

3.5 DISPOSAL OF EXCAVATED MATERIALS

A. Excess excavated material or excavated material not suitable for backfill may be disposed of on-site, provided that:

1. The finished grade substantially conforms with the Drawings, or any deviation therefrom is approved by the Engineer.

a. Blend with natural terrain.

b. Minimum slope: 2%.

c. Maximum slope: 4:1.

2. All excess excavated material spread on the right-of-way is compacted to the same specifications as final backfill, as set for in Section 31 23 23 - Backfill and the Drawings, and

3. All on-site disposal of material is approved by the Engineer.

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.

D. Re-seed waste material areas in accordance with Section 32 92 19 - Seeding.

3.6 TOLERANCES

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

B. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

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, ASTM D698, AASHTO T180.

C. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D6938.

2. Moisture Tests: ASTM D6938.

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 or in accordance with the NMDOT Standard Specifications for Road and Bridge Construction, 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. The frequency of testing shall be at least once every 400 linear feet of trenching.

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 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
2. Section 31 23 18 - Rock Removal: Removal of rock during excavating.
3. Section 31 23 23 - Backfill: General backfilling.
4. Section 33 11 00 - Water Utility Distribution Piping.

1.2 REFERENCES

A. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):
1. NMSSPWC Sections 701, 801 & 802 "Trenching, Excavation and Backfill".

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

C. American Society for Testing and Materials International (ASTM):
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 D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
16. ASTM D4254 - Minimum Index Density and Unit Weight of Sols and Calculation of Relative Density.
17. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
18. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
19. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
20. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
21. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
22. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
23. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
24. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
25. ASTM D5080 - Rapid Determination of Percent Compaction.
26. 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: Concrete for thrust blocking and valve collars shall have a 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, Ramah Navajo Utility Authority, and any other local utility companies at least three (3) days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Notify Engineer at least five (5) working days prior to commencing work within 100 feet of any designated culturally sensitive area, as shown on Plans. Do not commence work unless barricades are in place and/or archaeological monitor is present, as required. Refer to Section 01 00 00 for site-specific requirements.

C. Identify required lines, levels, contours, and datum locations.

D. Protect plant life, lawns and other features remaining as portion of final landscaping.

E. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Maintain and protect above and below grade utilities indicated to remain.

G. 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. To allow for proper compaction, cut trenches to width indicated on Drawings, providing at least 12 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 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 100 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 500 feet ahead of installed pipe. Whenever local, county, state, tribal 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.

   a. Comply with all stipulations set forth by the Bureau of Indian Affairs for work within their right-of-way and all right-of-way stipulations listed in the grant of easement requirements.

   b. The Owner or land-controlling agencies, at their sole discretion, may require temporary fencing to protect livestock, wildlife and local residents and land users from open trenches. Such fences shall be required in all trenches left open in active livestock grazing areas. Contractor shall provide such fencing, if required, at no additional cost to the Owner.

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. The cost for any dewatering required shall 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.

O. Open trenches and ditches can trap small mammals, amphibians and reptiles and can cause injury to large mammals. Periods of highest activity for many of these species include night time, summer months and wet weather. Loss of wildlife can be minimized by implementing the following recommendations.

1. To minimize the amount of open trenches at any given time, keep trenching and backfilling crews close together.

2. Avoid leaving trenches open overnight. Where trenches cannot be backfilled immediately, escape ramps should be constructed at least every 300 feet. Escape ramps can be short lateral trenches sloping to the surface or wooden planks extending to the surface. The slope should be less than 45 degrees (100%). Trenches that have been left open overnight, especially where endangered species occur, should be inspected and animals removed prior to backfilling.

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 excavated material or excavated material not suitable for backfill may be disposed of on-site, provided that:

1. The finished grade substantially conforms with the Drawings, or any deviation therefrom is approved by the Engineer

a. Blend with natural terrain.

b. Minimum slope: 2%.

c. Maximum slope: 4:1.

2. All excess excavated material spread on the right-of-way is compacted to the same specifications as final backfill, as set forth in Section 31 23 23 - Backfill and the Drawings, and

3. All on-site disposal of material is approved by the Engineer.

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.

D. Re-seed waste material areas in accordance with Section 32 92 19 - Seeding.

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 and/or Explosives to assist rock removal.

B. Related Sections:

1. Section 31 22 13 - Rough Grading.
2. Section 31 23 17 - Trenching: Trenching and backfilling for utilities.
3. Section 31 23 23 - Backfill: Backfill materials.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Rock Removal:

1. Basis of Measurement: By vertical 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. Payment will not be made for over-excavated work nor for replacement materials.
3. Where trench rock removal is required, additional pipe bedding or backfill material will be needed and cost of additional bedding or backfill material is considered incidental to the cost of pipe installation.

1.3 DEFINITIONS

A. Rock is defined as limestone, sandstone, granite or similar rocks/solid mineral material in solid beds or masses in original or stratified position which can be removed only by continuous drilling, blasting or the use of pneumatic tools, and all boulders of 1 cubic yard in volume or larger, that cannot be removed with conventional equipment.
   1. For general excavation, a D-9N Caterpillar tractor with a single shank ripper, or equivalent equipment, is considered conventional equipment, if it can rip at a production rate of at least 300 bank cubic yards per hour.
   2. For trench excavation, a 235C Caterpillar excavator with a medium stick and a rock ripping bucket, or equivalent equipment, is considered conventional equipment, if it can excavate at a production rate of at least 30 bank cubic yards per hour.
   3. Any rock pieces or boulders less than one cubic yard in volume able to be removed with conventional equipment will <u>not</u> be considered as meeting the

definition of rock and will not be applicable for additional payment. Only removal of solid rock using specialized equipment will be paid for.

B. If material cannot be excavated by conventional equipment, the Engineer must be immediately notified. The Contractor shall provide performance tests of the specified conventional or equivalent equipment. If the Engineer confirms in writing that the specified conventional equipment cannot perform at the production rates specified, the excavation shall be considered rock excavation.

1.4 SUBMITTALS

A. Section 01 00 00 - Submittals: Submittal procedures.

B. Shop Drawings: Indicate proposed method of intended rock removal method.

C. Survey Report: Submit survey report on conditions of buildings near locations of rock removal.

1.5 PROJECT CONDITIONS

A. Blasting is not allowed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Explosives are not allowed.

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.

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 ROCK REMOVAL BY EXPLOSIVE METHODS

A. Not allowed.

3.5 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 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 31 22 13 - Rough Grading: Site filling.
2. Section 31 23 17 - Trenching: Backfilling of utility trenches.
3. Section 31 23 18 - Rock Removal.
4. Section 33 11 00 - Water Utility Distribution Piping.

1.2 REFERENCES

A. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):
1. NMSSPWC Sections 701, 801 & 802 "Trenching, Excavation and Backfill".

B. American Association of State Highway and Transportation Officials (AASHTO):
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.

C. American Society for Testing and Materials International (ASTM):
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 (56,000 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 D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
16. ASTM D4254 - Minimum Index Density and Unit Weight of Sols and Calculation of Relative Density.
17. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
18. ASTM D4564 - Density of Soil in Place by the Sleeve Method.
19. ASTM D4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.
20. ASTM D4718 - Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
21. ASTM D4832 - Compressive Strength of Controlled Low Strength Material.
22. ASTM D4914 - Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.
23. ASTM D4959 - Determination of Water (Moisture) Content of Soil by Direct Heating.
24. ASTM D5030 - Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
25. ASTM D5080 - Rapid Determination of Percent Compaction.
26. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Percentage Compaction: Ratio, expressed as percentage, of actual density of material compared with maximum dry density based on Modified Proctor (ASTM D1557).

B. Optimum Moisture Content: Based on Modified Proctor (ASTM D1557).

C. Unified Soil Classification System: Based on ASTM D2487.

1.4 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 on the Bid Form. The following types of materials are defined as suitable where scheduled:

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

Sieve Size	Percentage Passing
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.

Sieve Size	Percentage Passing
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): Crushed rock or gravel with 100 percent passing a 1/2-inch sieve and not more than 3 to 5 percent passing a No. 10 sieve and 1 to 2 percent passing a No. 200 sieve.

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:

Sieve Size	Percentage Passing
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:

Sieve Size	Percentage Passing
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:

Sieve Size	Percentage Passing
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:

Sieve Size	Percentage Passing
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 (zone within 4 inches of the pipe wall in any direction) 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. 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.

   b. 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 (zone more than 4 inches from the pipe wall in any direction) 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. 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. Backfill areas to contours and elevations with unfrozen materials as indicated on the Drawings or as directed by the Engineer.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer.

D. 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.

E. Employ placement method that does not disturb or damage other work.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Slope grade away from building minimum 6 inches in 10 ft, unless noted otherwise.

H. Make gradual grade changes. Blend slope into level areas.

I. 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.

J. 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.

K. Under surfaced or paved roads, driveways or parking areas, apply base course at uppermost layer of backfill to same thickness as existing driving surface, or 6 inches, whichever is greater. If paved, apply pavement patch to thickness equal to or greater than existing pavement.

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. Place a minimum of 4 inches of bedding material in pipe trenches to lines and grades indicated on Drawings or as directed by Engineer and compact before pipe is laid. Grade bedding material parallel to bottom of pipe.

B. Do not place material when either the material or the surface upon which it is to be placed is frozen.

C. 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.

1. Exercise care not to damage pipe or appurtenances when placing embedment material.

2. Maintain optimum moisture content of fill materials to attain required compaction density.

3. Ensure material is placed to equal height on both sides of pipe to avoid unequal loading and possible lateral displacement of the pipe. Elevation difference of embedment between each side of pipe shall not exceed 6 inches.

4. Place material in uniform layers.

5. Work material into pipe haunches to prevent voids and achieve specified compaction under the haunches.

6. 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.

7. Place material to a compacted depth of 12 inches over the top of the pipe, 15 inches of compacted depth over the top of the pipe in paved or traffic areas, and compacted by hand held compacting tools before other backfilling is done.

D. If pipe laying operations are interrupted for more than 24 hours, cover pipe laid in the trench with backfill.

E. When the bottom of the trench is unstable, an additional 4 inches shall be over-excavated and filled with bedding material before pipe is laid.

F. Where rock is present and 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, as directed by the Engineer.

G. When using free-draining crushed rock or gravel for embedment on stretches longer than 300 feet, install trench plugs composed of silty, non-plastic material at 300 foot intervals to impede flow of trench water through the embedment.

H. Under surfaced or paved roads, driveways or parking areas, apply base course at uppermost layer of backfill to same thickness as existing driving surface, or 6 inches, whichever is greater. If paved, apply pavement patch to thickness equal to or greater than existing pavement.

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 Modified Proctor method, ASTM D1557.

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. Over-excavation: Backfill of over-excavation 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 over-excavation backfill may be compacted to 95%.

2. Pipe Bedding Material: Place and compact pipe bedding material as indicated on Drawings for given soil classification, pipe wall thickness, and depth of cover. If native material meets grading requirements and is used, 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 to 95%.

6. Note that all Percent Compaction values in these Technical Specifications and Drawings are based on Modified Proctor, ASTM D1557, unless otherwise noted.

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 D6938.

2. Moisture Tests: ASTM D6938.

D. When tests indicate Work does not meet specified requirements, remove material, replace, compact, and retest.

E. 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.

F. 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. The frequency of testing shall be at least once every 400 linear feet of trenching.

G. 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, at no additional expense to the Owner.

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.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of subsoil.
2. Placing topsoil.
3. Seeding, Hydroseeding, Seed Drilling.
4. Mulching.
5. Maintenance.

B. Related Sections:

1. Section 31 22 13 - Rough Grading: Rough grading of site.
2. Section 31 23 17 - Trenching: Rough grading over cut.
3. Section 31 23 23 - Backfill

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Grassed Areas:

1. Basis of Measurement: By linear foot of pipe trenches.
2. Basis of Payment: Includes preparation of subsoil, topsoil, placing topsoil, seeding, watering and maintenance to specified time limit.

1.3 REFERENCES

A. Federal Specifications:

1. OF-241 - Fertilizers, Mixed, Commercial.

B. ASTM International:

1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

1.4 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

1.5 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, mulch, and other accessories.

1.6 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Perform Work in accordance with Navajo Department of Agriculture requirements, provided within Appendix H of the Contract Documents.

C. Temporary Best Management Practices (BMPs) must be installed along areas where sediment is being transported out of the construction area. Fiber rolls (mulch socks) rip rap blankets, rip rap check dams, soil cement, soil berms, surface roughening, shall be used in these areas.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Product storage and handling requirements shall be as specified in applicable sections of these Specifications and in accordance with recommendations of the supplier.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.8 COORDINATION

A. Section 01 00 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate seeding dates with the Engineer. Final seeding shall occur 4-6 weeks after the last killing frost.

C. Dates of seeding will correspond to the high probability (60 percent or more) of receiving effective precipitation (0.6 to 1.0 inch during any three week period) for seeding establishment.

1.9 MAINTENANCE SERVICE

A. Section 01 00 00 - Execution Requirements: Requirements for maintenance service.

B. The cover will be maintained by occasional mowing, spot spraying, reseeding weak areas, or by controlled burns. Maintain seeded areas for three months from Date of Substantial Completion. Maintenance shall include weekly watering.

C. If after the first full season of growth (not the first year) the cover should be mowed or grazed to control annual weeds to encourage good growth. Timing of mowing should avoid nesting times of birds (Mar-June).

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Furnish materials in accordance with Navajo Department of Agriculture seeding requirements, provided within Appendix H of the Contract Documents.

B. In developing seed mixtures, the percentage of each included species should first be determined. This percentage, which should total 100, is then multiplied by the recommended seeding rate for the concerned species. This will give the required pounds PLS for that species in the mix.

2.2 SOIL MATERIALS

A. Topsoil: Excavated from site and free of weeds.

2.3 ACCESSORIES

A. Mulching Material: Dry oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

C. Erosion Fabric: Jute matting, open weave.

D. Herbicide: If required, Owner and Engineer's approval must be obtained prior to use.

E. Stakes: Softwood lumber, chisel pointed.

F. String: Inorganic fiber.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify prepared soil base is ready to receive the Work of this section.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas. The heel of a boot should not sink in more than ½ to 1 inch.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Topsoil removed from the right-of-way must not be mixed with sagebrush debris which may impede seed germination during the revegetation process.

D. Areas needing reseeding need the top layer of soil softened by ripping and disking prior to seeding to create the soil structure necessary to allow for seed germination.

E. Scarify subsoil to depth of 6 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

A. Spread topsoil to minimum depth of 6 inches over area to be seeded. Rake until smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.4 SEEDING

A. Apply seed at rates specified in 2.1.B of this Section. Rake in lightly and use a light harrow or log chain to drag over area to incorporate seed approximately ½ inch deep.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Planting Season: See 1.8.B of this Section.

D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

E. Immediately following seeding and dragging, apply mulch to thickness of 1/8 inch. Maintain clear of shrubs and trees.

F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.5 HYDROSEEDING

A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at an approved rate evenly in one pass.

B. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

3.6 SEED DRILLING

A. If a seed drill (planter) is used; the specified rates of application should be reduced by one-half of those listed in 2.1.B of this Section.

3.7 SEED PROTECTION

A. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. minimum 6 inches.

B. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36 inch intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

3.8 At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges MAINTENANCE

A. Immediately reseed areas showing bare spots.

B. Repair washouts or gullies.

C. Protect seeded areas with warning signs during maintenance period.

3.9 SCHEDULE

A. All utility routes, disturbed areas, vault areas, and non-traveled areas in road rights-of-way to be reseeded when Work is completed in affected areas.

END OF SECTION

SECTION 33 05 23.16

TRENCHLESS UTILITY INSTALLATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavation for approach trenches and pits.
2. Casing pipe.
3. Carrier pipe.

B. Related Sections:
1. Section 01 00 00 - Basic Requirements
2. Section 01 22 00 - Measurement and Payment
3. Section 31 10 00 - Site Clearing
4. Section 31 23 17 - Trenching
5. Section 31 23 23 - Backfill
6. Section 33 11 00 - Water Utility Distribution Piping.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

1. Basis of Measurement and Payment: By the linear foot.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO M133 - Standard Specification for Preservatives and Pressure Treatment Processes for Timber.
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.

B. ASTM International:
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 A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
4. ASTM A449 - Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated 120/105/90 ksi minimum tensile strength General Use.
5. 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.
6. ASTM C33 - Standard Specification for Concrete Aggregates.

7. ASTM C150 - Standard Specification for Portland Cement.
8. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
9. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
10. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3).
11. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
12. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. American Wood-Preservers' Association:
1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
2. AWPA C3 - Piles - Preservative Treatment by Pressure Process.

D. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

E. National Utility Contractors Association:
1. NUCA - Pipe Jacking & Microtunneling Design Guide.
2. NUCA - Trenchless Excavation Construction Equipment & Methods Manual.

1.4 DESIGN REQUIREMENTS

A. Design bracing, backstops, and use jacks of sufficient rating for continuous jacking without stoppage, except for adding pipe sections and as conditions permit, to minimize tendency of ground material to "freeze" around casing pipe.

1.5 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Installation Plan: Submit description of proposed construction plan, dewatering plan, and plan to establish and maintain vertical and horizontal alignment. Contractor shall provide the Engineer the make and model of the machine to be used for the work.

C. Submit emergency response procedures to handle situations when conduit is compromised and jeopardizes integrity of installation or safety.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of casing, carrier pipe, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with applicable New Mexico state standards, NUCA Trenchless Excavation Construction Equipment & Methods Manual, NUCA Pipe Jacking & Microtunneling Design Guide, AREMA guidelines.

B. When boring, jacking or tunneling under BIA Route 114, follow permit requirements included in the Appendix of the contract documents.

1.8 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.
   1. Work Experience: Include projects of similar magnitude and conditions.
   2. Furnish list of references upon request.

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 00 00 - Administrative Requirements: Pre-Construction Conference.

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 delivering, handling, storing, and protecting products.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping system pieces from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.

D. Accept system components on site in manufacturer's original containers or configuration. Inspect for damage.

E. Use wooden shipping braces between layers of stacked pipe. Stack piping lengths no more than 3 layers high.

F. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature of 60 to 85 degrees F.

G. Support casing and carrier 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.

1.12 FIELD MEASUREMENTS

A. Verify invert elevations prior to excavation and installation of casing.

1.13 COORDINATION

A. Section 01 00 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate work with NTUA, NN, and utilities within construction area.

PART 2 PRODUCTS

2.1 CASING AND JACKING PIPE MATERIALS

A. 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.
1. Welding: Per AWS D1.1.
2. Dimensions in accordance with AWWA C208.

2.2 CARRIER PIPE MATERIALS

A. Water Utility Distribution System Piping: As specified in Section 33 11 00.

2.3 COVER MATERIALS

A. Soil Backfill for Trench Approaches and Pits to Finish Grade: Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.4 ACCESSORIES

A. Pipe Casing End Seals (Pipeline Seal Insulator or Approved Equal): Seamless, vulcanized edge, pull-on casing end seals composed of a minimum 1/8" thick 60 durometer synthetic neoprene rubber. Includes ½" wide T304 stainless steel bandings with 100% non-magnetic worm gear mechanism.

B. Pipe Casing Spacers (PSI Ranger II Mini or Approved Equal): 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. 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 connection to existing piping system size, location, and invert elevations are in accordance with Drawings.

3.2 PREPARATION

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

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 CASING PIPE INSTALLATION

A. No work or significant surface disturbance is allowed within BIA right-of-way limits. All work to be performed outside of the BIA Route 114 right-of-way limits, as shown in the plans. Surface shall be repaired to pre-construction conditions following completion of all work, as specified in the BIA road crossing permit.

1. Boring:
   a. Push pipe into ground with boring auger rotating within pipe to remove spoil. Do not advance cutting head ahead of casing pipe except for distance necessary to permit cutting teeth to cut clearance for pipe. Arrange machine bore and cutting head to be removable from within pipe. Arrange face of cutting head to provide barrier to free flow of soft material.
   b. When unstable soil is encountered during boring retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.
   c. When voids develop greater than outside diameter of pipe by approximately one inch, grout to fill voids.
   d. When boring is obstructed, relocate, jack, or tunnel as directed by Engineer.
2. Jacking
   a. Construct adequate thrust wall normal to proposed line of thrust.
   b. Impart thrust load to pipe through suitable thrust ring sufficiently rigid to ensure uniform distribution of thrust load on full pipe circumference.

3.7 PRESSURE GROUTING

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

3.8 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.

3.9 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.

3.10 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.

3.11 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.

3.12 REMOVAL OF FACILITIES AND CONTROLS

A. Remove temporary facilities for casing installation and jacking 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, valves and fittings for public line including potable water line.
2. Underground and Aboveground Pipe Markers.
3. Bedding and Cover Materials.

B. Related Sections:

1. Section 31 23 17 - Trenching: Execution requirements for trenching.
2. Section 31 23 23 - Backfill: Requirements for backfill to be placed.
3. Section 33 05 23.16 - Trenchless Utility Installation: Boring, jacking and tunneling conduits for waterline installation under roadways and other obstructions.
4. Section 33 12 13 - Water Service Connections
5. Section 33 12 16 - Water Utility Distribution Valves.
6. 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 trenching, hand trimming excavation, piping and fittings, all valves and appurtenances not listed separately on the Bid Form, bedding, backfill, compaction, tracer wire, detectable warning tape, above ground pipe marker posts, concrete thrust restraints (where applicable), mechanical joint restraints, connection to public utility water source (if not separately listed on Bid Form). Soil cement, if used, shall be considered incidental to the cost of the pipe installation.
3. The cost of laboratory testing for water quality bacterial testing, material testing and the cost of compaction testing shall be reimbursed to the Contractor, upon submittal of invoices from laboratory/testing company using testing allowance bid item. Work performed by Contractor related to such testing shall not be reimbursable from testing allowance, but is covered by separate bid item. Work shall be coordinated and directed by Engineer. Contractor shall pay for all failed tests.
4. The cost of work by the Contractor associated with hydrostatic pressure testing, material testing, etc. is covered by a specific bid item. Work shall be coordinated and directed by Engineer.

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 A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   5. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   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 D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
   9. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
   10. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
   11. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. American Water Works Association (AWWA):
   1. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. (76 mm through 1,219 mm), for Water.
   2. AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   3. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   4. 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.
   5. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
   6. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.

7. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In. (100 mm through 3,600 mm).
8. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
9. AWWA C209 - Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
10. AWWA C605 - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
11. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution.

E. Manufacturer's Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

F. National Sanitation Foundation (NSF):

1. NSF-14 - Plastics Piping System Components and Related Materials
2. NSF-61 - Drinking Water System Components-Health Effects

G. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):

1. NMSSPWC Sections 701, 801 & 802 "Trenching, Excavation and Backfill".

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. In addition to the submittal requirements listed above, Contractor shall also submit:

1. Joint restraint table for all types of restrained joints to be used for the project based on the manufacturer's specifications and calculations.
2. Shop drawings for all custom-fabricated steel fittings which clearly show compliance with AWWA M11, AWWA C207 and AWWA C208. Include design calculations, as applicable.
3. Submittal for all coatings which demonstrate compliance with relevant AWWA standards.
4. As-built survey data. Refer to Sections 01 00 00 – Basic Requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Refer to Sections 01 00 00 – Basic Requirements.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with applicable New Mexico Standards, standards and specifications of the Navajo Tribal Utility Authority (Navajo Area Standards and Construction Requirements, Technical Specifications for Materials and Workmanship for Water and Wastewater Facilities), whichever is most stringent.

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 PVC materials out of sunlight.

E. 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):

1. Pipe: 4" diameter and greater - AWWA C900, with Dimension Ratio (DR) as indicated on the Drawings or on the Bid Form. Nominal laying length of 20 feet.

2. Pipe: 2" diameter – ASTM D2241 Class 200 SDR 21 PVC, IPS, gasketed.

3. Gaskets:

a. Use rubber gaskets manufactured and tested in accordance with ASTM F477.

b. For all PVC casings at petroleum line crossings or where otherwise indicated on Drawings, use petroleum-resistant gaskets in accordance with ASTM F477.

1. Fittings:

a. 2" diameter and greater - Ductile iron, American-made on all PVC pipe

b. Compact MJ fittings conforming to AWWA C153 or C110, unless otherwise noted on Drawings.

c. Flanged fittings shall conform to AWWA C110. Do not use flanged fittings for buried installations unless otherwise noted on the Drawings.

1) Contractor responsible to ensure that all mating flanges have compatible diameters, bolt sizes and drill patterns. Over drill bolt holes as necessary, provided such over drilling is within manufacturer's recommended tolerances.

d. Working pressure rating of fittings and gaskets shall be at least 250 psi, unless otherwise noted on the Drawings.

e. Marked with pressure rating, nominal diameter of opening, manufacturers' identification, country where cast, and degree of bend.

f. All exposed interior and exterior surfaces shall be coated with fusion-bonded epoxy in accordance with AWWA C116.

g. Joint restraints: EBBA Iron Mega-Lug, or approved equal.

h. No glue fittings allowed.

i. Provide adaptors as needed.

2. Joints: Mechanical conforming to ANSI/AWWA C111/A21.11, American-made. Solvent-cement couplings are not permitted on pipe 1-1/2" diameter and greater.

3. Joint Restraints: American-made, mechanical joint restraints for all fittings and appurtenances. Mechanical joint restraints shall be:

a. "EBAA Iron, Series 3800", or approved equal, for all pipe 4" diameter and greater.

b. "EBAA Iron, Series 6500 and 7500", or approved equal, for 2" diameter,

c. Installation and spacing as per manufacturer's specifications. Spacing provided on plans are only a guide.

d. Fusion bonded epoxy coating in accordance with AWWA C116, EBAA Iron Mega-Bond, or approved equal.

B. Steel/Galvanize Pipe and Fittings:

1. Pipe fabrication:

a. Arc-welded spiral seam steel pipe: ASTM A139, Grade B, C, D or E.

b. Fabricated in accordance with AWWA C200, except:
1) Steel plate: ASTM A283, Grade C or D, or ASTM A36.
2) Steel sheet: ASTM A1011, Designation SS, Grade 40, 45 or 50; or ASTM A1018, Designation SS, Grade 40.

c. Wall thickness as shown on Drawings, or as needed to provide required working pressure.

2. Fittings and Special Sections:

a. Steel for fittings: ASTM A283, Grade C or D, or ASTM A36.

b. Welding: Per AWS D1.1. All welding must be completed prior to application of lining and coatings, unless otherwise permitted by the Engineer. In no case shall any welding damage lining or coatings.

c. Joints between steel fittings and PVC pipe: Rubber gaskets in accordance with AWWA C219. Joint dimensions and tolerances to match those of PVC pipe manufacturer's joint design.

d. Dimensions in accordance with AWWA C208.

e. Custom fabricated fittings shall be designed and fabricated in accordance with AWWA M11, with outlet reinforcements per AWWA M11. All other standards and specifications for steel, welds, coatings, flanges and dimensions of component fittings provided herein shall apply equally to custom fabricated fittings.

f. No custom-made fittings shall be used without prior written approval by the Engineer.

3. Field Coatings:

a. Exterior surfaces of all buried steel pipe and fittings shall include cold-applied tape coating, manufactured and installed in accordance with AWWA C209, applied with a minimum overlap width of 1-inch and a total coating thickness shall be a minimum of 80 mils. Such tape coating shall be applied in addition to fusion-bonded epoxy coatings specified above.

4. Flanges:

a. Steel: ANSI Class 150 / AWWA C207 Class E / ASME B16.5 Class 150, unless otherwise noted on Drawings.

b. Ductile or Cast Iron: ANSI Class 125 / AWWA C207 Class E / ASME B16.1 Class 125, unless otherwise noted on Drawings.

c. Pressure rating of flanges and gaskets shall meet or exceed surge pressure rating of attached pipe.

d. Coatings and linings shall be continuous to the ends of pipe and backs of flanges.

e. Do not apply coatings to mating surfaces of flanges.

f. Gaskets shall be full-face, AWWA C207 Type E with outer diameter equal to that of the flange.

g. Retainers shall be fabricated of phenolic or other suitable material as recommended by manufacturer and conforming to NSF 61, with minimum thickness of 1/8 inch and minimum dielectric strength of 500 volts/mil.

h. Nitrile sealing rings.

i. All bolts shall have isolating sleeves: Sleeves shall be full length, extending halfway into both steel washers when installed, with tube thickness of 1/32-inch. Sleeves shall be composed of mylar or other suitable material recommended by flange manufacturer.

j. Steel washers shall be 1/8-inch thick, with inner diameter sufficient to fit over bolt isolating sleeve.

k. Isolating washers shall be 1/8-inch thick, with inner diameter sufficient to fit over bolt isolating sleeve, composed of phenolic or other suitable material with minimum dielectric strength of 500 volts/mil as recommended by flange manufacturer.

l. Bolts and nuts shall be carbon steel, in accordance with AWWA C207 and ASTM A307, Grade B. Bolt shall be long enough to protrude through the assembled nut at least two threads but not more than ½-inch.

m. Contractor is responsible to ensure that all pipe flanges that connect to valve body flanges have the same dimensions, drill pattern, bolt hole diameter and equal or higher pressure rating as the valves to which they are connected.
   1) Overdrill bolt holes as necessary, provided such overdrlling is within manufacturer's recommended tolerances.

n. Contractor shall be responsible to verify compatibility of all flange bolt patterns prior to purchasing materials and shall notify the Engineer in the event that alternate bolt patterns are required to mate flanges.

C. Brass Nipples/Fittings:
   a. Brass threaded nipples and fittings shall conform to ASTM B 43, regular wall thickness.
      1) Threads shall conform to ANSI B1.20. 1.
   b. Pipe fittings must comply with requirements for "lead free".
   c. Brass nipples as per ASTM B687
   d. Fittings as per ASME/ANSI B16

2.2 UNDERGROUND PIPE MARKERS

A. Tracer Wire: 12 AWG, Solid Copper, Single Conductor, 600V, UF-XHHW wire or equal, for underground installation.

B. Splice Connectors: Model LV 9500 Blazing Snap-locking waterproof connectors pre-filled with silicone or engineer approved equal.

C. Plastic Ribbon Tape: Bright colored, metallized for detection by above-ground metal detector, continuously printed, minimum 6 inches wide by 4-mil thick, manufactured for direct burial service, imprinted with "BURIED WATER SERVICE" 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.

2.3 ABOVEGROUND PIPE MARKERS

A. Carsonite marker posts, blue in color. Place markers as specified on the Drawings.

2.4 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.

2.5 BEDDING AND BACKFILL MATERIALS

A. As specified in Section 31 23 23.

2.6 ACCESSORIES

A. Concrete for collars: Conform to Section 03 30 00 with minimum compressive strength of 3,000 psi.

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

C. Field-applied Roskote coal tar epoxy coating on all buried steel bolts on all fittings and valves.

2.7 SOURCE QUALITY CONTROL

A. Pipe:

1. Polyvinyl chloride (PVC): Factory test in accordance with AWWA C900.

B. Fittings:

1. Ductile iron (DI): Factory test in accordance with AWWA C153, AWWA C110, and AWWA C114, as applicable.

C. Cure testing for fusion bonded or liquid epoxy coatings: ASTM D4752 and ASTM D3363, Every 1000 sq.ft. of epoxy coating.

2.8 SOURCE QUALITY ASSURANCE

A. Acceptance of materials will be based on compliance with relevant AWWA, ASTM and other relevant standards. Materials must pass all relevant tests prior to acceptance.

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 and location are as indicated on Drawings.

3.2 PREPARATION

A. Pre-Construction Site Documentation:

1. Prior to beginning construction, take photographs or videotape along centerline of proposed pipe trench; minimum one photograph for each 200 feet of pipe trench. The photos or video must include coverage of all areas and adjacent features that may potentially be impacted by the impending construction work.

2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing site features.

3. Include project description, date taken and sequential number on back of each photograph.

4. Contractor must submit two (2) copies of the video documentation on DVD format as part of the submittal process.

B. Clearly stake centerline and boundaries of rights-of-way prior to commencing construction activities.

C. 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.

D. Remove scale and dirt on inside and outside before assembly.

E. Prepare pipe connections to equipment with flanges or unions.

F. 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 TRENCHING

A. In accordance with Section 31 23 17 - Trenching

3.4 BEDDING

A. In accordance with Section 31 23 23 - Backfill

3.5 INSTALLATION – PIPE

A. Install PVC pipe in accordance with AWWA C605.

1. Use only lubricants supplied by the pipe manufacturer and apply to both bell and spigot ends of the joint, in accordance with manufacturer's recommendations.

2. Clean the gasket, bell, groove and spigot immediately prior to connecting pipe joints.

3. Do not over-insert pipe joints. Any over-inserted pipe joints shall be removed and the pipe bell and gasket inspected for damage. Any damaged bells or gaskets shall be discarded and replaced.

B. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings. Inspect each pipe and fitting prior to lowering into trench to ensure there is no damage to the pipe, fitting or coatings. Repair any damage prior to installation. Clean ends of pipe and remove foreign material from inside of pipe and fittings.

C. For jointed pipe, excavate bell holes in the bottom of the trench to prevent the bell from coming into contact with the sub-grade.

D. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of Roskote coal tar epoxy coating before backfilling. All exposed bolt heads and threads shall be thoroughly coated.

E. Maintain 10 ft horizontal separation of water main from sewer piping in accordance with local code.

F. Centering and straightness of pipe:

1. Lay PVC pipe in straight line and center pipe within trench. Re-lay pipe that is out of alignment.

2. Ensure that adequate side clearance is provided on both sides of the pipe to allow for placement of soil cement slurry or placement and compaction of embedment material, and to eliminate voids in the pipe haunch area. In the event that minimum side clearances are not met and/or Contractor is unable to achieve required embedment specifications, the Contractor shall either straighten out the pipe and/or widen the trench as necessary to meet embedment specifications at no additional cost to the Owner.

G. Horizontal and vertical pipe bending, angles and joint deflections

1. All mitered bend elbows shall be one of the following standard angles: 11.25, 22.5, 45, 60 or 90 degrees. No other mitered bend angles shall be allowed.

2. PVC pipe deflections shall be minimized as much as possible but may be made either at joints or by pipe bending, as allowed by AWWA C605.

   a. Pipe bending shall be minimized, but allowed, provided that such bending complies with AWWA C605 and/or pipe manufacturer's minimum allowable bending radius, whichever is more stringent. Lateral pipe bending force shall be isolated from the fitting.

   b. Joint deflection shall not exceed 1 degree per joint.

H. Horizontal and vertical pipe line and grade

1. The horizontal and vertical lines and grades shown on the Drawings indicate the intent of the design. Actual horizontal and vertical lines and grades in the field may deviate from those shown on the Drawings, provided all of the following conditions are met:

   a. Actual minimum slope of pipe shall not be less than 0.00100 ft/ft.

   b. Direction of pipe slope shall not differ from that shown on Drawings.

   c. Minimum pipe cover of 4 feet shall be maintained throughout the project.

   d. Additional minimum cover or specific minimum vertical clearances called out on the Drawings at specific locations, such as wash crossings, road crossings or pipeline crossings, shall be maintained.

   e. In certain locations, the pipe elevation and/or slope must remain as shown on drawings to facilitate pipe draining, maintain pressures, or other performance criteria. In such cases, deviation from the Drawings may not be allowed.

   f. All vertical deviations more than 6 inches and horizontal deviations more than 1 foot from the alignments shown in the Drawings must be documented by the Contractor and approved in advance by the Engineer.

   g. All other specifications shall be met.

   h. Any exceptions to the foregoing conditions must receive prior written approval by the Engineer.

2. No high points of any magnitude shall be allowed in the pipe without an approved air valve. If unforeseen field conditions arise which necessitate high points not

shown on the Drawings, increase pipe bury depth or install additional air valves, as directed by Engineer.

a. Additional air valves required due to unforeseen field conditions not the fault of the Contractor shall be paid for at the prices established in the Bid.

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. This includes failure of Contractor to meet lines and grades set forth in the Drawings or failure to meet minimum pipe slope.

I. Install pipe to bear on the trench bottom along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench. Direction of pipe bells may be reversed for ease of installation, provided that all pipe material and installation meets applicable AWWA, ASTM, NTUA and material manufacturer's standards.

1. On grades greater than 10%, install jointed pipe uphill.

J. Do not allow trench water, dirt, debris or other foreign material to enter the pipe during or after installation.

1. Keep pipe ends sealed after joining pipes.

2. Close pipe openings with watertight plugs during work stoppages.

3. 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.
   a. Continuity of tracer wire shall be tested periodically as indicated by Engineer, and prior to final acceptance of work.
   b. Any segment of tracer wire that fails the continuity test shall be repaired or replaced by Contractor at no additional cost to Owner.
   c. Expose tracer wire at every surface penetration (i.e. valves, hydrants, vaults, etc.).
   d. Protect wire ends with wire caps and protect from corrosion.
   e. 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.
   f. For air valves, coil excess wire inside valve can.
   g. For gate valves, tape tracer wire to outside of valve box up to last section of box and bring tracer wire into the valve box above the operating nut.

K. Install detectable plastic ribbon tape continuous over top of pipe, buried 18 inches above pipe; coordinate with Section 31 23 17 and 31 23 23.

L. Mechanical joint restraints (Mega-Lug, OAE) shall be used to prevent joint/pipe movements. Concrete thrust blocks may be used in addition to the mechanical joint restraints, but such use shall not relieve the Contractor of responsibility to mechanical joint restraints as specified and as shown on the Detail Drawings.

M. Flanged Joints: Do not use flanges in buried applications unless shown on Drawings.

N. All pipes, fittings and appurtenances must remain within designated permanent rights-of-way. All construction activities must remain within the right-of-way or temporary use areas. Do not encroach on adjacent properties or culturally sensitive areas.

O. Embed pipe within 100 feet behind pipe-laying operations, unless otherwise permitted by the Engineer.

P. Install aboveground utility markers as specified on the Drawings.

3.6 THRUST RESTRAINT

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 restrained fittings in accordance with Drawings and in accordance with manufacturer's instruction.

C. All thrust blocks, if used in addition to mechanical joint restraints, shall bear against undisturbed earth.

3.7 BACKFILLING

A. In accordance with Section 31 23 23.

3.8 PIPELINE RIGHT-OF-WAY GRADING

A. Establish finished grade to provide a minimum of four (4) foot of cover over the pipe. Measure depth of cover from final surface grade to top of pipe barrel.

1. At certain locations such as wash crossings, road crossings, utility line crossings or to prevent high points, the Drawings indicate greater than 4 ft minimum cover. At such locations, Contractor shall maintain the site-specific minimum cover.

B. Do not place fill material or raise the finished grade above existing grade in the flow lines of washes or surface water drainages, regardless of size.

C. Finished grade along pipeline right-of-way and temporary use area shall have a maximum longitudinal slope of 3:1 and maximum side slope of 3:1.

D. The pipeline right-of-way shall be leveled from side-to-side to slow down surface run-off from causing erosion rills perpendicular to the pipeline, as well as to make the ROW accessible to the Owner for future maintenance.

1. The entire right-of-way shall be re-seeded and reclaimed after construction. Do not build any new roads. Refer to Section 32 92 19 – Seeding for re-seeding requirements.

2. The right-of-way shall not be open to the general public and shall have minimal impact on the environment. Upon completion of construction, the right-of-way shall be reclaimed to visually blend in with the surrounding environment and minimize its visual impact.

E. All construction activities, including clearing and grading, must remain within the designated right-of-way and temporary use area. Do not encroach on adjacent properties or culturally sensitive areas.

3.9 TAPPING EXISTING WATER DISTRIBUTION FACILITIES

A. Obtain permission to tap from the Ramah Navajo Utility Authority (RNUA). A blank Permission to Tap application form is provided in the appendix. Contractor shall not connect to existing system without written permission from RNUA and the Engineer to proceed with connection to the existing system.

B. Coordinate with RNUA's designated representative regarding schedule, means and methods, maximum allowable shut-off time, water usage rates (both gpm and gpd) and other parameters stipulated by RNUA.

C. Perform all work in conformance with the tapping permit and all written and verbal instructions from RNUA personnel, including notification and coordination with RNUA, maximum water usage rates, time and duration of shut-offs, and disinfection requirements.

D. Minimize shut-off time during connections to existing facilities. Contractor shall have all tools and materials for actual field conditions as well as foreseeable problems on hand in order to minimize shut-off time.

E. Taps on existing RNUA pipelines shall be by restrained cut-in tees, with RNUA's approval.

F. Prevent contamination of existing facilities with trench water, mud, debris, chemicals or other substances.

3.10 INITIAL FILLING OF PIPELINE

A. "Initial filling" refers to first introduction of water and evacuation of air in the pipeline.

B. Initial filling of pipeline shall not exceed maximum instantaneous flow rate (in gpm) or maximum daily fill rate (in gpd) set forth by RNUA and the Engineer in the field.

3.11 DISINFECTION OF POTABLE WATER PIPING SYSTEM

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

3.12 FIELD QUALITY CONTROL

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

B. The Contractor shall be required to hydrostatic pressure test all water mains, appurtenances and plumbing trains.

1. Perform testing in accordance with applicable standards:

   a. PVC pipe: AWWA C605

2. Hydrostatic pressure testing of main line shall be performed in sections between each pair of adjacent gate valves.

   a. Contractor shall fill and test each section as it is constructed, in order to detect leak problems with each section before the remainder of the pipeline installed.

3. Hydrostatic pressure shall be equal to the working pressure rating of the pipe (i.e. 150 psi for C900 DR 18, 200 psi for C900 DR 14, etc.) at the lowest point in the line section being tested. 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.

a. The Engineer shall provide a testing schedule to the Contractor.
   1) Additional testing access points may be required to be installed by the Contractor, as directed by the Engineer, and such work shall be considered incidental to construction of the pipeline and no additional compensation will be provided.

b. In no case shall the test pressure exceed the manufacturers' recommended maximum safe test pressure for the pipe, fittings or appurtenances.

c. Pressure shall be maintained for time period stipulated in relevant AWWA standard for each pipe material.

d. No observable leakage is allowed. Measurable leakage must be within the maximum allowable limits set forth by applicable AWWA standards.

e. 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.

4. Pressure testing with air shall not be allowed.

C. Compaction Testing: Refer to Section 31 23 23 – Backfill.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Owner.

3.13 TOLERANCES

A. Line and grade surveying tolerances:

1. Contractor shall follow installation instructions presented herein, including maintenance of horizontal and vertical pipe line and grade as shown in the Drawings.

2. All vertical deviations more than 6 inches and horizontal deviations more than 1 foot from the alignments shown in the Drawings shall be approved in advance by the Engineer and shall be documented by the Contractor and shown with the record as-built drawings.

B. Flange alignment tolerances as specified in AWWA C207 and AWWA M11.

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 31 23 17 - Trenching.
3. Section 31 23 23 - Backfill.
4. Section 33 11 00 - Water Utility Distribution Piping.
5. 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 and service line assembly: Regular or tapped tee, corporation stop assembly, and all associated fittings from corporation stop to meter, curb stop assembly, radio read meter, meter box, meter setting and radio read equipment, fittings and accessories, backflow preventer, pressure reducing valve (if required), connection to service line from home, connection to existing home service line from cistern system, excavation, bedding, backfill, pressure testing and disinfection.

B. Service Line:

1. Basis of Measurement: By the linear foot.
2. Basis of Payment: Includes service line pipe, excavation, bedding, backfill, pressure testing and disinfection.

1.3 REFERENCES

A. Navajo Area Standards and Construction Requirements, Technical Specifications for Materials and Workmanship for Water and Wastewater Facilities, 2013 edition.

B. New Mexico Standard Specification for Pubic 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.

C. 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.

D. 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.

E. American Society of Sanitary Engineering (AMSE):

1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

F. 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).

G. American Water Works Association (AWWA):

1. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
2. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
3. AWWA C800 - Underground Service Line Valves and Fittings.
4. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
5. 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, radio read meters, meter setting and reading 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 applicable New Mexico Standards, standards and specifications of the Navajo Tribal Utility Authority (Navajo Area Standards and Construction Requirements, Technical Specifications for Materials and Workmanship for Water and Wastewater Facilities), whichever is most stringent.

B. All piping, fittings, valves, and any other service connection appurtenances shall comply with the "Reduction of Lead in Drinking Water Act", in effect as of 2014, or any subsequent revision thereof.

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 PIPE

A. Manufacturer

1. Driscopipe 5100 Ultra-line
2. Yardley Ultra-high Molecular Weight PE
3. Approved Equal

B. Polyethylene Pipe

1. 1-inch diameter, max 200 feet length
2. Conforming to ASTM D-2239, SIDR 7, 200 psi pressure rating:
3. Produced from a high density ultra-high molecular weight PE pipe compound, PE 3406 or PE 3408 which conforms to the latest revision of ASTM D-1248.
4. Designation PE 3406 or PE 3408 shall be stamped on the pipe.

2.2 WATER PIPE FITTINGS

A. Manufacturer

1. Mueller Insta-Tite (Model H-15426).
2. Approved Equal

B. Fittings

1. Conforming to ASTM D-2239.
2. Made with non-flare compression connections.
3. All threaded connections from the water main to and including the inlet of the domestic stop shall be standard iron pipe (I.P.) threads.

2.3 CORPORATION STOP ASSEMBLY

A. Manufacturer

1. Mueller (Model H-10046)

2. Ford (Type FB1700)
3. Approved Equal

B. Corporation Stops:

1. Shall be bronze alloy with MIP threads inlet by FIP threads outlet.

2.4 CURB STOPS

A. Manufacturer

1. Mueller Model B-10287
2. Ford B11-444M
3. Approved Equal

B. Curb Stops (1-inch):

1. Bronze alloy with tee head
2. Quarter turn check, FIPT x FIPT end connections.
3. Minneapolis pattern top threads.
4. Resilient O-Ring seals.

2.5 CURB STOP BOXES, RODS AND COVERS

A. Curb stop box:

1. Cast iron body, Extension Type
2. 1 ½ inch x 54 inch
3. Minneapolis pattern 2-inch base x 1 ½-inch Bushing.
   a. Mueller (Model H-10302)
   b. Ford (Type PXL)
   c. Approved Equal

B. Rod:

1. Secured to curb stop with cotter pin,
2. Sized to extend 2 to 4-inches below the top of the curb box.

C. Lid:

a. Cast iron
b. Inscription "WATER".
c. Shall have a countersunk brass Pentagon Head Plug.
d. Finished elevation of plug shall be such that it extends just slightly above the ground surface.
e. Mueller (Part # 89980) or Approved Equal

D. Collar:

1. Size per plans and made with reinforced concrete.
2. Poured around each curb box.
3. Place two #4 rebar each way on center (4 total).

2.6 DOMESTIC STOP ASSEMBLY

A. Per detail in plans

B. Rod:

1. Secured to curb stop with cotter pin,
2. Sized to extend ½"-inch above the top of riser pipe when plug removed to allow valve to be easily turned on and off in emergency with regular hand tools (i.e. hand wrench/pliers)

2.7 METER SETTING EQUIPMENT

A. Manufacturer

1. Ford (No. VBHH72-12W-FF-44-NL) with drain/test valve - for use without PRV
2. Ford (No. TVHH72-12W-FF-44-NL) with drain/test valve - Tandem Style for use with PRV
3. Approved Equal

B. Outside meter setting for residential meter assemblies:

1. 3/4-inch I.D. x 12-inch high setter.
2. 1-inch FIPT end connectors for 5/8" x ¾" meter.
3. Ball valve with padlock wing angle on the inlet.
4. 1-inch iron pipe union nut/swivel assembly connection.
5. Yokes shall have an eye for the insertion of a cross brace.
6. Cross brace shall be # 4 rebar.
7. The tandem coppersetter (where necessary) shall have an "S" tube with two bronze adapters, iron thread by meter nut, for the pressure regulators.

2.8 RESIDENTIAL WATER METERS

A. Radio read water meter:

1. Manufacturers:
   a. Badger Meter Model M25 – 5/8", 5/8" x ¾"
   b. Substitutions: Not allowed
2. *Recordall* Disc Meter
3. Lead-Free Bronze Alloy
4. Case shall be electronic encoder register with an attached EA Water Module (AMI ready)
5. Shall include module for AMI metering technology

2.9 COMMERCIAL WATER METERS

A. Radio read water meter:
   1. Manufacturers:
      a. EVO Q4 Electromagnetic
      b. Substitutions: Not allowed
   2. Contractor shall coordinate submittals on flow meter, AMI/AMR module, and appurtenant equipment with Engineer and RNUA, and receive Engineer's approval prior to ordering materials.

B. Provide encoder module for AMR/AMI interface and radio:
   1. Provide battery powered radio for connection to encoder module.
   2. 10-year minimum battery life.

2.10 PRESSURE REDUCING VALVES

A. Manufacturers
   1. Watts Industries Series 25AUB
   2. Wilkins Model 600
   3. Approved Equal

B. 3/4 inch FIPT

C. Note no PRV's are anticipated to be required for the project but actual water pressure shall be field verified at each meter. Pressure reducing valves shall be installed on services over 70 psi, as directed in the field by the Engineer.

2.11 METER CANS:

A. Double Lid Meter Cover/Frame with Frost Lid
   1. For 20 inch diameter meter can, 11 ½ inch minimum lid opening
   2. Hole in top of lid for meter reading equipment
   3. Manufacturer:
      a. Castings Inc. Model CI7020
      b. Approved Equal

B. Plastic Meter Inner Lid
   1. Finish – Plastic Opaque
   2. Shall accommodate EA Module (#W3BPD Style)
   3. Manufacturer:
      a. Castings Inc. Model INLP3
      b. Approved Equal

C. Meter Can/Pit:
   1. 20" Diameter x 36" Height
   2. Heavy Duty rated
   3. Manufacturer:
      a. DFW – 2036H

b. Approved Equal

D. Meter can and meter vault specifications:

1. Meter can shall be extended a minimum of 1-inch below the service line.
2. Maximum wall deflection shall not exceed $^1/_8$" at any one point when subtracted from earth pressures or forces created during backfilling.
3. A 3" x 3" pipe hole shall be located at the bottom ends of the can.
4. The walls inside and outside of the can shall be reasonably smooth and free of burrs.
5. Cover of the meter can or vault must have a non-skid surface and have "WATER METER" inscribed on the top.
6. The 11½" minimum diameter frost lid (plastic) and outer entrance lid (cast iron) shall be centered in the meter can.
7. Outer lid shall have a pentagon head worm type lock.

2.12 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.

B. Tracer Wire: 12 AWG, Solid Copper, Single Conductor, 600V, UF-XHHW wire or equal, for underground installation.

C. Splice Connectors: Model LV 9500 Blazing Snap-locking waterproof connectors pre-filled with silicone or engineer approved equal.

D. Plastic Ribbon Tape: Bright colored, metallized for detection by above-ground metal detector, continuously printed, minimum 6 inches wide by 4-mil thick, manufactured for direct burial service, imprinted with "BURIED WATER SERVICE" 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.

2.13 ABOVEGROUND PIPE MARKERS

A. Carsonite marker posts, blue in color.

B. Place markers as specified on the Drawings.

2.14 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.

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. Route pipe in straight line, as much as possible. Do not crimp polyethylene pipe during installation or at any other time.

B. Install pipe to allow for expansion and contraction without stressing pipe or joints.

C. Establish elevations of buried service line piping with not less than 42" 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.

D. Backfill trench in accordance with Section 31 23 23.

3.6 INSTALLATION - CURB STOP ASSEMBLY

A. Set curb stops on solid bearing.

B. Center and plumb curb box over curb stops. Set box cover flush with finished grade.

3.7 INSTALLATION - WATER METERS

A. Install positive displacement meters in accordance with AWWA M6, and the following sections of the New Mexico Standard Specifications for Public Works Construction (NMSSPWC), in total or in part, except where amended by these Technical Specifications.

1. Section 801 - Installation of Water Transmission, Collector, and Distribution Lines.

2. Section 802 - Installation of Water Service Lines.

3.8 INSTALLATION - BACKFLOW PREVENTERS

A. Install backflow preventer where indicated on the Contract Drawings and in accordance with manufacturer's instructions.

B. Comply with local water company requirements and plumbing codes in regards to testing and installation requirements.

3.9 SERVICE CONNECTIONS

A. Install water service in accordance with utility company requirements with double check valve backflow preventer and water meter in meter box.

B. Connect water meter assembly to existing 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.

3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

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

3.11 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. The frequency of testing shall be at least once for each service line trench.

END OF SECTION

SECTION 33 12 16

WATER UTILITY DISTRIBUTION VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gate Valves
2. Combination Air Valves.
3. Flush Valve Assemblies.
4. Valve boxes.

B. Related Sections:

1. Section 01 00 00 - Basic Requirements
2. Section 01 22 00 - Measurement and Payment
3. Section 03 05 00 - Basic Concrete Materials and Methods
4. Section 33 11 00 - Water Utility Distribution Piping
5. Section 33 13 00 - Disinfection of Water Utility Distribution

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 01 22 00 – Measurement and Payment.

1.3 REFERENCES

A. American Water Works Association (AWWA):

1. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
2. AWWA C512 - Air Release, Air/Vacuum, and Combination Air Valves for Water Supply Service
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. New Mexico Standard Specifications for Public Works Construction (NMSSPWC):

1. 801 - Installation of Water Transmission, Collector, and Distribution Lines.
2. 802 - Installation of Water Service Lines.

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.

B. Provide Operation and Maintenance Data for each type of valve installed.

1.6 DELIVERY, STORAGE AND HANDLING

A. Prepare valves and accessories for shipment per 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.

1.7 COORDINATION

A. Coordinate work with RNUA and utilities within construction area.

1.8 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. Mueller Company
2. Approved Equal

B. Resilient Seat Wedge Gate Valves: AWWA C509, 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, threaded or mechanical joint, as approved by the Engineer.
7. Coating: Fusion bonded epoxy conforming to AWWA C550 with 10 mil or greater thickness; interior/exterior.
8. Working pressure: 250 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 COMBINATION AIR VALVES

A. Manufacturers:

1. Val-Matic.
2. Approved Equal

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. Working pressure: 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.

2.3 VALVE BOXES

A. Manufacturers:

1. Tyler 6850 Series
2. East Jordan Iron Works.
3. Approved Equal

B. Domestic cast iron, two-piece, screw type.

C. Where waterline is buried at a depth greater than 4 feet, provide valve box extensions as required.

D. Cast iron lid marked "Water", non-locking

E. All valve boxes and lids shall be extra heavy duty, traffic-rated.

2.4 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.

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. Perform trench excavation, backfilling and compaction in accordance with Sections 31 23 17 and 31 23 23.

3.3 INSTALLATION

A. All buried steel pipe shall be cold-applied tape-wrapped, in accordance with AWWA C-209.

B. 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. All buried metallic components shall be wrapped in 8-mil polyethylene.

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 plastic meter box with a removable frost lid, 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.

4. PVC downspout shall have horizontal piece long enough to drip clear of the air valve.

5. Center both the air valve and the curb stop under the meter box lid so that both can be reached from above

6. Provide sufficient clearance between the curb stop and the air valve that the curb stop can be operated from above ground using a valve key.

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 gate valves and air valves, shall be manually actuated through their full cycle to ensure proper operation prior to installation.

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 01 00 00 - Basic Requirements
2. Section 01 22 00 - Measurement and Payment
3. Section 33 11 00 - Water Utility Distribution Piping
4. Section 33 12 13 - Water Service Connections
5. Section 33 12 16 - Water Utility Distribution Valves

1.2 MEASUREMENT AND BASIS OF PAYMENT

A. Basis of Measurement: By the linear foot of pipe

B. Basis of Payment: Payment for pipeline disinfection will be made based on linear footage of mainline pipe, upon successfully passing bacteriological testing.

1. Disinfection of individual service lines shall be incidental to that bid item.
2. This includes all costs incidental to disinfection and testing, including chlorination, flushing, water for flushing, de-chlorination, sampling, sample transport, laboratory testing fees, and any other costs incidental to flushing, disinfection, and bacteriological testing activities.
3. Costs for passing bacteriological laboratory tests, for both mainline and service lines, shall be reimbursed using the Testing Allowance.
   a. Contractor shall be reimbursed for the cost of laboratory tests themselves only upon submittal of the invoice(s). The laboratory results of all tests shall be submitted directly to the Engineer.
   b. Contractor shall pay for all failed tests.

1.3 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.

1.4 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.

1.5 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. Fecal and Total 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.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.

1.7 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. 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.

B. Introduce liquid chlorine into the system and perform disinfection in accordance with AWWA C651 using the continuous feed method, with the following modifications:

1. Initial chlorine concentration, as measured by water flowing out of representative points throughout the system, shall be at least 50 ppm.

2. Maintain disinfectant in system for 24 hours, or 48 hours if the temperature is less than 41 degrees Fahrenheit.

3. Upon completion of retention period required for disinfection but prior to collecting bacteriological samples, flush pipeline until chlorine concentration in water leaving pipeline is not more than 0.4 ppm.

C. Provide and attach required equipment to perform the Work of this section.

D. Flush, circulate, and clean until required cleanliness is achieved; use domestic water.

E. 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.

F. 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. 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.

2. 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