

SUPPLEMENTARY TECHNICAL SPECIFICATIONS INDEX

Historic Village of Agua Fria Wastewater Improvements Phase III

Standard Specifications

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 GENERAL

- A. The Work to be performed under this Contract shall consist of furnishing all plant, tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all Work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents.
- B. By submitting a bid for this project, the CONTRACTOR hereby acknowledges and assures the OWNER that it has sufficient experience in constructing this type of work and therefore is familiar with all combinations of materials, labor, and equipment that are required for the successful completion of this project. The Work shall be complete, and all Work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete, safe and proper construction of the Work in good faith shall be provided by the CONTRACTOR at no increase in cost to the OWNER.

1.02 CONTRACTOR'S REPRESENTATIVES

- A. At the Pre-construction conference, the CONTRACTOR shall provide the OWNER an Organizational Chart of the CONTRACTOR'S PROJECT TEAM for the project, including responsibilities of all related personnel. At a minimum, this organizational chart should include the Project Manager, Project Superintendent, Safety Representative, Scheduler and OWNER or Partner of the CONTRACTOR under Contract. Phone numbers or instructions on how to contact key personnel must be provided. Resumes of all project-related personnel should be included for review and approval by the OWNER. All key personnel as identified in the organizational chart are required to have assumed the same level of responsibility on three (3) projects of similar scope and magnitude.
- B. An Authorized Representative must be designated, with a clear definition of the scope of this individual's authority to represent or act on behalf of the CONTRACTOR. Any limitations in the authority of this designated representative must also be clearly delineated. At all times when work is underway at the jobsite, the CONTRACTOR'S Project Manager or Superintendent shall be present at the jobsite to supervise the work. The CONTRACTOR shall also supply an alternative Authorized Representative to act on his behalf in an emergency situation or if the prime Authorized Representative is unavailable for any reason. The limits and extent of this individual's authority to act on the CONTRACTOR'S behalf must also be clearly defined. All instructions, determinations, notices and other communications given to the Authorized Representative of the CONTRACTOR

shall be binding upon the CONTRACTOR. An Authorized Representative must be available by cell phone and/or radio on twenty-four (24) hours a day, seven (7) days a week basis throughout the course of the Contract. In the event that no Authorized Representative is available in an emergency situation requiring the CONTRACTOR'S action or should the CONTRACTOR fail to respond within two (2) hours, the OWNER may take the appropriate actions to remedy the situation at the CONTRACTOR'S expense. The CONTRACTOR, by failing to respond to the call, shall waive any rights to claims caused by the OWNER'S actions.

- C. All key personnel as described in the CONTRACTOR'S organizational chart must be approved by the OWNER prior to the commencement of work on the project. Resumes of key personnel should include related experience on three previous projects of similar magnitude and complexity. In the event that a member of the project team proves to be unsatisfactory to the CONTRACTOR and ceases to be in his employ, all substitutions must be reviewed and approved by the OWNER. Key personnel shall not be replaced without prior approval by the OWNER.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this Base Bid Contract comprises construction of the following:

- 1. Avenida De Sesario

- a. Construction of approximately 1700 LF of 2" of HDPE Low pressure sewer, including seven (7) stub outs for future residential grinder pump connections.
- b. Construction of approximately 125 LF of 1 ¼" HDPE low pressure service line for future connections, including all fittings.
- c. Install one (1) low pressure flush terminal and one (1) in line flushing station.
- d. Connection to an existing manhole in Avenida De Sesario.
- e. Remove and replace approximately 665 square-yards of asphalt roadways.
- f. All associated surface repairs.

- 2. Alamo Lane:

- a. Construction of approximately 1300 LF of 8" gravity sewer.
- b. Construct ten (10) new manholes as well as eight (8) sewer service connections, including double cleanout and appurtenances.
- c. Construction of approximately 60 LF of 4" PVC private residential service line, including all fittings.
- d. Connection to an existing manhole in La Junta Del Alamo.

- e. Remove and replace approximately 806 square-yards of asphalt roadways.
 - f. All associated Service Connections, Valves, and surface repairs.
3. Lopez Lane
- a. Construction of approximately 1010 LF of 8” gravity sewer.
 - b. Construct three (3) new manholes as well as seven (7) sewer service connections, including double cleanout and appurtenances.
 - c. Connection to an existing manhole in Rufina Lane.
 - d. Construction of approximately 80 LF of 4” PVC private residential service line, including all fittings.
 - e. Construction of approximately 590 LF of 2” of HDPE Low pressure sewer, including nine (9) stub outs for future residential grinder pump connections.
 - f. Construction of approximately 265 LF of 3” of HDPE Low pressure sewer, including four (4) stub outs for future residential grinder pump connections.
 - g. Construction of approximately 185 LF of 1 ¼” HDPE low pressure service line for future connections, including all fittings.
 - h. Install one (1) low pressure flush terminal station.
 - i. Remove and replace approximately 2100 square-yards of asphalt roadways.
 - j. All associated Service Connections, Valves, and surface repairs.
4. Ledd Drive
- a. Connection to existing gravity sewer main in Agua Fria using 8” x 4” wye.
 - b. Construction of approximately 275 LF of 2” of HDPE Low pressure sewer, including four (4) stub out for future residential grinder pump connections.
 - c. Construction of approximately 40 LF of 1 ¼” HDPE low pressure service line for future connections, including all fittings.
 - d. Install one (1) low pressure flush terminal station.
 - e. Remove and replace approximately 10 square-yards of asphalt roadways.
 - f. All associated Service Connections, Valves, and surface repairs.

5. Camino dos Antonios
 - a. Construction of approximately 455 LF of 2" of HDPE Low pressure sewer, including eight (8) stub outs for future residential grinder pump connections.
 - b. Construction of approximately 70 LF of 1 ¼" HDPE low pressure service line for future connections, including all fittings.
 - c. Install one (1) low pressure flush terminal.
 - d. Connection to existing gravity sewer main in Agua Fria using 8" x 4" wye.
 - e. All associated Service Connections, Valves, and surface repairs.
6. Callejon De Rita
 - a. Construction of approximately 320 LF of 8" gravity sewer.
 - b. Construct two (2) new manholes as well as four (4) sewer service connections, including double cleanout and appurtenances.
 - c. Construction of approximately 90 LF of 4" PVC private residential service line, including all fittings.
 - d. Connection to an existing manhole in Agua Fria.
 - e. Construction of approximately 1355 LF of 2" of HDPE low pressure sewer, including nine (9) stub outs for future residential grinder pump connections.
 - f. Construction of approximately 240 LF of 3" of HDPE low pressure sewer, including four (4) stub outs for future residential grinder pump connections.
 - g. Construction of approximately 200 LF of 1 ¼" HDPE low pressure service line for future connections, including all fittings, Install one (1) low pressure flush terminal station and one (1) in line flushing station.
 - h. All associated Service Connections, Valves, and surface repairs.
7. Plaza Montoya
 - a. Construction of approximately 180 LF 8" gravity sewer.
 - b. Construct two (2) new manholes as well as three (3) sewer service connections, including double cleanout and appurtenances.
 - c. Construction of approximately 30 LF of 4" PVC private residential service line, including all fittings.
 - d. Connection to an existing manhole in Agua Fria.
 - e. Remove and replace approximately 10 square-yards of asphalt roadways.
 - f. All associated Service Connections, Valves, and surface repairs.

8. Case Road
 - a. Construction of approximately 520 LF of 2 HDPE low pressure sewer, including nine (9) stub outs for future residential grinder pump connections.
 - b. Construction of approximately 90 LF of 1 ¼" HDPE low pressure service line for future connections, including all fittings.
 - c. Install one (1) low pressure flush terminal.
 - d. Connection to existing gravity sewer main in Agua Fria using 8" x 4" wye.
 - e. Remove and replace approximately 10 square-yards of asphalt roadways.
 - f. All associated Service Connections, Valves, and surface repairs.
9. 3197 Agua Fria Street
 - a. Construction of approximately 270 LF of 2" of HDPE low pressure sewer, including four (4) stub outs for future residential grinder pump connections.
 - b. Construction of approximately 20 LF of 1 ¼" HDPE low pressure service line for future connections, including all fittings.
 - c. Connection to existing gravity sewer main in Agua Fria using 8" x 4" wye.
 - d. Install one (1) low pressure flush terminal.
 - e. Remove and replace approximately 10 square-yards of asphalt roadways.
 - f. All associated Service Connections, Valves, and surface repairs.
10. Skeeter Lane
 - a. Construction of approximately 300 LF 8" gravity sewer.
 - b. Construct two (2) new manholes as well as three (3) sewer service connections, including double cleanout and appurtenances.
 - c. Construction of approximately 30 LF of 4" PVC private residential service line, including all fittings.
 - d. Connection to an existing manhole located behind Skeeter Lane.
 - e. Install new access road turnaround.
 - f. All associated Service Connections, Valves, and surface repairs.

- B. The Work is located in the Historic Village of Agua Fria, in Santa Fe County, New Mexico, as indicated in the Drawings.

1.04 WORK BY OTHERS

- A. The CONTRACTOR’S attention is directed to the fact that work may be conducted at or adjacent to the Site by other contractors during the performance of the Work under this Contract. The CONTRACTOR is to conduct its operations in a manner that will minimize any interference with the Work of other contractors under separate contract with the OWNER or other entities, and shall coordinate its operations and cooperate fully, with such contractors to provide continued safe access to their respective portions of the Site, as required to perform Work under their respective contracts. The CONTRACTOR shall include in the bid price all costs associated with the successful coordination of its operations with other contractors. Copies of Contract Documents pertaining to Work conducted on or adjacent to the site are available for review upon request.

1.05 COORDINATION

A. Existing Utilities and Structures

1. Known utilities and structures adjacent to or expected to be encountered in the work are shown in the drawings. The locations shown are taken from existing records or information obtained from the Utility Owner. All existing utility data represented on the profile is approximate field measurements from surveying of manholes. Profile elevations for gravity lines such as storm drain, and sanitary sewer were calculated. Data points identified as “DEPTH UNK” were based on assumed typical depth of bury and not verified by potholing activities. Prior to construction activities, the CONTRACTOR shall verify the horizontal and vertical locations of all existing utilities and obstructions within or adjacent to the work zone which would impact the proposed alignment. Utilities shown are for the convenience of the CONTRACTOR only, and no responsibility is assumed by either the OWNER or the ENGINEER for their accuracy or completeness. If a conflict with any existing utility is identified during construction, the CONTRACTOR shall submit the existing utility information (referenced by station, offset and TP or invert elevation) to the OWNER AND ENGINEER for review. The CONTRACTOR shall provide a minimum of five (5) working days from when all requested information is provided by the CONTRACTOR for the OWNER to provide a resolution of the conflict.
 - a. CONTRACTOR shall protect all existing utilities within the boundaries of the work. Utilities damaged as a result of the CONTRACTOR’S operations due to his negligence or oversight shall be repaired to the satisfaction of the OWNER of said utility at CONTRACTOR’S sole expense.
 - b. At least 48 hours prior to start of said work, CONTRACTOR shall notify all utilities that may be affected.

- c. For location of utilities, CONTRACTOR shall call New Mexico One Call, phone number (800) 321-2537 for coordinating and identifying utility locations.
 - d. CONTRACTOR shall protect all existing structures within the boundaries of the work and adjacent to the work. CONTRACTOR shall be responsible for visiting the site and becoming familiar with all existing structures. Existing structures damaged that were not part of this contract shall be repaired to their original condition at CONTRACTOR'S sole expense.
 - e. For convenience, the CONTRACTOR may remove and replace small structures such as mailboxes, signs, gates, walls, fences and valve boxes that indirectly interfere with the pipeline construction. CONTRACTOR shall notify the OWNER of each structure to be removed seven (7) calendar days prior to removal and provide temporary mailboxes, signs, fences, or other miscellaneous structures until the permanent structures are replaced. If a traffic control sign is removed, CONTRACTOR shall make arrangements to erect a temporary sign acceptable to the OWNER. All small surface structures removed shall be replaced in the same location in as good, or better, than the original condition. The cost for this work shall be considered incidental to the pipeline construction and shall be included in the pipeline unit costs as shown in the bid proposal.
- B. Cultural and Archaeological Resources: In the event that cultural material or human remains are encountered during excavation, CONTRACTOR shall immediately stop all work in the vicinity of the discovery, notify ENGINEER of the discovery and protect the area from further disturbance. No work shall proceed in the vicinity of the discovery without written approval of ENGINEER.
- C. Physical Resources: Implement temporary and permanent soil erosion and storm-water pollution control measures in accordance with the NPDES stormwater permit process and develop a SWPPP using BMPs.

1.06 WORK SEQUENCE AND SCHEDULING CONSTRAINTS

- A. The CONTRACTOR shall schedule and perform the Work in such a manner as to result in the least possible disruption to the public's use of roadways, driveways, and utilities. Utilities shall include but not be limited to water, sewerage, drainage structures, ditches and canals, gas, electric, cable television, and telephone. Refer to all available plans and profile sheets for approximate location of utilities. It is the CONTRACTOR'S responsibility to locate each utility and incorporate as-built locations on the reproducible record plans, in red ink, showing proper location on each sheet where these utilities are located including depths, widths, and lengths of each utility. There is no guarantee as to exact location of each utility and no additional compensation will be made for utilities that are within a reasonable proximity of the area shown on the record plans.

1.07 CONTRACTOR ACCESS AND USE OF PROJECT SITE

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

1.08 TIME OF WORK AND OVERTIME NOTIFICATION

- A. For work on this project, no work shall be performed between 6:00 p.m. and 7:00 a.m., or on Sundays or legal holidays, without the written permission of the OWNER or ENGINEER or unless otherwise noted in the drawings. However, critical maintenance or emergency work may be completed without prior approval.
- B. If CONTRACTOR, for convenience, should desire to work outside of normal hours, written authorization must be obtained from the County and ENGINEER prior to start of the work.

1.09 STORAGE

- A. Storage conditions shall be in accordance with the manufacturer's requirements and shall be acceptable to OWNER for all materials and equipment not yet incorporated into the Work but included in Applications for Payment. Such storage arrangements and conditions shall be presented in writing for OWNER review and acceptance and shall provide adequate and satisfactory security and protection. Off-site storage facilities shall be accessible to OWNER. The stored materials shall be insured for full value.

1.10 NOTICES TO OWNERS OF ADJACENT PROPERTIES AND UTILITIES

- A. CONTRACTOR shall notify OWNERS of adjacent property and utilities in advance of when prosecution of the Work may affect them.
- B. When it is necessary to temporarily interrupt any utility service connection, CONTRACTOR shall give notice sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit any resulting inconvenience.
- C. Utilities and other concerned agencies shall be contacted at least seven days prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines. The CONTRACTOR must submit to the OWNER and each affected utility a written description of the area, time, duration, and proposed method of disruption and reparation. With the exception of emergencies and/or events that may compromise public safety, no disruption will be allowed without the CONTRACTOR having first obtained the express written approval of the OWNER.

1.11 PROJECT MEETINGS

A. Preconstruction Conference

1. Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place which shall be attended by the CONTRACTOR'S Project Manager, its Superintendent, its Safety Representative, and its Subcontractors as the CONTRACTOR deems appropriate. Other attendees will be:
 - a. OWNER'S CONSTRUCTION MANAGER;
 - b. Representatives of OWNER;
 - c. Governmental representatives as appropriate;
 - d. Others as requested by CONTRACTOR, OWNER, or OWNER'S CONSTRUCTION MANAGER;
 - e. ENGINEER; and
 - f. CONTRACTOR'S personnel assigned to Scheduling. In the event CONTRACTOR elects to utilize an outside agency to perform its scheduling requirements, the responsible personnel from such Agency is required to attend.
2. Bring to the conference the submittals indicated in Section 01300 - Contractor Submittals.
3. The purpose of the conference is to designate responsible personnel, discuss contract requirements and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the CONTRACTOR prior to the meeting date. Any additions to the agenda by CONTRACTOR must be forwarded to the OWNER at least 24 hours prior to the scheduled meeting date and time.
4. The CONTRACTOR shall be prepared to discuss all items listed below.
 - a. CONTRACTOR'S assignments for safety and first aid, including Designated Competent person(s) and CONTRACTOR'S safety Representative.
 - b. CONTRACTOR'S schedules as required by Contract.
 - c. Transmittal, review, and distribution of all documents between the CONTRACTOR and the OWNER including CONTRACTOR'S submittals, RFI'S, Survey Requests, etc.

- d. Processing applications for payment.
 - e. Maintaining record documents.
 - f. Critical Work sequencing.
 - g. Field decisions and Change Orders.
 - h. Use of project site, office and storage areas, security, housekeeping, and OWNER'S needs.
 - i. Major equipment deliveries and priorities.
 - j. Permits required for construction.
 - k. Utilities required for construction.
 - l. Contract Authority and channels of communication.
 - m. Coordination with others.
 - n. Conflict resolution procedures.
5. The OWNER'S CONSTRUCTION MANAGER will preside at the pre-construction conference and will arrange for keeping and distributing the minutes to all persons in attendance.

B. Progress Meetings

- 1. The OWNER'S CONSTRUCTION MANAGER will schedule and hold regular on-Site progress meetings at least weekly and at other times as requested by OWNER'S CONSTRUCTION MANAGER or as required by progress of the Work. The CONTRACTOR, OWNER'S CONSTRUCTION MANAGER and all Subcontractors active on the Site must attend each meeting. CONTRACTOR may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.
- 2. The OWNER'S CONSTRUCTION MANAGER will preside at the meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings will be to review the progress of the Work, discuss safety, maintain coordination of efforts, discuss commercial issues, discuss changes in scheduling, and resolve other problems which may develop. During each meeting, the CONTRACTOR is required to present any issues which may impact his Work, with a view to resolving these issues expeditiously.

C. Subcontractor Coordination Meetings

- 1. The CONTRACTOR is expected to conduct regularly scheduled coordination meetings with Subcontractors, Suppliers, and Manufacturers to

manage and ensure the smooth progression of the work. Request representation at each meeting by all applicable parties involved in the coordination of current activities or concerned with the planning of upcoming work. During each meeting the following topics need to be addressed:

- a. The development of a four week look-ahead schedule (to be distributed to the OWNER at the subsequent progress meeting).
- b. Any concerns relating to the progress of the work.
- c. Any other items as deemed necessary by any of the related parties.

D. Pre-Activity/Specialty Coordination Meetings

1. Pre-Activity meetings are to be held no later than twenty-four (24) hours prior to the execution of any activity requiring inspection or as deemed necessary by the OWNER. Required attendees should include at a minimum the OWNER'S CONSTRUCTION MANAGEMENT TEAM, the CONTRACTOR'S Project Manager, Superintendent and any other related personnel.

1.12 CONTRACTOR'S REQUEST FOR INFORMATION (RFI)

- A. In the event that the CONTRACTOR determines that some portion of the Contract Documents requires additional information or interpretation, the CONTRACTOR shall submit a written statement to the OWNER'S CONSTRUCTION MANAGER requesting clarification on the issue. Such request must be provided by the CONTRACTOR to the OWNER immediately upon discovery. Prior to the submittal of the RFI the CONTRACTOR shall carefully study and review the Contract Documents to ensure that the requested information is not contained therein. Submit only one issue to be clarified per form. The CONTRACTOR must include in a properly written RFI the following information:

1. Contract number and title, RFI number (sequentially numbered), date, person requesting clarification and signature.
2. A clear and concise summary of the issue in question and why further clarification or information is required from the OWNER.
3. The specific drawing shall be identified by drawing number and location on the drawing sheet.
4. The specific specification section shall be identified by section number, page and paragraph.

5. Where applicable, the CONTRACTOR shall include his own interpretation of the drawings or specifications and why he believes such an understanding is correct.
 6. In cases requesting clarification of coordination issues, the CONTRACTOR shall include a suggested solution with necessary drawings or sketches with the RFI.
- B. Only RFI'S submitted by the CONTRACTOR will be accepted. Any clarifications required by the Subcontractors, Manufacturers, or Suppliers of the CONTRACTOR must be properly routed through the CONTRACTOR to the OWNER on the appropriate form. All RFI'S must be limited to clarifications of the Contract Documents. RFI'S shall not be used for the purpose of notifying the OWNER of the following:
1. To request approval of submittals.
 2. To request approval of substitutions.
 3. To request changes which entail additional cost or credit.
 4. To request methods of performing work different than those shown or specified.
- C. If the OWNER determines that the RFI is not in relation to clarifications relating to the Contract Documents, such RFI will be returned to the CONTRACTOR with an explanation which may include references to other sections within the Contract for the CONTRACTOR to follow.
- D. Improper or frivolous RFI'S that are not properly prepared as detailed above, or request information that is clearly shown in the Contract Documents, will be returned to the CONTRACTOR labeled as either Improper or Frivolous with the reasons for such determination. Should additional costs be incurred by OWNER as a result of reviews of RFI'S that were deemed Improper or Frivolous, OWNER will withhold from CONTRACTOR'S final payment an amount based on ENGINEER'S current fee schedule, including applicable miscellaneous expenses, so that OWNER may reimburse ENGINEER for such reviews.
- E. After receipt of the RFI, the OWNER will be allowed fourteen (14) calendar days to review and respond to the issue. If additional time is required by the OWNER, the CONTRACTOR will be notified in writing. Responses by the OWNER shall not be interpreted as authorization to proceed with extra work. In the event that the CONTRACTOR believes that additional cost or time is involved from the clarification provided by the OWNER, the CONTRACTOR shall notify the OWNER in writing that a change order is required and the reasons for his belief that this work constitutes a change in his Contractual requirements. At no point in time is the CONTRACTOR to proceed with extra work without the written consent of the OWNER.

1.13 DAILY ACTIVITIES REPORT

A. Commencing with the date of Notice to Proceed, which shall be considered as Contract Day No. 1, the CONTRACTOR shall prepare and forward to the OWNER'S CONSTRUCTION MANAGER a Daily Activity Report. A Daily Activity Report shall be executed by the CONTRACTOR for each Contract day, for each shift, whether work takes place or not. Report shall be submitted to the OWNER'S CONSTRUCTION MANAGER either at the end of each working day or the following morning prior to the start of operations. This report shall contain not less than the following data:

1. CONTRACTOR.
2. Contract name and number.
3. Contract day, date and shift.
4. All personnel engaged in the Contract, including management, supervisory, clerical, engineering and manual.
5. An exact count of personnel hours by trade, craft, duties, CONTRACTOR or Subcontractor.
6. An exact account of all equipment that is on site or committed to the Contract, indicating hours worked and idle.
7. All personnel hours and equipment hours shall be identified by the activity number or node displayed in the approved construction schedule.
8. List all accidents.
9. List all Subcontractors active on site.
10. Name and Signature of CONTRACTOR'S Authorized Representative.
11. Work performed, including area (i.e. - station).
12. Conflicts encountered.

1.14 AS-BUILT DRAWINGS

A. The CONTRACTOR shall, during progress of the work keep a careful record of all changes and corrections to the Contract Drawings. This record shall show the actual field locations, all project conditions, configurations, and any other changes or deviations that vary from the details provided in the original Contract drawings. The horizontal and vertical locations of any buried or concealed construction and utility features that were either not shown on the drawings or vary from the locations

indicated, shall be carefully recorded. Include detailed sketches to fully illustrate the construction work. The as-built drawings shall be available for review by the OWNER at all times during the construction period. At the end of each month, prior to each monthly progress payment, these drawings will be inspected by the OWNER. If these drawings are not found to be complete and up to date, a non-compliance report will be issued and ten (10) percent will be withheld from the CONTRACTOR'S progress payment. If the OWNER receives a written notice of the correction of the condition that resulted in the withholding, signed by an authorized agent of the CONTRACTOR, the OWNER shall pay the amount withheld within 30 days after receiving the next progress estimate.

- B. The as-built drawing format shall be red-line mark-ups on a set of 24" x 36" drawing paper prints.
- C. Upon completion of construction and prior to final payment, the CONTRACTOR shall submit to the OWNER one (1) copy of the red-lined mark-ups showing all changes, including the type, make, model, class, manufacturer, etc., as applicable, of all major items of material used in the project as well as the source of all said items. The as-built drawings shall be completed and certified by a New Mexico Professional Surveyor.

1.15 CITY NOISE ORDINANCE COMPLIANCE

- A. CONTRACTOR shall comply with the requirements of the Santa Fe County noise ordinance at all times. CONTRACTOR shall obtain all permits and/or variances required to permit work outside of normal working hours, including Extended Hours of Construction if required on this project.

1.16 PERMITS

- A. The CONTRACTOR shall procure all permits and encroachments except for those already obtained by the OWNER.
- B. PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 SEQUENCE OF WORK

- A. Sequence of Work shall be determined by the CONTRACTOR and specific sequences of work are not required for this Contract.

3.02 LIQUIDATED DAMAGES

- A. Construction is required to be accomplished within described durations and liquidated damages shall be assessed. Liquidated damages will be cumulative for each calendar day that work within each construction phase remains incomplete beyond either the allowable duration or the allowable dates as set forth below. The

scheduling constraints and liquidated damages to be assessed for failure to complete all work within the constraints are as follows:

CONST ACTIVITY	DURATION CONSTRAINTS	DATE CONSTRAINTS	LIQUIDATED DAMAGES (per day)
Entire Project	Max 180 calendar days duration from Notice to Proceed	N/A	\$1,500.00
Punch List	Max 30 calendar day duration following substantial completion	N/A	\$1,500.00

NOTE: All Liquidated Damages Shall Be Cumulative.

PART 4 – PAYMENT

4.01 GENERAL

- A. Costs for the work in this Section shall not be paid for separately but shall be considered incidental to the contract work to be accomplished.

END OF SECTION

SECTION 02 22 00
VIDEO RECORDING OF PROJECT SITE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Contractor shall provide a video in USB Thumb drive format of the entire project site prior to mobilization or construction.

1.02 RELATED WORK

- A. General conditions of the Contract.

1.03 VIDEO REQUIREMENTS

- A. Contractor shall video all areas that will be, or have the potential to be, affected by construction activities. This shall include but not be limited to roads, sidewalks, above ground utilities, homes, driveways, fences, etc. that are located within the right-of-way or adjacent to the right-of-way for the construction areas.
- B. Contractor shall provide the four (4) copies of the Video to the Owner in USB Thumb drive format. Copies are to be distributed to: the Owner, the Engineer, the Inspector, and the funding agency (if applicable).

1.04 PAYMENT

- A. Cost is incidental: no separate payment.

END OF SECTION

SECTION 01 26 20
UTILITY OBSTRUCTIONS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provisions for bracing transverse utilities to remain in service during trenching and backfilling, and operations shall be considered incidental, and no additional payments shall be made.
- B. The ENGINEER has made a reasonable effort to show the general location of existing underground and overhead utility lines (gas, telephone, electrical, water, sewer) on the Drawings.

1.02 RELATED WORK

- A. Section 31 23 33: Trenching

1.03 RELOCATION OF UTILITIES

- A. Water, gas, electric, telephone, and other above and underground utilities: The CONTRACTOR shall be responsible for coordinating with the appropriate utility company to remove or relocate the existing utilities that interfere with his construction. Any charges by any utility company for removal or relocation of utilities will be the responsibility of the CONTRACTOR.

END OF SECTION

SECTION 01 14 16
COORDINATION WITH PUBLIC

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Before, after and special construction notices.

1.02 NOTICES

- A. Notice:
 - 1. Inform residents and businesses personally and by written notice whenever access to property will be impaired, stating scheduling of such impairment in the notice.
 - 2. Hand-delivery to each resident and business adjacent to and/or which may be reasonably expected to be affected by construction.
- B. Before Construction:
 - 1. Delivered to residents and commercial businesses not more than seven, nor less than four, calendar days prior to actual physical construction on each line or line segment.
 - 2. Corrected notices delivered if construction does not start within 48 hours of date given in notice.
 - 3. Written notice to state:
 - a. Contractor's name, address and local telephone number.
 - b. Nature of work to be done.
 - c. Disruption that residents or businesses might expect.
 - d. Expected duration of construction.
 - e. Contractor's local telephone number to which complaints may be made during normal working hours.
 - f. Contractor's local telephone number to which emergency conditions can be reported during non-working periods.

- C. After Construction:
 - 1. Delivered not more than seven calendar days following construction on each line or line segment.
 - 2. Written notice to:
 - a. State Contractor's name, address and telephone number.
 - b. Thank residents and businesses for cooperation and report that work is completed in their area.

1.03 SCHEDULE OF SPECIAL REQUIREMENTS FOR THIS PROJECT

- A. Notification of all residences and commercial businesses in the area affected by water and sewer service outages as well as other impacts of construction.

END OF SECTION

SECTION 01 33 00

CONTRACTOR SUBMITTALS
PART 1 GENERAL

1.01 GENERAL

- A. CONTRACTOR "Submittals" may be Shop Drawings, schedules, surveys, reports, samples, plans, lists, drawings, documents, findings, programs, manuals, data, or any other item or information required by the Contract Documents to be submitted or offered by the CONTRACTOR in accomplishing the Work.
- B. Wherever Submittals are required hereunder, all such documents shall be furnished to the OWNER'S CONSTRUCTION MANAGER.
- C. The CONTRACTOR shall be responsible for the accuracy, completeness, and coordination of all Submittals, including but not limited to, Submittals of or from an item, product, thing, service, person or firm which is specified in the Contract Documents; such specified Submittals shall not be presumed to be acceptable to the OWNER and shall be subject to the same approval process as all other Submittals. The CONTRACTOR shall not delegate this responsibility in whole or in part to any Subcontractor. Submittals may be prepared by the CONTRACTOR, Subcontractor, or Supplier, but the CONTRACTOR shall ascertain that each Submittal meets the requirements of the Contract and the Project. The CONTRACTOR shall ensure that there is no conflict with other Submittals and shall notify the OWNER'S CONSTRUCTION MANAGER in each case where its Submittal may affect the work of another Contractor or the OWNER. The CONTRACTOR shall ensure coordination of Submittals of related crafts and Subcontractors.
- D. Failure to make timely submittals in accordance with the requirements of the specifications shall constitute grounds for the OWNER to withhold 20 percent of compensation for the equipment to which the submittal is related, or, in the case of information lists, record drawings, investigation findings, safety plans, quality plans, and similar items, the OWNER may withhold 20 percent of the value of the information in the submittal.

1.02 PRE-CONSTRUCTION CONFERENCE SUBMITTALS

- A. At the preconstruction conference, submit the following items for review:
 - 1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitute ("Or-Equal") submittals.
- B. A list of all permits and licenses the CONTRACTOR shall obtain indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.

- C. A preliminary schedule of values.
- D. A project overview bar chart.
- E. The names and qualifications of Designated Safety Representative.

1.03 PROGRESS REPORTS

- A. Furnish a progress report to OWNER'S CONSTRUCTION MANAGER with each Application for Payment. If the Work falls behind schedule, submit additional progress reports at such intervals as OWNER'S CONSTRUCTION MANAGER may request.
- B. Each progress report shall include sufficient narrative to describe any current and anticipated delaying factors, effect on the construction schedule, and proposed corrective actions. Any Work reported complete, but which is not readily apparent to OWNER'S CONSTRUCTION MANAGER, must be substantiated with satisfactory evidence.
- C. Each progress report shall include a list of the activities completed with their actual start and completion dates, a list of the activities currently in progress, and the number of working days required to complete each.

1.04 SHOP DRAWINGS

- A. Wherever called for in the Contract Documents, or where required by the ENGINEER, furnish to the OWNER'S CONSTRUCTION MANAGER for review, nine copies of each Shop Drawing Submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. Whenever the CONTRACTOR is required to submit design calculations as part of a Submittal, such calculations shall bear the signature and seal of a professional engineer registered in New Mexico unless otherwise directed.
- B. All Shop Drawing Submittals shall be accompanied by a Submittal transmittal form acceptable to the OWNER'S CONSTRUCTION MANAGER. Any Submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal.
- C. Organization
 - 1. A single Shop Drawing Submittal transmittal form shall be used for each technical specification section, item, or class of material or equipment for which a Submittal is required. A single Submittal covering multiple sections will not be acceptable, unless the primary specification references other sections for components. Example: If a pump section references other sections for the motor, protective coating, anchor bolts, local control panel, and variable frequency drive,

a single Submittal would be accepted; a single Submittal covering vertical turbine pumps and horizontal split case pumps would not be acceptable.

2. On the transmittal form, index the components of the Submittal and insert tabs in the Submittal to match the components. Relate the Submittal components to specification paragraph and subparagraph, drawing number, detail number, schedule title, room number or building name, as applicable.
3. Unless otherwise approved by OWNER, terminology and equipment names and numbers used in Submittals shall match the Contract Documents.

D. Format

1. Submittals shall be submitted electronically via www.bhinc.com under the Project Tracker section, located at the top-right of the above website. Access will be provided to those who upload and review submittals.
2. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with all pertinent data, capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports. Sufficient level of detail shall be presented for assessment of compliance with the Contract Documents.
3. Each Submittal shall be assigned a unique number. Submittals shall be numbered sequentially. The Submittal numbers shall be clearly noted on the transmittal. Original Submittals shall be assigned a numeric Submittal number. Resubmittals shall bear an alphanumeric system which consists of the number assigned to the original Submittal for that item followed by a letter of the alphabet to represent that it is a subsequent Submittal of the original. For example, if Submittal 25 requires a resubmittal, the first resubmittal will bear the designation "25-A" and the second resubmittal will bear the designation "25-B" and so on.

E. Disorganized Submittals which do not meet the requirements above will be returned without review.

F. Except as may otherwise be indicated herein, the OWNER'S CONSTRUCTION MANAGER will return each Submittal to the CONTRACTOR, with its comments noted thereon, within 28 calendar days following their receipt by the OWNER'S CONSTRUCTION MANAGER. For resubmittal of Submittals, the OWNER'S CONSTRUCTION MANAGER will be allowed the same review period as for the original Submittal. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable Submittal to the OWNER'S CONSTRUCTION MANAGER by the second submission of a Submittal item. Should the ENGINEER be required to review third and subsequent submittals, OWNER will withhold from CONTRACTOR'S next payment request an amount based on ENGINEER'S current fee schedule, including applicable miscellaneous expenses, so that OWNER may reimburse ENGINEER for such reviews.

- G. If three copies of a Submittal are returned to the CONTRACTOR marked “NO EXCEPTIONS TAKEN,” formal revision and resubmission of said Submittal will not be required.
- H. If three copies of a Submittal are returned to the CONTRACTOR marked “MAKE CORRECTIONS NOTED,” formal revision and resubmission of said Submittal will not be required.
- I. If a Submittal is returned to the CONTRACTOR marked “NOTE MARKINGS-RESUBMIT,” the CONTRACTOR shall revise said Submittal and resubmit the required number of copies. Resubmittal of portions of multi-page or multi-drawing Submittals will not be allowed. For example, if a Shop Drawing Submittal that consists of ten drawings contains only one drawing that needs to be amended and resubmitted, the Submittal as a whole is deemed as “NOTE MARKINGS-RESUBMIT,” and all ten drawings of the Submittal are required to be resubmitted.
- J. If a Submittal is returned to the CONTRACTOR marked “REJECTED-RESUBMIT,” the CONTRACTOR shall revise said Submittal and resubmit the required number of copies. Resubmittal of portions of multi-page or multi-drawing Submittals will not be allowed. For example, if a Shop Drawing Submittal that consists of ten drawings contains only (one) drawing that is rejected and needs to be resubmitted, the Submittal as a whole is deemed as “REJECTED-RESUBMIT,” and all ten drawings of the Submittal are required to be resubmitted.
- K. Any changes made on a resubmittal, other than those made or requested by the ENGINEER or OWNER’S CONSTRUCTION MANAGER, shall be identified and flagged on the resubmittal.
- L. Fabrication of an item shall commence only after the ENGINEER has reviewed the pertinent Submittals and the OWNER’S CONSTRUCTION MANAGER has returned copies to the CONTRACTOR marked either “NO EXCEPTIONS TAKEN” or “MAKE CORRECTIONS NOTED.” Corrections indicated on Submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the Contract requirements.
- M. All CONTRACTOR Shop Drawing Submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR prior to submission. Each Submittal shall be dated and signed with the following: “I have verified that the equipment or material in this Submittal meets all the requirements specified or shown in the Contract Documents without exception.” In the case of Shop Drawings, each sheet shall be so dated, signed, and certified. No consideration for review of any submittals will be made for any items which have not been so certified. All non-certified submittals will be returned without action taken, and any delays caused thereby shall be the total responsibility of the CONTRACTOR. Submittals which the CONTRACTOR wishes to have reviewed that cannot bear this certification because they contain an exception or deviation to the Contract

Documents shall be submitted in accordance with Section 01600 – Products Requirements.

- N. The OWNER'S CONSTRUCTION MANAGER'S and/or ENGINEER'S review of Shop Drawing Submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions and for compliance with the Contract Documents. The CONTRACTOR shall assume all responsibility and risk for any problems due to any errors in Submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.
- O. No changes in the Contract times will be considered for schedule delays resulting from non-compliant Submittals.
- P. Within 30 Days of the Notice to Proceed, the CONTRACTOR shall submit a complete list of anticipated Submittals which includes Specification and Drawing references. The list shall be updated with "early start" Submittal dates within 15 Days of Submittal of the CONTRACTOR'S construction schedule. The Submittal dates shall be updated whenever the schedule is updated. Any additional Submittals identified after the initial Submittal shall be included in the updates.
- Q. If the CONTRACTOR submits an incomplete Submittal, the Submittal may be returned without review. A complete Submittal shall contain sufficient data to demonstrate that the items contained therein comply with the Contract Documents, meet the minimum requirements for Submittals as described in the Contract Documents, and include all corrections as required from previous Submittals.

1.05 CONTRACTOR'S SCHEDULE

- A. The CONTRACTOR'S construction schedules and reports shall be prepared and submitted to the OWNER'S CONSTRUCTION MANAGER.

1.06 SAMPLES

- A. Whenever in the Specifications samples are required, submit not less than three samples of each item or material to the OWNER'S CONSTRUCTION MANAGER for acceptance at no additional cost to the OWNER.
- B. Samples, as required herein, shall be submitted for acceptance a minimum of 21 days prior to ordering such material for delivery to the jobsite, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the Work.
- C. All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and Manufacturer's name for identification. Upon receiving acceptance of the ENGINEER, one set of the samples will be stamped, dated, and returned to the CONTRACTOR, and one set of samples will be retained, and one set of samples shall remain at the job site until completion of the Work.

- D. Unless indicated otherwise, all colors and textures of specified items presented in sample Submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in contract time, price, or clearly indicate “same” on the transmittal page of the Submittal.

1.07 SURVEY DATA

- A. The CONTRACTOR shall make available for examination throughout the construction period all field books, notes, and other data developed by CONTRACTOR in performing the surveys required by the Work and shall submit all such data to OWNER’S CONSTRUCTION MANAGER with documentation required for final acceptance of the Work.

1.08 UTILITY INVESTIGATION

- A. The CONTRACTOR shall submit the findings of all utility investigations performed.

1.09 DAILY FORCE REPORT

- A. The CONTRACTOR and each Subcontractor shall submit to the OWNER’S CONSTRUCTION MANAGER, or designee, a daily force report. Deliver report not later than 9:00 A.M. of the workday following the report date and include the following:
 - B. Day of week, date, CONTRACTOR name and Report number.
 - C. Summary of work in progress (segregated by CONTRACTOR and Subcontractor).
 - D. Details of work accomplished including quantities of work installed.
 - E. Summary of equipment working and where working.
 - F. Summary of manpower by work element and Subcontractor.
 - G. Receipt of major equipment or materials.
 - H. All required testing performed and, if available, documented results.

1.10 OPERATIONS AND MAINTENANCE MANUAL

- A. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OPERATIONS AND MAINTENANCE MANUAL. It shall be written so that it can be used and understood by the OWNER’S operation and maintenance staff.

- B. The initial submittal of the OPERATIONS AND MAINTENANCE MANUALS shall be furnished to the OWNER'S CONSTRUCTION MANAGER upon delivery of the respective equipment. Failure to meet the initial Submittal requirement at the time of equipment delivery will result in withholding 20-percent of compensation for that equipment.
- C. The OPERATIONS AND MAINTENANCE MANUAL shall be subdivided first by specification section number; second, by equipment item; and last, by "Part." "Parts" shall conform to the following (as applicable):
1. Part 1 - Equipment Record:
 - a. Summary: An Equipment Record Form shall indicate the equipment name, equipment number, and process area in which the equipment is installed.
 - b. Form: The CONTRACTOR shall also complete an Equipment Record Form for each item of mechanical, electrical and instrumentation equipment in the Work. The form shall be included in the O&M Manual.
 2. Part 2 - Operational Procedures:
 - a. Procedures: Manufacturer-recommended procedures on the following shall be included in Part 2:
 - (1) Installation
 - (2) Adjustment
 - (3) Startup
 - (4) Location of controls, special tools, equipment required, or related instrumentation needed for operation
 - (5) Operation Procedures
 - (6) Load Changes
 - (7) Calibration
 - (8) Shutdown
 - (9) Troubleshooting
 - (10) Disassembly
 - (11) Reassembly

- (12) Realignment
 - (13) Testing to determine performance efficiency
 - (14) Tabulation of proper settings for all pressure relief valves, low and high-pressure switches, and other protection devices
 - (15) List of all electrical relay settings including alarm and contact settings
 - (16) Lubrication
3. Part 3 - Preventive Maintenance Procedures:
- a. Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by leaving the equipment in place.
 - b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.
4. Part 4 - Parts List:
- a. Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.
 - b. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.
5. Part 5 - Wiring Diagrams:
- a. Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.
6. Part 6 - Shop Drawings:
- a. Drawings: This part shall include approved shop or fabrication drawings, complete with dimensions.
7. Part 7 - Safety:
- a. Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.
8. Part 8 - Documentation:

- a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.
- D. The CONTRACTOR shall furnish to the OWNER'S CONSTRUCTION MANAGER four identical, initial, OPERATIONS AND MAINTENANCE MANUALS. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A table of contents indicating all equipment in the manuals should be prepared. The title of each volume shall be displayed on the cover and spine.
- E. OPERATIONS AND MAINTENANCE MANUALS shall be submitted in final form no later than 75 percent of construction completion date. All discrepancies found by the OWNER'S CONSTRUCTION MANAGER or ENGINEER in the OPERATIONS AND MAINTENANCE MANUALS shall be corrected by the CONTRACTOR within 30 Days from the date of written notification. Final, verified, and complete OPERATIONS AND MAINTENANCE MANUALS shall be submitted in PDF electronic format on CD-ROM. Four copies of the CD's shall be provided to the OWNER'S CONSTRUCTION MANAGER.

1.11 SPARE PARTS LIST

- A. The CONTRACTOR shall furnish to the OWNER'S CONSTRUCTION MANAGER five identical sets of spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall be limited to those spare parts which each manufacturer recommends be maintained by the OWNER in inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the OWNER in ordering. Cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents. The spare parts lists shall be bound in standard size, 3-ring, loose-leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

PART 4 – PAYMENT

4.01 GENERAL

- A. Costs for the work in the Section shall not be paid for separately but shall be considered incidental to the Contract work to be accomplished.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provision of the contract.

1.02 SUMMARY

- A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products, and includes:

1. Substitution requests.
2. Basis-of-design specification.
3. Single source.
4. Product delivery, storage, and handling.
5. Product warranties.
6. Product options.
7. Product selection procedures.
8. Comparable products.
9. Product Substitutions.

- B. The use of a brand name within Supplemental Technical Specifications or as identified on the Plans is for the purpose of describing the standard of quality, performance and characteristic desired and is not intended to limit or restrict competition.

1.03 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the items "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of the effective date of the Contract Documents.

2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 3. Comparable Products: Product that is demonstrated and approved through submittal process, or were indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product. Burden of proof of acceptability as a comparable product, or better product, is the responsibility of the CONTRACTOR, and shall be fully investigated and documented by the CONTRACTOR prior to submittal to the ENGINEER for consideration.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by CONTRACTOR.
- C. Basis-of-Design Product Specification: Where a specific manufacturer’s product is named whether accompanied or not by the words “basis of design,” including make or model number or other designation to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers. The product named shall be used to judge the minimum standard for compliance of any product used for the application intended. Other products will not be approved for use on the project that are not at least equal to, or better than, the product named as judged by the ENGINEER.
- D. Manufacturer’s Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to OWNER.
- E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer’s warranty or to provide more rights for OWNER.

1.04 SUBMITTALS

- A. Substitution Requests: Refer to “Product Substitutions” Article 2.02. With submittal of the bidding documents, the CONTRACTOR shall submit to the office of the ENGINEER (Bohannon Huston, Inc. 7500 Jefferson Street NE, Albuquerque, NM 87109) three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number, title, and Drawing numbers and titles.
1. Substitution Request Form: Use the form as provided at the back of this Specification Section. Improperly or incompletely filled out forms may be returned to CONTRACTOR, without action by ENGINEER, for correction.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product couldn't be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by OWNER and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of CONTRACTOR'S Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If a specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. CONTRACTOR'S certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. CONTRACTOR'S waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. By making request for substitution, when forwarded by the CONTRACTOR to the ENGINEER, the CONTRACTOR:

- a. Represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.
 - b. CONTRACTOR and the manufacturer will provide the same, or better, guarantee for the substitution that they would for that specified.
 - c. Certifies that the cost data presented is complete and includes all related costs under this Contract, but excludes costs under any separate contracts and the ENGINEER'S redesign costs, and that he waives all claims for additional costs related to the substitution which subsequently becomes apparent, and;
 - d. Will coordinate the installation of the accepted substitute making such changes as may be required for the Work to be complete in all respects.
4. OWNER and ENGINEER'S Action: The OWNER and ENGINEER may reject or allow substitutions, at their sole judgment and discretion. If necessary, ENGINEER will request additional information or documentation for evaluation within seven calendar days of receipt of a request for substitution. ENGINEER will notify the CONTRACTOR of acceptance or rejection of proposed substitution within 14 calendar days of receipt of request, or seven calendar days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Submittal marked "No Exceptions Taken".
 - b. Use product specified if ENGINEER does not render a decision on use of a proposed substitution within time allocated.
5. Substitutions will not be considered if:
- a. They are indicated or implied on Shop Drawings, Product Data, or Sample submissions without the formal Substitution Request; or
 - b. For their implementation, they require a substantial revision of the Contract Documents or work of the OWNER or separate Contractors in order to accommodate their use.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 – Contractor Submittals.

1.05 QUALITY ASSURANCE

- A. Compatibility of Options: If CONTRACTOR is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
- B. Single Source: All materials or products related to a specified warranty shall be from the same prime product manufacturer, or approved in writing by the prime

product manufacturer, and installed by the same entity; providing the OWNER with a single source system warranty.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.
 - 5. Store products to allow for inspection and measurement of quantity or counting of units.
 - 6. Store materials in a manner that will not endanger Project structure.
 - 7. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
 - 8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 9. Protect stored products from damage.
- B. Storage: Provide a secure location and enclosure, as necessary, at Project site for storage of materials and equipment by OWNER'S construction forces. Coordinate location with OWNER.

1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents, and Manufacturer's standard warranty. Manufacturer's disclaimers and limitations on product warranties do not relieve CONTRACTOR of obligations under requirements of the Contract Documents.

- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer’s Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate for properly executed.
 - 3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in COA General Conditions Section 13 “Warranty and Guarantee.”

PART 2 - PRODUCTS

2.01 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. OWNER reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term “as selected,” ENGINEER will make selection.
 - 5. Where products are accompanied by the term “match sample,” sample to be matched is ENGINEER’S.
 - 6. Descriptive, performance, and reference standard requirements in the Specifications establish “salient characteristics” of products.
 - 7. Or Equal: Where a product is specified and accompanied by the term “or equal” or “or approved equal” or “or approved,” or similar language; comply with provisions in “Comparable Products” and “Substitution Requests” requirements to obtain approval for use of an unnamed product. The term “equal” shall not be construed as requiring products to be exact in every

characteristic, unless the ENGINEER determines that exact matching of all characteristics is required for the intended result. The term “equal” shall, subject to the ENGINEER’S interpretation, mean generally equivalent in essential features for quality and performance for the intended result. The ENGINEER shall be the sole judge of the essential features for quality and performance, and the intended result.

- B. Product Selection Procedures: Procedures for product selection include the following:
1. Product: Where Specification paragraphs or subparagraphs titled “product” name a single product and manufacturer, provide the product named.
 - a. Substitutions may be considered, unless otherwise indicated as “no substitute,” or similar wording.
 2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled “Manufacturer” or “Source” name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
 - a. Substitutions may be considered, unless otherwise indicated as “no substitute,” or similar wording.
 3. Products: Where Specification paragraphs or subparagraphs titled “products” introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 - a. Substitutions may be considered, unless otherwise indicated as “no substitute,” or similar wording.
 4. Manufacturers: Where Specification paragraphs or subparagraphs titled “Manufacturers” introduce a list of manufacturers’ names, provide a product by one of the manufacturers listed that complies with requirements.
 - a. Substitutions may be considered, unless otherwise indicated as “no substitute,” or similar wording.
 5. Available Products: Where Specification paragraphs or subparagraphs titled “Available Products” introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in “Comparable Products” and “Substitution Request” Articles to obtain approval for use of an unnamed product.
 6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled “Available Manufacturers” introduce a list of manufacturers’ names, provide a product by one of the manufacturers listed or another manufacturer

that complies with requirements. Comply with provisions in “Comparable Products” and “Substitution Requests” Articles to obtain approval for use of an unnamed manufacturer’s product.

7. Product Options: Where Specification paragraphs titled “Product Options” indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in “Comparable Products” Article.
8. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled “Basis-of-Design Products” are included and also introduce or refer to a list of manufacturers’ names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in “Comparable Products” and “Substitution Requests” Article to obtain approval for use of a product.
 - a. Substitutions will not be considered, unless otherwise indicated.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches ENGINEER’S sample. The ENGINEER’S decision will be final on whether a proposed product matches satisfactorily.
 - a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of “Product Substitutions” for selection of a matching product.
10. Visual Selection Specification: Where Specifications include the phrase “as selected from manufacturer’s colors, patterns, textures” or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase “standard range of colors, patterns, textures” or similar phrase, ENGINEER will select color, pattern, or texture from manufacturer’s product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase “full range of colors, patterns, textures” or similar phrase, ENGINEER will select color, pattern, or texture from manufacturer’s product line that includes both standard and custom or premium items.

2.02 PRODUCT SUBSTITUTIONS

- A. Timing: Refer to “Substitution Requests.” ENGINEERS will consider requests for substitution if received during the submittal of the bid for the project. Requests received after that time may be considered or rejected at discretion of ENGINEER. After that time, CONTRACTOR has the burden of proof that the substitution is requested due to events or specified product unavailability beyond the CONTRACTOR’S control.
- B. Conditions: ENGINEER will consider CONTRACTOR’S request for substitution when, in the ENGINEER’S judgment, the following conditions are satisfied. If the following conditions are not satisfied, ENGINEER will return requests without action, except to record noncompliance with these requirements:
1. Requested substitution offers OWNER a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities OWNER must assume. OWNER’S additional responsibilities may include compensation to ENGINEER for redesign and evaluation services, increased cost of other construction by OWNER, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated or better results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect CONTRACTOR’S Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified or better warranty.
 10. Requested substitution is due to events or specified product unavailability beyond the CONTRACTOR’S control.

2.03 COMPARABLE PRODUCTS

- A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named on the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified or better warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
 5. Samples, if applicable, or requested.

PART 3 - EXECUTION

3.01 CONTRACTOR SUBSTITUTION REQUEST FORM IS ATTACHED.

PART 4 - PAYMENT

- 4.01 Costs for the work in this Section shall not be paid for separately but shall be considered incidental to the contract work to be accomplished.

END OF SECTION

CONTRACTOR SUBSTITUTION REQUEST FORM

The undersigned, as CONTRACTOR for the above project, requests that the following product be accepted for use in the Project in lieu of _____ Specified in Section _____

PRODUCT: _____

MODEL NO: _____

MANUFACTURER: _____

ADDRESS: _____

Reason for substitution request is as follows: _____

The following items are attached:

- Product description including specifications, performance and test data, and applicable reference standards.
- Samples
- Tabulated comparison with specified product.
- Documentation of reason for request.
- Cost data for comparing proposed substitution with specified product.
- Other: _____

The undersigned certifies that unless stated otherwise:

- Proposed substitution has been thoroughly investigated and function, appearance and quality meet or exceed that of specified product.
- Same warranty will be provided for substitution as for specified product.

Use of substitution will not adversely affect:

- Dimensions shown on Drawings.
- Construction schedule and date of completion.
- Work of other trades.
- Maintenance service and replacement parts for proposed substitution will be readily available in Clovis area.

Any changes to Contract Sum related to use of proposed substitution are included in price listed below. CONTRACTOR waives claims for additional costs related to acceptance of substitution which may subsequently become apparent.

Costs of modifying project design caused by use of proposed substitution which subsequently become apparent will be paid for by CONTRACTOR.

If substitution request is accepted:

- Contract Sum will be (decreased, increased) by \$ _____
- Contract Time will be (decreased, increased) by \$ _____ calendar days

Submitted By:

CONTRACTOR/SUPPLIER

ADDRESS: _____

TELEPHONE NUMBER: _____

NAME OF PERSON SUBMITTING REQUEST: _____

TITLE: _____ DATE: _____

SECTION 01 32 36

VIBRATION MONITORING AND DIGITAL VIDEO RECORDING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Vibration monitoring shall be performed in, and around historic structures identified on the drawings and to include
 - 1. Residential and commercial structures within 50 feet of the construction activities.
 - 2. Any other pertinent structures or facilities within 50 feet of the construction activities, such as walls, fences, roadway intersections, etc.
 - 3. And as directed by the Engineer.
- B. Vibration monitoring shall be performed to determine if potentially damaging vibrations to the structures are created as a result of construction activities.
- C. Video recordings shall be provided at locations specified in the Technical Provisions and in areas requiring vibration monitoring.
- D. The Contractor shall furnish all labor, tools, equipment, materials, and other appurtenances.

1.02 DESCRIPTION

- A. Perform vibration monitoring and video recordings in and around all engineered structures, sensitive features and construction areas as indicated in the General Notes of the plans and as determined by the vibration risk survey, or as directed by the OWNER'S Project Manager. Sensitive features may include archaeological sites, historical features, utilities, and historic structures, watercourses, and other areas subject to damage or erosion.
- B. Perform vibration monitoring and digital video recordings to determine if potentially damaging vibrations to engineered structures and sensitive features are created as a result of construction activity. Up to sixty (60) engineered structures and/or sensitive features shall be vibration monitored and digitally video recorded.

1.03 MATERIALS – Vacant

1.04 CONSTRUCTION REQUIREMENTS

A. General

1. Vibration monitoring consists of the following:
 - a. Vibration risk survey of all engineered structures and/or sensitive features within the influence zone of construction activity to determine size and locations of any existing cracks and other defects in any sensitive features.
 - b. Use of a seismograph, by a qualified vibration specialist, to monitor vibration levels in the zone of influence during blasting and nearby construction.
 - c. Immediate notification of the OWNER’S Project Manager, if visual inspection or seismograph readings indicate that damage to any engineered structure and/or sensitive feature is occurring due to vibrations.

2. Digital video recordings consist of the following:
 - a. Record in both directions along the PROJECT sites and pipeline corridor and along roadways to be constructed or reconstructed. Ensure that these digital video recordings pick up existing utilities within the corridor as well as existing drainage patterns. The maximum speed of camera movement shall not exceed 4 ft/s;
 - b. Pre-construction digital video recordings for each area on the project shall take place not more than fourteen (14) days prior to beginning construction in that area or as directed by the Project Manager.
 - c. During all digital video recordings, provide a clear audio explanation in English of significant features observed during recordings.
 - d. Any notification of any damage or any concerns/remedies resulting from construction activities shall be immediately relayed to the OWNER’S Project Manager.
 - e. Record building structure front and side views, including close-ups of each view, for any features or facilities that may be affected by construction. Where cracks exist on building structures place a scale next to the crack and record to show the existing crack size. Such building features may include, but are not limited to, all buildings, fences, garden walls, and landscaping adjacent to the project limits.
 - f. Record the construction area immediately following rainfall over the area to ascertain drainage patterns. This digital video recording shall take place before commencing construction when possible.

- g. Digital video recording equipment and operator shall be onsite within ½ hour at the OWNER’S Project Manager’s request.
 - h. The digital video viewing system and the appropriate digital video recordings should be available for meetings as scheduled, and at the request of the Project Manager.
 - i. The quality of the visual and audio portions of the digital video recordings, and the method of indexing locations on the recordings, shall be acceptable to the Project Manager. Recordings or portions of recordings deemed defective or substandard shall be re-recorded.
- B. Condition Survey of Engineered Structures and Sensitive Features. Conduct a vibration risk survey of any engineered structures and/or sensitive features within the influence zone of construction activity.
- 1. Submit to the OWNER’S Project Manager, a report documenting conditions of all potentially affected engineered structures and/or sensitive features within the survey influence zone or as shown in the Contract.
 - 2. Include the following information from the survey, for each engineered structure and/or sensitive feature:
 - a. The age, foundation, and above-ground Structure type or sensitive feature.
 - b. Provisions for water drainage from roof and around foundation exterior.
 - c. The age, type, and condition of any sensitive utility.
 - d. Documentation (in the form of drawing, photographs, or digital video recording) of the size and location of all cracks, and the type and location of all structural defects.
- C. Equipment
- 1. Seismograph Equipment. Provide seismograph(s) with self-triggering unit(s), approved by the OWNER’S Project Manager, and capable of recording three mutually perpendicular components of ground motion time histories, in terms of velocity. In the case of monitoring blast vibrations, provide additional capability for recording of air blast levels. Provide unit(s) capable of reporting the frequency as well as the peak values for all vibration time histories.
 - 2. Digital Video Camera Equipment
 - a. Furnish at least one digital video camcorder and appurtenances for the duration of the project. The equipment shall be capable of producing color pictures and video when the recording is viewed, equipped with audio capabilities, wind noise reducer, and equipped with a zoom lens. The camera must be capable of downloading

- digital video recordings from the camera to a Personal Computer (PC) using Microsoft operating system of Windows XP or higher.
- b. Furnish at least one digital video recording viewing system with a diagonal viewing area twenty-six inches (26”) or greater, and appurtenances for the duration of the project. The equipment shall be capable of reproducing a color picture with audio on a television screen; and capable of slow motion, stop for viewing of single picture image, and reverse controls. The viewing equipment shall be compatible with the recording equipment such that the two may be linked with a digital cable and function properly.
 - c. Supply enough DVDs, with protective cases, to record the entire construction area and adjacent areas before construction commences, and as required or directed by the OWNER’S Project Manager during and after construction. Each DVD shall be titled, recordings catalogued, dated, sequenced in chronological order, and cross-referenced. A copy of each DVD shall be submitted to the OWNER’S Project Manager. This copy shall also be titled, catalogued, dated, sequenced, and cross-referenced; and will remain the property of the Owner upon acceptance by the OWNER’S Project Manager.
- D. Seismograph Location and Usage. Place seismographs outside the engineered structure and/or sensitive feature closest to the construction activity as determined by the vibration risk survey or approved by the OWNER’S Project Manager. The transducer(s) shall be placed between the construction and the engineered structures, and/or sensitive features and coupled to the ground.
- E. Frequency of Vibration Monitoring. For all construction activity other than blasting, perform monitoring at least two times during peak construction when construction activity is occurring near the engineered structures and/or sensitive features, and at the OWNER’S Project Manager’s request.
- F. Qualification for Vibration Monitoring. Provide a qualified specialist to perform the Work and analyze the results of vibration monitoring from the following list:

J. Aimone Associates, LLC
 PO Box 748
 Chimayo, NM 87522
 (575) 838-2229

AMEC Earth and Environmental, Inc.
 8519 Jefferson NE
 Albuquerque, NM 87113
 (505) 821-1801

J R Associates
 1886 Emory Street
 San Jose, CA 95126
 (408) 293-7390

Matheson Mining Consultants
 11460 W 44th Ave, #6
 Wheat Ridge, CO 80033
 (303) 456-5638 or (303) 884-0136

Vibra-Tech Engineers, Inc.

Geo-Test, Inc.

4818 E Ben White Blvd Ste. 202
Austin, TX 78741
(512) 442-6464

8528 Calle Alameda NE
Albuquerque, NM 87113
(505) 857-0933

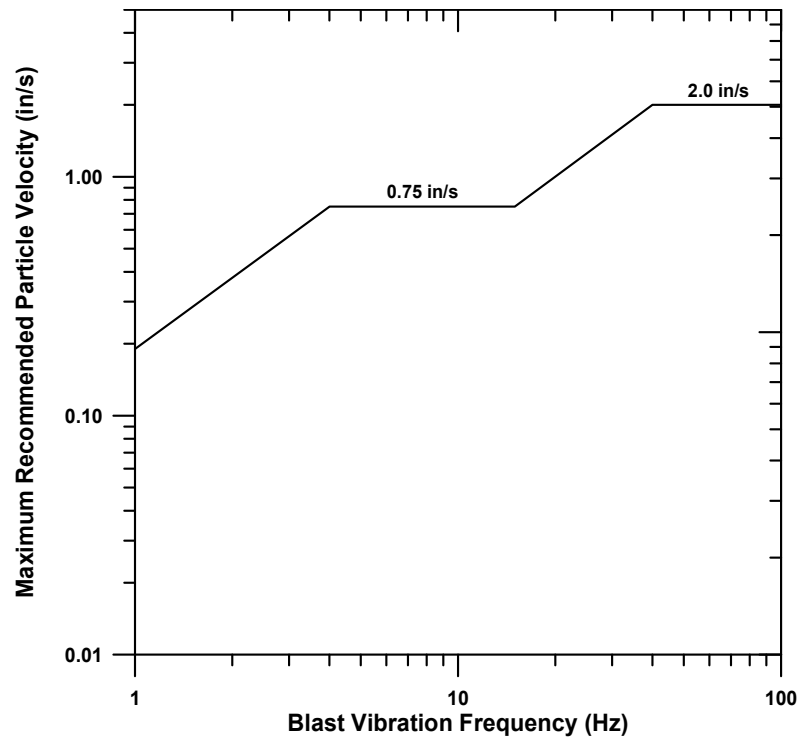
Western Technologies, Inc.
8305 Washington Place, NE
Albuquerque, NM 87113-1670
(505) 823-3388

G. Analysis of Vibration Monitoring. Submit to the OWNER'S Project Manager eight copies of a comprehensive report for each engineered structure and/or sensitive features. Each report shall include a discussion of:

1. Site conditions and description, including a site map drawn to scale showing the location of the engineered structure and/or sensitive feature and the location of the construction activity.
2. Field procedures and Equipment used, including the seismograph manufacturer, model, and unit serial number.
3. The name of the seismograph operator.
4. A hard copy of all ground vibration time histories, in units of velocity.
5. A record summary of the maximum value of ground vibration in any one of three directions measured (longitudinal, radial, or vertical), the frequency associated with the maximum value, in unit of hertz, and the measured distance between the seismograph and the construction activity.
6. Analysis of results with conclusions and recommendations.

H. In the case of blasting, the report shall also include:

1. A hard copy of the air blast time history, in units of decibels and pounds per square inch (psi), the maximum value of air blast, in decibels, and the peak air blast frequency in hertz.
2. The maximum charge weight of explosive used per 8 millisecond time delay.
3. The scaled distance factor used for design.
4. A plot of the ground motion velocity plotted against frequency for the maximum values recorded on a graph similar to that shown in Figure 1.



- I. Submit any additional inclusions to the report(s) at the direction and request of the OWNER'S Project Manager.
- J. Safe Vibration Levels for Blasting. Base safe levels of the maximum ground motions and air blast in accordance with nationally recognized standards specified by the U.S. Bureau of Mines 30 CFR Parts 715 and 817.
- K. METHOD OF MEASUREMENT
 - 1. Vibration Monitoring, Vibration Risk Survey, and Digital Video Recording will be billed on a time and materials basis.
- L. BASIS OF PAYMENT

Pay Item	Pay Unit
Vibration Monitoring and Digital Video Recording	Allowance

SECTION 01 78 00
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Comply with requirements stated in Conditions of the Contract and Specifications for administrative procedures in closing out the Work.

1.02 RELATED WORK

- A. Section 01 78 39: Record Drawings

1.03 SUBSTANTIAL COMPLETION

- A. When CONTRACTOR considers the Work is substantially complete, he shall submit to ENGINEER:
 - 1. A written notice that the Work, or designated portion thereof, is substantially complete.
 - 2. A list of items to be completed or corrected.
- B. Within a reasonable amount of time after receipt of such notice, ENGINEER will inspect to determine the status of completion.
- C. Should ENGINEER determine that the Work is not substantially complete:
 - 1. ENGINEER will promptly notify the CONTRACTOR in writing, giving the reasons therefor.
 - 2. THE CONTRACTOR shall remedy the deficiencies in the Work and send a second written notice of substantial completion to the ENGINEER.
 - 3. ENGINEER will reinspect the Work.
- D. Upon satisfactory completion of the review, the ENGINEER shall issue to the CONTRACTOR a written "Notice of Substantial Completion."

1.04 FINAL INSPECTION

- A. When CONTRACTOR considers the Work is complete, he shall submit written certification that:
 - 1. Contract Documents have been reviewed.
 - 2. Work has been inspected for compliance with Contract Documents.
 - 3. Work has been completed in accordance with Contract Documents.
 - 4. Equipment and systems have been tested in the presence of the OWNER'S representative and are operational.
 - 5. Work is completed and ready for final inspection.
- B. ENGINEERS will inspect to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should ENGINEER consider that the Work is incomplete or defective:
 - 1. ENGINEER will promptly notify the CONTRACTOR in writing, listing the incomplete or defective work.
 - 2. CONTRACTOR shall take immediate steps to remedy the stated deficiencies and send a second written certification to ENGINEER that the Work is complete.
 - 3. ENGINEERS will reinspect the Work.
- D. When the ENGINEER finds that the Work is acceptable under the Contract Documents, he shall request the CONTRACTOR to make closeout submittals.

1.05 REINSPECTION FEES

- A. Should ENGINEER perform reinspection's due to failure of the Work to comply with the claims of status of completion made by the CONTRACTOR:
 - 1. OWNER will compensate ENGINEER for such additional services.
 - 2. CONTRACTOR shall submit purchase order to pay ENGINEER at ENGINEER'S standard billing rate for all costs associated with reinspection.

1.06 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

- A. Evidence of compliance with requirements of governing authorities.
- B. Project Record Documents: Conform to requirements of Section 01 78 39.
- C. Operating and Maintenance Data and Instructions to OWNER'S personnel.
- D. Warranties and Bonds: Conform to requirements of General Conditions.
- E. Evidence of Payment and Release of Liens: Conform to requirements of General and Supplemental Conditions.
- F. Consent of Surety
- G. Certification of Labor Standards.

1.07 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement of accounting to ENGINEER.
- B. Statement shall reflect all adjustments to the Contract Sum:
 - 1. The original Contract Sum.
 - 2. Additions and deductions resulting from:
 - a. Previous Change Orders.
 - b. Allowances.
 - c. Unit Prices.
 - d. Deductions from uncorrected Work.
 - e. Deductions for liquidated damages.
 - f. Deductions for reinspection payments.
 - g. Other adjustments.
 - 3. Total Contract Sum, as adjusted.
 - 4. Previous payments.
 - 5. Sum remaining due.
- C. ENGINEER will prepare a final Change Order, reflecting approved adjustments to the Contract Sum not previously made by Change Orders.

1.08 FINAL APPLICATION FOR PAYMENT

- A. CONTRACTOR shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Maintain for the OWNER at the site one record copy of:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. ENGINEER field orders or written instructions.
 - 6. Approved shop drawings, product data and samples.
 - 7. Approved Operation and Maintenance data.
 - 8. Field test records.
 - 9. Receipts for delivery of items to OWNER.

1.02 RELATED WORK

- A. Section 01 33 00: Contractor Submittals

1.03 QUALITY ASSURANCE

- A. General: Delegate the responsibility for maintenance of recorded documents to one person on the Contractor's staff who is approved in advance by the ENGINEER.
- B. Accuracy of Records: Thoroughly coordinate all changes within the record documents, making adequate and proper entries on each page of specifications and each sheet of drawings and other documents where such entry is required to properly show the change. Accuracy of records shall be such that future searches for items shown in the contract documents may reasonably rely on information obtained from the approved record documents.
- C. Timing of Entries: Make all entries within 24 hours after receipt of information.

1.04 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in Contractor's field office separately from documents used for construction.
 - 1. Provide files and racks for storage of documents.
 - 2. Provide locked cabinet or secure storage space for storage of samples.
- B. File documents and samples in accordance with specification format.
- C. Maintenance:

1. Maintain documents in a clean, dry, legible condition and in good order.
2. Do not use record documents for construction purposes.

D. Always make documents and samples available for inspection by ENGINEER and OWNER.

1.05 MARKING DEVICES

A. Provide felt-tip marking pens for recording information in a color code acceptable to ENGINEER.

1.06 RECORDING

A. Label each document "PROJECT RECORD" in neat, large, printed letters.

B. Record information concurrently with construction progress.

C. Do not conceal any work until required information is recorded.

D. Drawings: Legibly mark to record actual construction of:

1. Depths of various elements of foundation in relation to established data.
2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
4. Field changes of dimension and detail.
5. Changes made by Field Order or Change Order.
6. Details not on original contract Drawings.
7. Sewer lines:
 - a. Invert elevations at manholes, line and manhole alignment and locations.
 - b. Location of each service line, referenced by distances from downstream manhole and sewer centerline to end of service line.
8. Facility:
 - a. Flow line elevations from the entrance works to the discharge.
 - b. Location of all valves.
9. Demolished features:
 - a. Locations and inverts of all pipe terminations/plugs
 - b. Locations of all electrical wiring terminations.

E. Specifications and addenda: Legibly mark each section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment installed.
2. Changes made by Field Order or Change Order.

1.07 SUBMITTAL

A. At Contract close-out, deliver Record Documents to ENGINEER for the OWNER.

- B. Accompany submittal with transmittal letter in duplicate, containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. Title and number of each Record Document.
 - 5. Signature of Contractor or his authorized representative.

1.08 PAYMENT

- A. Project record documents are incidental to the Work for which no separate payment will be made.
- B. No payment will be made to the Contractor on any portion of the work for which project record documents, including recording, are not complete.

END OF SECTION

SECTION 31 23 33

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Trenching, backfilling, and compacting for buried pipes.
- B. Bedding of buried pipes.

1.02 RELATED WORK

- A. Section 33 30 00: Sanitary Sewerage Systems
- B. Section 03 30 00: Concrete Work

1.03 REFERENCES

- A. ATSM D2774, "Underground Installation of Thermoplastic Pressure Piping."
- B. ATSM D2321, "Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications."
- C. AWWA C604, "Installation of Ductile Iron Water Mains and Their Appurtenances."

1.04 SUBMITTALS

- A. Testing laboratory results on bedding materials to demonstrate compliance with Specifications.

1.05 JOB CONDITIONS

- A. All trenching is unclassified.
- B. Protect adjacent structures and surrounding areas.
- C. Work to remain within available easements.

D. Weather:

1. No backfill placement during freezing weather.
2. No frozen materials, ice, or snow in backfill or fill.
3. No backfill or fill on frozen surfaces.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bedding Materials:

1. Bedding materials are those materials located a maximum of 8" below bottom of pipe.
2. Native materials not meeting the acceptable gradation standard shall require fill to be placed for bedding defined as Class II or Class III per ASTM D2487 (Unified Soil Classification System).
3. Cast or Ductile Iron Pipe:
 - a. Any granular material free from cinders, ashes, refuse, organic material, boulders, rocks, or stones 3" in diameter or larger, or frozen soil.
4. Thermoplastic Pressure Pipe:
 - a. As recommended by the manufacturer.
 - b. Any native granular material with a maximum rock size as follows:
 - i. ½" for pipe up to 4 inches
 - ii. ¾" for pipes 6 inches to 8 inches
 - iii. 1" for pipes 10 inches to 16 inches
 - iv. 1 ½" for pipes greater than 16 inches
 - c. Select a fill consisting of gravel and sands meeting Class II or Class III of ASTM D2487.
5. Thermoplastic Non-Pressure Sewer Pipe
 - a. As recommended by the manufacturer.
 - b. Any native granular material with a maximum rock size as follows:
 - i. ½" for pipe up to 4 inches
 - ii. ¾" for pipes 6 inches to 8 inches
 - iii. 1" for pipes 10 inches to 16 inches
 - iv. 1 ½" for pipes greater than 16 inches

- c. Select a fill consisting of gravel and sands meeting Class II or Class III of ASTM D2487.
 - 6. Concrete:
 - a. Any granular material with maximum rock size less than ¾" may be used for bedding material.
 - 7. Corrugated Metal Pipe:
 - a. Any granular material with maximum rock size less than ¾" may be used for bedding material.
- B. Initial Backfill Materials:
 - 1. Initial backfill is that material placed above the bedding material, around and over the pipe to a height 12" above the pipe.
 - 2. Native material:
 - a. Use excavated material (native material) from the excavated trench unless gradation requirements cannot be met.
 - b. Same as bedding material if native material is unacceptable.
- C. Final Backfill Materials:
 - 1. Backfill materials are those materials placed in the trench between the initial backfill material and the top of the trench.
 - 2. Native material:
 - a. Use excavated material (native material) from the excavated trench unless gradation requirements cannot be met.
 - b. Same as bedding material if native material is unacceptable.
- D. Materials Not Allowed:
 - 1. All pipe bedding and backfill material shall be free from refuse, organic material, cobbles, boulders, large rocks or stones, and frozen soil.
 - 2. Mine tailings shall not be used for pipe bedding or backfill material.

PART 3 EXECUTION

3.01 BLASTING

- A. Comply with all laws, regulations, and ordinances relative to the handling, storage and use of explosives, and the protection of life and property.
- B. Confine all materials lifted by blasting to limits of excavation or trench area.

- C. Repair any damage caused by blasting.
- D. Separate rock, that cannot be handled and compacted as earth, from other excavated matter; do not mix with backfill or embankment materials.

3.02 SHEETING

- A. Use it when necessary to protect facilities adjacent to work areas.
- B. If used, cut off at top of pipe and leave in place unless removal is specifically approved by Engineer.
- C. Cost for sheeting or shoring to be included as part of trench excavation unless a specific line item is in the Bid Proposal.

3.03 STABILIZATION

- A. Thoroughly compact and consolidate trench bottoms so they remain firm, dense, and intact during required construction activities.
- B. Remove all mud and muck during excavation.
- C. Reinforce trench bottom with crushed rock or gravel if it becomes mucky during construction activities.
- D. Allow no more than ½" depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon.
- E. Where trench bottoms out in rock, rock is to be removed to 8" below bottom of pipe and replaced with bedding material.

3.04 TRENCH EXCAVATION

- A. Do not open more trenches in advance of pipe being laid than is necessary to expedite the work (not to exceed 600').
- B. Except where jacking and boring is indicated on the Drawings, or is specified or permitted by Engineer, excavate trenches by open cut from the surface.
- C. Alignment, grade, and minimum cover:
 - 1. Establish alignment and grade or elevation from offset stakes.

2. Excavate trenches so pipes can be laid straight at uniform grade, without dips or bumps, between the terminal elevations indicated on the Drawings.
3. Comply with pipe specification sections regarding vertical and horizontal alignment and max joint deflection.
4. Water lines to have minimum bury as shown on the Drawings.
5. In general, grade shall follow surface contours unless otherwise shown on the Drawings.

D. Limiting trench widths:

1. Excavate to a width able to provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment.
2. If needed to reduce earth loads to prevent sloughing, cut banks back on slopes extending not lower than 1' above the top of the pipe.
3. Minimum trench widths and minimum clearances between installed pipe and trench wall:
 - a. Pipe size 18" or less:
 - i. Minimum trench width: O.D. plus 16".
 - ii. Minimum clearance: 8".
 - b. Pipe size larger than 18":
 - i. Minimum trench width: O.D. plus 24".
 - ii. Minimum clearance: 12".

E. Mechanical excavation:

1. Do not use where its operation would damage trees, buildings, culverts or other existing property, structures, or utilities above or below ground; only hand excavate in such areas.
2. Use mechanical equipment of a type, design, and construction, operated so that:
 - a. Rough trench bottom elevation can be controlled.
 - b. Uniform trench widths and vertical sidewalls are obtained from 1' above the top of the installed pipe to the bottom of the trench.
 - c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls.
3. Do not undercut trench sidewalls.

- F. Cuts in Surface Construction:
1. No larger than necessary to provide adequate working space.
 2. Cut a clean groove not less than 1½" deep along each side of trench or around perimeter of excavation area.
 3. Remove pavement and base pavement to provide shoulder not less than 6" wide between cut edge and top edge of trench.
 4. Do not undercut trenches that would result in bottom trench width being greater than top width.
 5. Make pavement cuts to and between straight or accurately marked curved lines parallel to trench centerline or limits of excavation.
 6. Where the trench crosses drives or other surface construction, remove and replace the surface construction between saw cuts as specified for pavement.

G. Excavation Below Pipe Standards:

1. Except as otherwise required, excavate trenches below the underside of pipes, as indicated on the Drawings, to provide for installation of granular embedment pipe foundation material.
2. Where in earth:
 - a. Trench bottoms for 6" and smaller pipes may be excavated below pipe subgrade and granular embedment provided.
 - b. Trench may be graded to provide uniform and continuous support (between bell bores or end joints) of the installed pipe.
 - c. Contractor's option.

H. Bell Holes:

1. Excavate to provide adequate clearance for tools and methods of pipe installation.
2. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined.

3.05 PIPE BEDDING

- A. Bedding material as required.

- B. Provide uniform and continuous support to pipe barrels except at bell holes in all cases; no bridging will be allowed.
- C. Pipe to be bedded to the springline of the pipe and compacted as shown in plans.

3.06 INITIAL BACKFILL

- A. From springline of pipe to 12" above pipe.
- B. Lift thickness: 18" (loose)
- C. Compacted as shown on the plans.

3.07 FINAL BACKFILL

- A. Material as defined by applicable reference for installation for type of pipe used.
- B. Private roads:
 - 1. Initial Backfill: Compact to 95% ASTM D-1557
 - 2. Final Backfill: Compact to 95% ASTM D-1557
- C. Public right of ways (i.e. City, County, State, Federal)
 - 1. Initial Backfill: Compact to 95% ASTM D-1557
 - 2. Final Backfill: Compact to 95% ASTM D-1557
- D. Lift Thickness
 - 1. NMDOT – 8" loose lift (maximum)
 - 2. All other undefined locations – 8" loose lift (maximum)
- E. Upper 12" of trench shall contain no particles larger than 6" in any dimension.
- F. Surface Finish:
 - 1. For placement of paving or gravel surfacing, subgrade where applicable.
 - 2. Match existing and surrounding contours.
 - 3. Graded finished appearance.

3.08 FIELD QUALITY CONTROL

- A. One proctor and gradation for each backfill material.
- B. One field density for each 250 linear feet of trench per lift.
- C. One density at each service.

END OF SECTION

SECTION 03 05 33
HIGH DENSITY POLYETHYLENE (HDPE)
PIPE & FITTINGS

1.01 WORK INCLUDED

- A. This specification includes but is not limited to high density polyethylene (PE 3408) pressure pipe primarily intended for the transportation of water and sewage either buried or above grade.

1.02 REFERENCE STANDARDS

<u>Reference:</u>	<u>Title:</u>
AWWA C901	Polyethylene (PE) pressure Pipe & Tubing, ½ inch through 3 inch for water service
AWWA C906	Polyethylene (PE) pressure Pipe & Fittings, 4inch through 63 inch for water distribution
ASTM D3035	Standard Spec for PE Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3261	Butt Heat Fusion PE Fittings for PE Pipe & Tubing
ASTM D3350	Standard Specification for PE Pipe & Fittings Materials
ASTM D1238	Melt Flow Index
ASTM D1505	Density of Plastics
ASTM D2837	Hydrostatic Design Basis
NSF Standard #14	Plastic Piping Components & Related Materials

1.03 SUBMITTALS

- A. Submit product data and manufacturer's recommended installation for all supplied items.

1. HDPE Pipe & Fittings
2. Warning Tape
3. Copper Tracer Wire

1.04 GENERAL REQUIREMENTS

- A. Use: High Density Polyethylene (HDPE) pipes/fittings shall be allowed for use as water, wastewater, and reclaimed water pressure pipe where compatible with the specific conditions of the project. All materials used in the production of water main piping shall be approved by the National Sanitation Foundation (NSF).
- B. Documentation:
1. Documentation from the resin's manufacturer showing results of the following tests for resin identification:
 - a. Melt Flow Index ASTM D1238
 - b. Density ASTM D1505
- C. Manufacturer: All HDPE pipe and fittings shall be from a single manufacturer, who is fully experienced, reputable, and qualified in the manufacture of the HDPE pipe to be furnished. The pipe shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications. Qualified manufacturers shall be PLEXCO Division of Chevron Chemical Company, DRISCOPIPE as manufactured by Phillips Products Co., Inc., or equal as approved by the Owner or Owner's Representative.
- D. Finished Product Evaluation:
1. Production staff shall check each length of pipe produced for the items listed below. The results of all measurements shall be recorded on production sheets, which become part of the manufacturer's permanent records.
 - a. Pipe process shall be checked visually, inside, and out for cosmetic defects (grooves, pits, hollows, etc.)
 - b. Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM F714 or ASTM D3035, whichever is applicable.
 - c. Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference of both ends of the pipe to ensure conformance with ASTM F714 or ASTM D3035, whichever is applicable.
 - d. Pipe length shall be measured.
 - e. Pipe marking shall be examined and checked for accuracy.
 - f. Pipe ends shall be checked to ensure they are cut square and clean.
 - g. Subject inside surface to a "reverse bend test" to ensure pipe is free of oxidation (brittleness)
- E. Stress Regression Testing: The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacture of this product. This stress regression testing shall have been

done in accordance with ASTM D2837 and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined in accordance with ASTM D2837.

- F. Compatibility: Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.
- G. Warranty: The pipe MANUFACTURER shall provide a warranty against manufacturing defects of material and workmanship for a period of ten years after the final acceptance of the project by the Owner or Owner's Representative. The MANUFACTURER shall replace at no expense to the Owner any defective pipe/fitting material including labor within the warranty period.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Materials for Pipe Sizes 4-inch Diameter and Larger:

1. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 high density polyethylene resin compound meeting cell classification 345464C per ASTM D3350; and meeting Type III, Class C, Category 5, Grade P34 per ASTM D1238.
2. The High-Density Polyethylene (HDPE) pipe shall comply with AWWA Specifications C906.
3. Dimensions and workmanship shall be as specified in ASTM F714. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.
4. HDPE pipe and accessories 4-inch diameter and larger, shall be 160 psi at 73.4°F meeting the requirements of SDR 11 as minimum strength unless otherwise noted on the plans. Pipe shall be IPS.

B. Materials for Pipe Sizes 2-inch Diameter and Less:

1. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 high density polyethylene resin compound meeting cell classification 345464C per ASTM D3350; and meeting Type III, Class C, Category 5, Grade P34 per ASTM D1238.
2. The High-Density Polyethylene (HDPE) pipe shall comply with AWWA Specifications C901.

3. Dimensions and workmanship shall be as specified in ASTM D3035. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.
 4. HDPE pipe and accessories 2-inch diameter and less, shall be 200 psi at 73.4°F meeting the requirements of SDR 7 as minimum strength. Pipe shall be IPS.
- C. Pipe Fittings: All molded fittings and fabricated fittings shall be fully pressure rated to match the pipe SDR pressure rating to which they are made. All fittings shall be molded or fabricated by the manufacturer. No Contractor fabricated fittings shall be used unless approved by the Owner or Owner's Representative.

The manufacturer of the HDPE pipe shall supply all HDPE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the drawings and specified herein.

All fittings shall be installed using butt-fused fittings, thermo-fused fittings/couplings, or flanged adapters and must be approved by the Owner or Owner's Representative. No size on wet taps shall be permitted.

All transitions from HDPE pipe to ductile iron or PVC shall be made per the approval of the Owner or his/her representative and per the HDPE pipe manufacturer's recommendations and specifications. A molded flange connector or mechanical joint adapter within a carbon steel back-up ring assembly shall be used for pipe type transitions. Ductile iron back-up rings shall mate with cast iron flanges per ANSI B16.1. A 316 stainless steel back-up ring shall mate with a 316 stainless steel flange per ANSI B16.1.

- D. Warning Tape: Metallic impregnated warning tape shall be blue in color with "Caution – Buried Water Line Below" continuously printed on it for water line pipe. Metallic impregnated warning tape shall be green in color with "Caution – Sewerline Below" continuously printed on it for sewer line pipe. The tape shall be a minimum of 3-inches wide, 5 mils total thickness, composed of plastic with a metal foil core, and equal to Traceline Detectable for Underground Utility Marking Tape. Where copper tracer wire is buried with the pipeline, the locator/warning tape shall be plastic without metal foil. The warning tape shall be installed above the pipe with an 18-inch maximum bury depth.

E. Copper Tracer Wire:

1. Wire: 12-gauge single strand copper polyethylene insulated tracing wire, type THHN/THWN.
2. Installation/Termination: Tracer wire shall be securely attached to the top of the pipe a minimum of three (3) times for each pipe length. The wire shall be properly grounded at all valve boxes, fire hydrants, and flush hydrants. For terminations at hydrants, the wire is to extend up through the interior and is to be affixed to the safety flange bolt. For gate valve boxes, the wire is to extend up through the interior and is to be affixed to a

Contractor installed bolt located 6-inches below the cover. Adequate tracer wire slack shall be maintained to allow for easy access.

2.02 JOINTING METHOD

- A. The pipe shall be joined with butt, heat fusion joints as outlined in ASTM D2657. All joints shall be made in strict compliance with the manufacturer's recommendations. A factory qualified joining technician as designated by the pipe manufacturer or experienced, trained technician shall perform all heat fusion joints in the presence of the Owner or Owner's Representative.
- B. Lengths of pipe shall be assembled into suitable installation lengths by the butt-fusion process. All pipes so joined shall be made from the same class and type of raw material made by the same raw material supplier.
- C. On days butt fusions are to be made, the first fusion shall be a trial fusion in the presence of the Owner or his/her representative. The following shall apply:
 - 1. Heating plates shall be inspected for cuts and scrapes. The plate temperature shall be measured at various locations to ensure proper heating/melting per manufacturer's recommendations and approval by Owner or Owner's Representative.
 - 2. The fusion or test section shall be cut out after cooling completely for inspection.
 - 3. The test section shall be 12-inches or 30 times (minimum) the wall thickness in length and 1-inch or 1.5 times the wall thickness in width (minimum).
 - 4. The joint shall be visually inspected as to continuity of "beads" from the melted material, and for assurance of "cold joint" prevention (i.e. – joint shall have visible molded material between walls of pipe). Joint spacing between the walls of the two ends shall be a minimum of 1/16 inch to a maximum of 3/16 inch.
- C. The polyethylene flange adapters at pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion resisting bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturer's specified torques. Bolts shall be tightened alternatively and evenly. After installation apply a bitumastic coating to bolts and nuts.

PART 3 EXECUTION

3.01 INSTALLATION

- A. High Density Polyethylene (HDPE) Pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the drawings and as specified herein. A factory qualified joining technician as designated by the pipe manufacturer shall perform all heat fusion joints.
- B. HDPE shall be installed either by Open Trench Construction or Directional Bore Method.
- C. Care shall be taken in loading and transporting and unloading to prevent injury to the pipe. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the Owner or Owner's Representative. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense.
- D. Under no circumstances shall the pipe or accessories be dropped into the trench or forced through a directional bore upon "pull-back".
- E. Care shall be taken during transportation of the pipe such that it will not be cut, kinked, or otherwise damaged.
- F. Ropes, fabric, or rubber protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe.
- G. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
- H. r
- I. ts.
- J. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches, or gouges on the exterior of the pipe is 5 percent of the wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches.
- K. Pipe shall be laid to lines and grade shown on the drawings with bedding and backfill as shown on the drawings.

- L. When laying pipe is not in progress, including lunchtime, the open ends of all on-site pipe shall be closed by fabricated plugs, or by other approved means.
- M. Sections of pipe with cuts, scratches or gouges exceeding 5 percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined.
- N. The pipe shall be joined by the method of thermal butt fusion, as outlined in Section 2.01 above. All joints shall be made in strict compliance with the manufacturer's recommendations.
- O. Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections which shall consist of the following:
 - 1. A polyethylene flange shall be thermally butt-fused to the stub end of the pipe.
 - 2. A 316 stainless steel back up ring shall mate with a 316 stainless steel flange.
 - 3. 316 stainless steel bolts and nuts shall be used.
- P. Flange connections shall be provided with a full-face neoprene gasket.
- Q. All HDPE pipes must be at the temperature of the surrounding soil at the time of backfilling and compaction.
- R. If a defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.
- S. Open Trench Installation:
 - 1. Trenching and backfilling operations shall be performed as specified in Section 31 23 33 – TRENCHING.
 - 2. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.
 - 3. Good alignment shall be preserved during installation. Deflection of the pipe shall occur only at those places on design drawings and as approved by the Owner's representative. Fittings, in addition to those shown on the drawings, shall be used only if necessary or required by the Owner or Owner's

Representative.

4. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be “pulled” or “cramped”.
5. Precautions shall be taken to prevent flotation of the pipe in the trench.
6. When moveable trench bracing such as trench boxes, moveable sheeting, shoring, or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, movable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. As trench boxes, movable sheeting, shoring, and plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.
7. Restrained joints shall be installed where shown on the drawings or as directed by the Owner or Owner’s Representative.

3.02 PIPE CLEANING

- A. At the conclusion of the work, thoroughly clean all the new pipelines to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period by forcing a cleaning swab through all mains 6-inch or greater. Flushing velocities shall be a minimum of 2.5 feet per second. All flushing shall be coordinated with the Owner or Owner’s Representative. Debris cleaned from the lines shall be removed from the job site.

3.03 TESTING

- A. Pressure testing shall be conducted per the Manufacturer’s recommendations and as approved by the Owner or his/her representative.
- B. All HDPE mains shall be field-tested. The contractor shall supply all labor, equipment, material, gages, pumps, meters, and incidentals required for testing. Each main shall be pressure tested upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing.
- C. All mains shall be tested at 120 PSI for 4 hours minimum unless otherwise approved by the Owner or Owner’s Representative.
- D. Pressure testing procedure shall be per manufacturer’s recommendations or in accordance with ASTM F2164 as follows:
 1. Restrain test section against movement.

2. Fill line slowly with water to remove air.
 3. Expel air completely from the line during filling and again before applying test pressure. Air shall be expelled by means of taps at points of highest elevation.
 4. Apply initial test pressure and allow to stand without makeup pressure for four hours, to allow for diametric expansion or pipe stretching to stabilize.
 5. After this equilibrium period, reduce test pressure by 10 PSI and turn the pump off. The final test pressure shall be held for one hour. If pressure stays within 5% of reduced pressure then the test passes.
 6. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the Owner or his/her representative at the point where the pressure is being monitored and shall be shown on the recorded pressure read-out submitted to the Owner.
- E. If any test of pipe laid disclosed leakage significant pressure drop greater than the manufacturer's recommended loss, the Contractor shall, at his/her own expense, locate and repair the cause of leakage and retest the line.
- F. All visible leaks are to be repaired regardless of the amount of leakage.

3.04 SITE CLEAN UP

- A. Upon completion of the work, the entire site shall be cleared of all debris, and the ground surface shall be finished to smooth and uniform slopes. Cleanup shall be considered an incidental item, and no additional payment shall be made for it

3.05 AS-BUILT INFORMATION

- A. The Contractor shall be responsible for keeping accurate records of all installed items under this section of the specifications and indicating revisions of the furnished construction drawings in sufficient detail to be accepted by the Owner for as-built drawings. Sufficient detail under this contract means that the Contractor shall take accurate measurements and record them on the drawings to provide the minimum information of at least two swing ties and distances to permanent objects and/or marker posts for all valves, pressure reducing valves, air and vacuum valves, hydrants, connections to other lines, and bends; the

beginning, end of any stabilization material placed; the beginning, end, and depth to rock encountered; the beginning, end, and depth of any encasement installed; and the location and depth of any other utilities encountered.

- B. The recording of the as-built information is considered an integral part of the progress of this construction and shall be reviewed with the Owner or Owner's Representative in determining progress under this contract.

END OF SECTION

SECTION 03 05 33
HIGH DENSITY POLYETHYLENE (HDPE)
PIPE & FITTINGS

1.01 WORK INCLUDED

- A. This specification includes but is not limited to high density polyethylene (PE 3408) pressure pipe primarily intended for the transportation of water and sewage either buried or above grade.

1.02 REFERENCE STANDARDS

<u>Reference:</u>	<u>Title:</u>
AWWA C901	Polyethylene (PE) pressure Pipe & Tubing, ½ inch through 3 inch for water service
AWWA C906	Polyethylene (PE) pressure Pipe & Fittings, 4inch through 63 inch for water distribution
ASTM D3035	Standard Spec for PE Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3261	Butt Heat Fusion PE Fittings for PE Pipe & Tubing
ASTM D3350	Standard Specification for PE Pipe & Fittings Materials
ASTM D1238	Melt Flow Index
ASTM D1505	Density of Plastics
ASTM D2837	Hydrostatic Design Basis
NSF Standard #14	Plastic Piping Components & Related Materials

1.03 SUBMITTALS

- A. Submit product data and manufacturer's recommended installation for all supplied items.

1. HDPE Pipe & Fittings
2. Warning Tape
3. Copper Tracer Wire

1.04 GENERAL REQUIREMENTS

- A. Use: High Density Polyethylene (HDPE) pipes/fittings shall be allowed for use as water, wastewater, and reclaimed water pressure pipe where compatible with the specific conditions of the project. All materials used in the production of water main piping shall be approved by the National Sanitation Foundation (NSF).
- B. Documentation:
1. Documentation from the resin's manufacturer showing results of the following tests for resin identification:
 - a. Melt Flow Index ASTM D1238
 - b. Density ASTM D1505
- C. Manufacturer: All HDPE pipe and fittings shall be from a single manufacturer, who is fully experienced, reputable, and qualified in the manufacture of the HDPE pipe to be furnished. The pipe shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications. Qualified manufacturers shall be PLEXCO Division of Chevron Chemical Company, DRISCOPIPE as manufactured by Phillips Products Co., Inc., or equal as approved by the Owner or Owner's Representative.
- D. Finished Product Evaluation:
1. Production staff shall check each length of pipe produced for the items listed below. The results of all measurements shall be recorded on production sheets, which become part of the manufacturer's permanent records.
 - a. Pipe process shall be checked visually, inside, and out for cosmetic defects (grooves, pits, hollows, etc.)
 - b. Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM F714 or ASTM D3035, whichever is applicable.
 - c. Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference of both ends of the pipe to ensure conformance with ASTM F714 or ASTM D3035, whichever is applicable.
 - d. Pipe length shall be measured.
 - e. Pipe marking shall be examined and checked for accuracy.
 - f. Pipe ends shall be checked to ensure they are cut square and clean.
 - g. Subject inside surface to a "reverse bend test" to ensure pipe is free of oxidation (brittleness)
- E. Stress Regression Testing: The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacture of this product. This stress regression testing shall have been

done in accordance with ASTM D2837 and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined in accordance with ASTM D2837.

- F. Compatibility: Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.
- G. Warranty: The pipe MANUFACTURER shall provide a warranty against manufacturing defects of material and workmanship for a period of ten years after the final acceptance of the project by the Owner or Owner's Representative. The MANUFACTURER shall replace at no expense to the Owner any defective pipe/fitting material including labor within the warranty period.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Materials for Pipe Sizes 4-inch Diameter and Larger:

1. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 high density polyethylene resin compound meeting cell classification 345464C per ASTM D3350; and meeting Type III, Class C, Category 5, Grade P34 per ASTM D1238.
2. The High-Density Polyethylene (HDPE) pipe shall comply with AWWA Specifications C906.
3. Dimensions and workmanship shall be as specified in ASTM F714. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.
4. HDPE pipe and accessories 4-inch diameter and larger, shall be 160 psi at 73.4°F meeting the requirements of SDR 11 as minimum strength unless otherwise noted on the plans. Pipe shall be IPS.

B. Materials for Pipe Sizes 2-inch Diameter and Less:

1. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 high density polyethylene resin compound meeting cell classification 345464C per ASTM D3350; and meeting Type III, Class C, Category 5, Grade P34 per ASTM D1238.
2. The High-Density Polyethylene (HDPE) pipe shall comply with AWWA Specifications C901.

3. Dimensions and workmanship shall be as specified in ASTM D3035. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.
 4. HDPE pipe and accessories 2-inch diameter and less, shall be 200 psi at 73.4°F meeting the requirements of SDR 7 as minimum strength. Pipe shall be IPS.
- C. Pipe Fittings: All molded fittings and fabricated fittings shall be fully pressure rated to match the pipe SDR pressure rating to which they are made. All fittings shall be molded or fabricated by the manufacturer. No Contractor fabricated fittings shall be used unless approved by the Owner or Owner's Representative.

The manufacturer of the HDPE pipe shall supply all HDPE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the drawings and specified herein.

All fittings shall be installed using butt-fused fittings, thermo-fused fittings/couplings, or flanged adapters and must be approved by the Owner or Owner's Representative. No size on wet taps shall be permitted.

All transitions from HDPE pipe to ductile iron or PVC shall be made per the approval of the Owner or his/her representative and per the HDPE pipe manufacturer's recommendations and specifications. A molded flange connector or mechanical joint adapter within a carbon steel back-up ring assembly shall be used for pipe type transitions. Ductile iron back-up rings shall mate with cast iron flanges per ANSI B16.1. A 316 stainless steel back-up ring shall mate with a 316 stainless steel flange per ANSI B16.1.

- D. Warning Tape: Metallic impregnated warning tape shall be blue in color with "Caution – Buried Water Line Below" continuously printed on it for water line pipe. Metallic impregnated warning tape shall be green in color with "Caution – Sewerline Below" continuously printed on it for sewer line pipe. The tape shall be a minimum of 3-inches wide, 5 mils total thickness, composed of plastic with a metal foil core, and equal to Traceline Detectable for Underground Utility Marking Tape. Where copper tracer wire is buried with the pipeline, the locator/warning tape shall be plastic without metal foil. The warning tape shall be installed above the pipe with an 18-inch maximum bury depth.

E. Copper Tracer Wire:

1. Wire: 12-gauge single strand copper polyethylene insulated tracing wire, type THHN/THWN.
2. Installation/Termination: Tracer wire shall be securely attached to the top of the pipe a minimum of three (3) times for each pipe length. The wire shall be properly grounded at all valve boxes, fire hydrants, and flush hydrants. For terminations at hydrants, the wire is to extend up through the interior and is to be affixed to the safety flange bolt. For gate valve boxes, the wire is to extend up through the interior and is to be affixed to a

Contractor installed bolt located 6-inches below the cover. Adequate tracer wire slack shall be maintained to allow for easy access.

2.02 JOINTING METHOD

- A. The pipe shall be joined with butt, heat fusion joints as outlined in ASTM D2657. All joints shall be made in strict compliance with the manufacturer's recommendations. A factory qualified joining technician as designated by the pipe manufacturer or experienced, trained technician shall perform all heat fusion joints in the presence of the Owner or Owner's Representative.
- B. Lengths of pipe shall be assembled into suitable installation lengths by the butt-fusion process. All pipes so joined shall be made from the same class and type of raw material made by the same raw material supplier.
- C. On days butt fusions are to be made, the first fusion shall be a trial fusion in the presence of the Owner or his/her representative. The following shall apply:
 - 1. Heating plates shall be inspected for cuts and scrapes. The plate temperature shall be measured at various locations to ensure proper heating/melting per manufacturer's recommendations and approval by Owner or Owner's Representative.
 - 2. The fusion or test section shall be cut out after cooling completely for inspection.
 - 3. The test section shall be 12-inches or 30 times (minimum) the wall thickness in length and 1-inch or 1.5 times the wall thickness in width (minimum).
 - 4. The joint shall be visually inspected as to continuity of "beads" from the melted material, and for assurance of "cold joint" prevention (i.e. – joint shall have visible molded material between walls of pipe). Joint spacing between the walls of the two ends shall be a minimum of 1/16 inch to a maximum of 3/16 inch.
- C. The polyethylene flange adapters at pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion resisting bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturer's specified torques. Bolts shall be tightened alternatively and evenly. After installation apply a bitumastic coating to bolts and nuts.

PART 3 EXECUTION

3.01 INSTALLATION

- A. High Density Polyethylene (HDPE) Pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the drawings and as specified herein. A factory qualified joining technician as designated by the pipe manufacturer shall perform all heat fusion joints.
- B. HDPE shall be installed either by Open Trench Construction or Directional Bore Method.
- C. Care shall be taken in loading and transporting and unloading to prevent injury to the pipe. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the Owner or Owner's Representative. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense.
- D. Under no circumstances shall the pipe or accessories be dropped into the trench or forced through a directional bore upon "pull-back".
- E. Care shall be taken during transportation of the pipe such that it will not be cut, kinked, or otherwise damaged.
- F. Ropes, fabric, or rubber protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe.
- G. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
- H. r
- I. ts.
- J. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches, or gouges on the exterior of the pipe is 5 percent of the wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches.
- K. Pipe shall be laid to lines and grade shown on the drawings with bedding and backfill as shown on the drawings.

- L. When laying pipe is not in progress, including lunchtime, the open ends of all on-site pipe shall be closed by fabricated plugs, or by other approved means.
- M. Sections of pipe with cuts, scratches or gouges exceeding 5 percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined.
- N. The pipe shall be joined by the method of thermal butt fusion, as outlined in Section 2.01 above. All joints shall be made in strict compliance with the manufacturer's recommendations.
- O. Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections which shall consist of the following:
 - 1. A polyethylene flange shall be thermally butt-fused to the stub end of the pipe.
 - 2. A 316 stainless steel back up ring shall mate with a 316 stainless steel flange.
 - 3. 316 stainless steel bolts and nuts shall be used.
- P. Flange connections shall be provided with a full-face neoprene gasket.
- Q. All HDPE pipes must be at the temperature of the surrounding soil at the time of backfilling and compaction.
- R. If a defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.
- S. Open Trench Installation:
 - 1. Trenching and backfilling operations shall be performed as specified in Section 31 23 33 – TRENCHING.
 - 2. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.
 - 3. Good alignment shall be preserved during installation. Deflection of the pipe shall occur only at those places on design drawings and as approved by the Owner's representative. Fittings, in addition to those shown on the drawings, shall be used only if necessary or required by the Owner or Owner's

Representative.

4. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be “pulled” or “cramped”.
5. Precautions shall be taken to prevent flotation of the pipe in the trench.
6. When moveable trench bracing such as trench boxes, moveable sheeting, shoring, or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, movable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. As trench boxes, movable sheeting, shoring, and plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.
7. Restrained joints shall be installed where shown on the drawings or as directed by the Owner or Owner’s Representative.

3.02 PIPE CLEANING

- A. At the conclusion of the work, thoroughly clean all the new pipelines to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period by forcing a cleaning swab through all mains 6-inch or greater. Flushing velocities shall be a minimum of 2.5 feet per second. All flushing shall be coordinated with the Owner or Owner’s Representative. Debris cleaned from the lines shall be removed from the job site.

3.03 TESTING

- A. Pressure testing shall be conducted per the Manufacturer’s recommendations and as approved by the Owner or his/her representative.
- B. All HDPE mains shall be field-tested. The contractor shall supply all labor, equipment, material, gages, pumps, meters, and incidentals required for testing. Each main shall be pressure tested upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing.
- C. All mains shall be tested at 120 PSI for 4 hours minimum unless otherwise approved by the Owner or Owner’s Representative.
- D. Pressure testing procedure shall be per manufacturer’s recommendations or in accordance with ASTM F2164 as follows:
 1. Restrain test section against movement.

2. Fill line slowly with water to remove air.
 3. Expel air completely from the line during filling and again before applying test pressure. Air shall be expelled by means of taps at points of highest elevation.
 4. Apply initial test pressure and allow to stand without makeup pressure for four hours, to allow for diametric expansion or pipe stretching to stabilize.
 5. After this equilibrium period, reduce test pressure by 10 PSI and turn the pump off. The final test pressure shall be held for one hour. If pressure stays within 5% of reduced pressure then the test passes.
 6. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the Owner or his/her representative at the point where the pressure is being monitored and shall be shown on the recorded pressure read-out submitted to the Owner.
- E. If any test of pipe laid disclosed leakage significant pressure drop greater than the manufacturer's recommended loss, the Contractor shall, at his/her own expense, locate and repair the cause of leakage and retest the line.
- F. All visible leaks are to be repaired regardless of the amount of leakage.

3.04 SITE CLEAN UP

- A. Upon completion of the work, the entire site shall be cleared of all debris, and the ground surface shall be finished to smooth and uniform slopes. Cleanup shall be considered an incidental item, and no additional payment shall be made for it

3.05 AS-BUILT INFORMATION

- A. The Contractor shall be responsible for keeping accurate records of all installed items under this section of the specifications and indicating revisions of the furnished construction drawings in sufficient detail to be accepted by the Owner for as-built drawings. Sufficient detail under this contract means that the Contractor shall take accurate measurements and record them on the drawings to provide the minimum information of at least two swing ties and distances to permanent objects and/or marker posts for all valves, pressure reducing valves, air and vacuum valves, hydrants, connections to other lines, and bends; the

beginning, end of any stabilization material placed; the beginning, end, and depth to rock encountered; the beginning, end, and depth of any encasement installed; and the location and depth of any other utilities encountered.

- B. The recording of the as-built information is considered an integral part of the progress of this construction and shall be reviewed with the Owner or Owner's Representative in determining progress under this contract.

END OF SECTION

SECTION 33 14 00

WATER SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Pipes, PE Tubing, materials, and appurtenances for potable water systems.
- B. Installation.

1.02 RELATED WORK

- A. Section 31 23 33: Trenching, Backfilling and Compacting

1.03 REFERENCES

A. AWWA:

1. C110: Gray iron and ductile iron fittings 3" through 48" for water and other liquids.
2. C400: Asbestos cement pressure pipe, 4" through 16" for water and other liquids.
3. C700: Cold water meters - displacement type.
4. C900: Polyvinyl chloride (PVC) pressure pipe 4" through 12" for water.
5. C901-08: Polyethylene (PE) pressure pipe and tubing ½" through 3" for water service.
6. C905: Polyvinyl chloride (PVC) pressure pipe 14" through 36" for water.

B. ASTM:

1. A370: Mechanical Testing of steel products.
2. A536: Ductile iron castings.
3. D1330: Rubber sheet gaskets.
4. D1598: Test for time-of-failure of plastic pipe under long-term hydrostatic pressure.
5. D1599: Test for short-term rupture strength of plastic pipe, tubing, and fittings.
6. D1784: Polyvinyl chloride (PVC) compound and chlorinated polyvinyl chloride (PVC) compounds, rigid.
7. D1785: Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80 and 120.
8. D1869: Rubber rings for asbestos cement pipe.
9. D2239: Polyethylene tubing, controlled inside diameter (SIDR-PR)
10. D2241: Polyvinyl chloride (PVC) plastic pipe (SDR-Series).
11. D3035: Polyethylene tubing (SDR-PR)
12. D3139: Joints for plastic pressure pipes using flexible elastomeric seals.
13. E8: Tension testing for metallic materials.

1.04 SUBMITTALS

- A. Submittals per Section 01 33 00.
- B. Manufacturer's installation recommendations.

1.05 GENERAL REQUIREMENTS

- A. Pipes, fittings and materials to be new, of the highest quality and shall be in first class condition when installed.
- B. Pipe, fittings and appurtenances of the same type and made by the same manufacturer.
- C. Provide labor, equipment, and materials for pipe field testing.
- D. Contact and coordination with the utility's OWNER is the full responsibility of the CONTRACTOR.

1.06 HANDLING AND STORAGE OF PIPE AND APPURTENANCES

- A. Pipe, valves, hydrants, and other appurtenances shall, unless otherwise directed, be unloaded, hauled, and laid as follows:
 - 1. Pipe and appurtenances shall be lifted by hoists with broad well-padded contact surfaces or rolled on skidways in such a manner to avoid shock.
 - 2. Under no circumstances shall pipe or appurtenances be dropped.
 - 3. Pipe must not be rolled or skidded against pipe already on the ground.
- B. The CONTRACTOR shall be responsible for the safe storage of material furnished by or to him and accepted by him, and intended for the work, until it has been incorporated into the completed project.
- C. Installation:
 - 1. In distributing material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
 - 2. Pipe shall be handled in a manner that only a minimum amount of damage to the pipe exterior will result. Damaged piping shall be repaired in a manner satisfactory to the ENGINEER or replaced.

3. The interior of all pipes, fittings, and other appurtenances shall be always kept free from dirt and foreign matter.

1.07 QUALITY ASSURANCE

- A. Ductile Iron:
 1. Tests:
 - a. ASTM E8: Tension Testing of Metallic Materials.
 - b. ASTM E23: Impact Test.
 2. Marking: cast on each pipe length:
 - a. Weight, class, nominal thickness, and casting period.
 - b. Manufacturer's name, year of production and the letters "DI" or the words "Ductile Iron."
- B. PVC Pipe and Fittings:
 1. Tests: ASTM D3034
 2. Marking: indelible, in each pipe:
 - a. Diameter and cell classification.
 - b. Manufacturer's name, ASTM, SDR or Schedule and date of production.
 - c. Service designation.
 - d. NSF approved.
 3. Rubber rings: marked with the manufacturer's identification, size, year of production and classes of pipe in which they are to be used.
- C. Polyethylene Tubing:
 1. Tests: ASTM D2737
 2. Marking: as per AWWA C901 Sec. 6.1
 - a. Nominal size and diameter base (ID, OD, IPS or CTS)
 - b. SIDR, SDR or min, wall thickness
 - c. Manufacturer's name or trademark
 - d. Material designation code (PE 4710)
 - e. Pressure rating.
 - f. Manufacturing date
 - g. Seal or Mark of testing agency (NSF/ANSI 61 approved)
- D. Valves:
 1. Valves shall be built and equipped for the type of material standard and operation shown on the Plans or as directed by the ENGINEER.
 2. All valves shall be of standard makes approved by the ENGINEER and shall have the name, monogram, or initials of the manufacturer cast thereon.

PART 2 PRODUCTS

2.01 MATERIALS AND FABRICATION

- A. Ductile Iron:
1. Pipe:
 - a. ANSI A21.51 (AWWA C151).
 - b. ASTM A536, Grade 60-42-10.
 - c. Ductile iron pipe shall meet ANSI/AWWA A21.51/C151 specifications:
 2. Fittings:
 - a. Ductile iron, ANSI A21.10 (AWWA C111).
 - b. ASTM A536, Grade 80-60-03 or 70-50-05.
 - c. Hydrostatic test: three times rated working pressure.
 3. Threaded connections: ANSI B2.1 NPT.
 4. Joints:
 - a. Mechanical: 350 psi working pressure.
 - b. Flange: DI; ANSI A21.14 or B16.1, 125 lb.
 - c. Gaskets: ASTM D1330, Grade I.
 - d. Push-on gaskets: neoprene or other synthetic rubber, D412 and D395. Natural rubber is not acceptable.
 - e. Lubricant: Heavy vegetable soap solution suitable for potable water use.
 5. Flanged adapters:
 - a. Body: ASTM Class 30 cast iron.
 - b. Flanges: DI ANSI A21.15.
 - c. Bolts: Steel with heavy hex nuts, ASTM A576.
 - d. Gaskets: Fastite neoprene.
 6. Expansion Joints:
 - a. For flanged and slip-on ductile iron pipe: ASTM A36.
 - b. Gaskets: Fastite neoprene with lubricating rings.
 7. Tapping Saddles:
 - a. Ductile iron with galvanized steel straps and rubber sealing gasket.
 - b. Pressure rating: 250 psi.
- B. Polyvinyl Chloride (PVC):
1. Pipe and fittings:
 - a. ASTM 2241, PVC 1120 or 1220, NSF approved:
 - i. All Sizes: SDR21 or as scheduled.

- ii. Pressure Rating: Minimum 200 psi or as scheduled.
 - b. AWWA C900:
 - i. All Sizes: SDR18 or as scheduled.
 - ii. Pressure Class: 235 psi or as scheduled.
 - c. AWWA C905
 - i. All Sizes: SDR18 or as scheduled.
 - ii. Pressure Class: 235 psi or as scheduled.
 - 2. Joints:
 - a. Gasket bell end: ASTM D3139 for plastic pressure pipes using elastomeric seals.
 - b. Gaskets: ASTM F477, elastomeric.
 - c. Solvent-Cement: Manufacturer's standard; use only where specifically scheduled, shown on Drawings or approved by ENGINEER.
- C. Service Lines:
- 1. Polyethylene: PE 4710 or higher grade as per latest revision of AWWA C-901
 - a. ASTM D2239, IPS/SIDR-7, based on iron pipe size, controlled inside diameter; or:
 - b. ASTM D3035, CTS, SDR-9, based on copper tubing size.
 - c. CONTRACTOR'S option unless otherwise scheduled.
 - 2. Minimum pressure rating: 200 psi.
 - 3. Joints:
 - a. Compression fittings.
 - b. Compatible with heavy duty copper service fittings, CONTRACTOR is responsible to verify that corporation stop valves, insert stiffeners, curb stop valves and couplings match the selected pipe standard.

2.02 APPURTENANCES

- A. Fire Hydrants:
- 1. Latest revision of AWWA C-502.
 - 2. Mueller A423 Super Centurion 200 or approved equal.
 - 3. 1-1/2" Pentagon bronze operating nut equipped with elastomer weather seal between the top casting and the operating nut.
 - 4. Sealed oil reservoir will inmate a system of ford lubrication of the thrust collar area each time the hydrant is operated.
 - 5. Two 2.5" and one 4.5" nozzles with National Standard fire hose threads mechanically connected into the barrel, O-ring sealed with National Standard nozzle caps.

6. Steel safety stem coupling with stainless steel fasteners and two-piece breakaway safety flange.
7. The centerline of hose nozzle will be a minimum of 18" above ground line.
8. 5-1/4" diameter main valve opening.
9. Upper valve plate shall be all bronze.
10. All internal surfaces of the shoe, the lower valve plate and cap nut shall be coated with a factory-applied, two-part, thermosetting epoxy coating with a minimum thickness of 4 mils.
11. The bronze valve seat shall be threaded into a bronze drain ring or shoe bushing; the drain channel shall be all bronze.
12. The hydrant shall have two drain outlets above the lower flange of the hydrant shoe assembly.
13. 200 psi working pressure and be certified as such by the manufacturer.
14. Lower barrel to shoe connection will have a minimum of six bolts made of stainless steel.
15. All hydrants furnished will have a standard 10-year warranty certified by the manufacturer.
16. Painted chrome yellow.
17. One Manufacturer's hydrant wrench supplied with each hydrant installed.

B. Resilient Wedge Gate Valves:

1. Size as shown on Drawings.
2. Mueller, Clow, Waterous, American Darling, Resilient Wedge Gate Valves or approved equal.
3. Valves shall conform to AWWA C-509 and comply with its latest revisions.
4. The wedge shall be cast iron, fully encapsulated in molded rubber including the guides. The bronze stem nut must be rigidly enclosed in the wedge to maintain alignment.
5. The stem shall have two O-rings above and one O-ring below the collar. Stem seats must be replaceable with the valve under pressure.
6. The stem material shall be stainless steel (AISI420) or ENGINEER approved equivalent.
7. The waterway shall be full size to allow for tapping use; no cavities or depressions are permitted in the seat area.
8. Valve body and bonnet shall be electrostatically applied, fusion bonded and epoxy coated, both inside and out, by the valve manufacturer. The coating shall meet the requirements of AWWA C-550. Coating to be applied only at the valve manufacturer's facilities.
9. The bonnet bolts shall not be exposed to the environment or, alternatively, be in 316 stainless steel.
10. O-ring style seals shall be used as gaskets on the bonnet and on the stuffing box.

11. All valves must be tested by hydrostatic pressure equal to the requirements in the AWWA C-509 specifications prior to shipment from the manufacturer.
12. 2-inch AWWA operating nut for valves in below-ground service; handwheel for above-ground service.
13. Mechanical joint ends for pipe or as shown on drawings.

C. Butterfly Valves with Actuator:

1. Butterfly valve:
 - a. Size as shown on Drawings.
 - b. AWWA C504.
 - c. Mueller Linesal III, Pratt, Dresser or approved equal.
2. Valve actuator:
 - a. Manufactured by a butterfly valve manufacturer.
 - b. Traveling nut type.
 - c. Withstand minimum 300 ft-lbs. torque at full open or full closed position.
 - d. Fully gasketed and sealed.
 - e. Withstand 10 psi submergence without leaking.
 - f. Minimum 16 turns full open to full closed position.
 - g. 2-inch AWWA nut.
3. Coating: Manufacturer's recommended factory coating on valve and actuator for buried service.

D. Swing Check Valves:

1. 3" and smaller: bronze, swing disc, screwed ends.
2. 4" and larger: iron body, bronze trim, swing disc, renewable disc and seat, outside weight and lever for exposed service, flanged ends.

E. Air Pressure and Vacuum Relief Valves:

1. Cast iron body, cover and baffle, stainless steel trim and float.
2. Sized for up to 800 gpm: 0 - 250 psi.
3. Seat: Buna-N.
4. 3" and smaller: NPT threaded outlet.
5. 4" and larger: Plain outlet with steel protector hood.
6. Val-Matic, Crispin or approved equal.

F. Backflow Preventer:

1. Body: Bronze ASTM B-61 and working parts.
2. Springs: Stainless steel.
3. Valve discs: Neoprene.
4. Diaphragm: Neoprene-coated cotton duck.
5. Minimum working pressure: 250 psi.

6. Hydrostatic test pressure: 350 psi.
 7. Breco Model 6 (Hersey-Sparling) or approved equal.
- G. Valve Boxes:
1. Cast iron, adjustable extension, traffic type.
 2. Minimum thickness of metal at any point: 3/16".
 3. Removable cast iron cover.
 4. For valves on washwater and irrigation system only: Class 200 PVC pipe.
 5. All valve boxes for plug valves shall be designed for integral installation of the required valve position indicator.
 6. Cast iron boxes: Factory painted inside and out with manufacturer's recommended asphalt paint.
 7. Cover marked "Water".
- H. Tapping Sleeves:
1. Minimum working pressure 250 psi.
 2. Mechanical joint type.
 3. Sizes as shown on Drawings.
 4. Mueller Type H-615 with two end gasket sets that allow to fit all classes of cast iron pipe or approved equal.
- I. Tapping Crosses:
1. Minimum working pressure 250 psi.
 2. Mechanical joint type.
 3. Sizes as shown on Drawings.
 4. Mueller Type H-715 with two end gaskets sets that allow to fit all classes of cast-in pipe or approved equal.
- J. Tapping Valves:
1. Minimum working pressure 250 psi.
 2. Size as shown on the Drawings.
 3. Mueller Type H-667 mechanical joint on outlet side and flange end on opposite side; attach to tapping drilling machine or approved equal.
 4. AWWA C500.
- K. Inserting Valves:
1. Sizes as shown on Drawings.
 2. Minimum working pressure 250 psi.
 3. Comply with Part 2.02C.
 4. Mueller Type H-800 for cast iron pipe or approved equal.
- L. Gauges:
1. All gauges shall be 3" in diameter.
 2. Each gauge shall be installed with block and bleed valves, and with a snubber and dielectric coupling.
- M. Locator Tape:

1. Metallic foil type, 3" wide; 5 mil min. thickness.
2. Labeling for water.
3. Color: blue.
4. Magnatec or approved equivalent.

N. Sentry Posts:

1. Metal posts.
2. Water pipeline warning sign.
3. Color: blue.

O. Dry Fire Hydrants

1. Dry hydrant shall be PVC swivel type with an aluminum male NPT threaded 4" adapter and plug with steel wire rope to secure plug. Red Head Brass model 132 or equivalent.
2. Dry Hydrant 6" underwater strainer shall be Red Head Brass style 133 with an underwater strainer support style 124 or approved equivalent.
3. Provide sign stating: "Dry Hydrant, No Parking, Fire Dept. Use Only." Dry Hydrants Model SDH or approved equivalent.

2.03 CORROSION PROTECTION

A. Ductile Iron:

1. Outside coating:
 - a. Bituminous, ANSI/AWWA C110, approximately 1 mil thick.
 - b. Strongly adherent to complete exterior of pipe.
 - c. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun.
2. Inside coating: Cement lined, in accordance with AWWA C-104.
3. Polyethylene encasement:
 - a. ANSI A21.5 Seamless tube black, ASTM D1248.
 - b. Type I, Class C, Grade G-1.
 - c. Thickness: Min. 8 mils.
 - d. Joint tape: Self-sticking PVC, 10 mils thick.
 - e. Strapping: Non-metallic, water resistance FS PPP-S-760.
 - f. Buried ductile iron pipe where scheduled.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install as indicated on Drawings.
2. Trenching, Backfilling and Compacting: Section 31 23 33.
3. Pipe Cutting:
 - a. Pipe cutting measurement taken at site.
 - b. Cutting of pipe or inserting valves, fittings, or closure pieces shall be done in a neat and workman like manner without damage to the pipe.
4. Direction of Bells:
 - a. Unless otherwise directed, pipe shall be laid with bell ends facing the direction in which work is progressing.
 - b. Pipe laid on an appreciable slope shall be laid with bell ends facing uphill.
5. Pipe Plugs: At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the ENGINEER.
6. Pipe Cleanliness:
 - a. Clean all pipes, fittings, and appurtenances before use.
 - b. Foreign materials or objects shall be prevented from entering the pipe while it is placed in the trench.
7. Temporarily support, adequately protect, and maintain all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of work.

B. Pipe Alignment and Grade

1. All pipes shall be laid and maintained to the required lines and grades; with fittings, valves, and hydrants at the required locations, with joints centered and spigots home; and with all valve and hydrant stems plumb. All water service lines shall be installed per plan and recommendation of the plastic pipe institute (PPI), with the following min. requirements:
 - a. The length of the PE tubing must be extended to allow for horizontal and vertical deflection not to exceed the min. bend radius based on the standard dimension ratio (SDR).
2. Deviations:
 - a. Wherever existing utility structures or branch connections leading to main sewers or to main drains, or other conduits, ducts, pipes or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated, or

reconstructed by the CONTRACTOR through cooperation with the OWNER of the utility, structure or obstruction involved.

- b. No deviation shall be made from the required line or grade except with the written consent of the ENGINEER.
- c. The CONTRACTOR shall make all necessary explorations to determine the location of existing pipes, valves, or other underground structures. The OWNER and ENGINEER shall furnish all available information; however, such information cannot be guaranteed to be accurate.

3. Depth of Bury:

- a. Depth of bury shall be as shown in the Plans.
- b. Minimum depth of bury of 3'-6" as measured from the established road grade or the surface of the permanent improvement to the top of the barrels of the pipe.

C. Pipe Laying:

- 1. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work.
- 2. All pipe fittings, valves and hydrants shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and protective coatings and linings.
- 3. Under no circumstances shall water main and water service materials be dropped into trench.
- 4. Trench shall be dewatered prior to installation of pipe.
- 5. Water service lines.
 - a. Both ends of the PE tubing must be supported in place and restrained from any movement.
 - b. Compaction around the corp. stop shall be a min. of 90% ASTM D-1557.

D. Jointing and Assembling:

- 1. Manufacturer's recommendations.
- 2. Lubricants: Vegetable soap solution suitable for use on potable water systems.
- 3. Prevent entrance of soil and other contaminants.
- 4. Use mechanical or push-on for exterior locations.
- 5. All lumps, blisters, burrs or excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any other foreign materials.
- 6. Water service lines:
- 7. no jointing of PE tubing shall be accepted.

- E. Clean all lines by repeated flushing after installation.
- F. Disinfection: Section 03 01 10.
- G. Pipe Sleeves:
 - 1. For all pipes passing through concrete or masonry.
 - 2. Install where practical before concrete is placed.
 - 3. Sleeve seal: watertight, modular sealing element when sleeve is placed in slabs with one side against soil.
- H. Buried pipe anchorage:
 - 1. Reaction blocking, anchors, joint harness, or other acceptable means of preventing pipe movement whether indicated or not required for:
 - a. Unlugged bell and spigot or all unflanged tees.
 - b. Y branches.
 - c. Bends deflecting 22 ½ degrees or more.
 - d. Plugs and caps.
 - e. Fittings in fills or unstable ground.
 - f. Above grade or exposed structure.
 - 2. Install blocking so joints are accessible for repair.
 - 3. When blocking is not practical or at CONTRACTOR'S option, metal harness anchorages across the joint; provide joint restraint computations for metal harnesses for continuous use.
 - 4. Concrete blocking as shown on Drawing for buried pipe unless otherwise approved by ENGINEER.
- I. Water service saddles: Rotation of saddle as shown on drawings or per ENGINEER'S direction.
- J. Valves: Installed as shown on Drawings with valve boxes and blocking as necessary.
 - 1. Corporation stop valves:
 - a. Verify dimension of outlet fitting and insert stiffener match PE tube material standard (CTS, IPS, IPS/SIDR).
- K. Fire hydrants: As indicated on Drawings with concrete blocking.

3.02 FIELD QUALITY CONTROL

- A. All pipes and fittings were tested in the presence of and to the satisfaction of the ENGINEER.
- B. Test Conditions:
 - 1. Medium: Water.
 - 2. Perform test at 150 psi for one hour per 1,000 linear feet of pipe or 2 hours minimum.
- C. Procedure:
 - 1. Disconnect fixtures, equipment and accessories that may be damaged by test pressure.
 - 2. Plug ends as required.
 - 3. Water shall be applied by means of a pump connected to the pipe in a satisfactory manner.
 - 4. All air shall be expelled from the pipe prior to pressure testing.
 - 5. No installation will be accepted unless the leakage is less than the number of gallons per hour as determined by the following formula:

$$L = (N D P^{1/2})/3,700$$

Where: L = allowable leakage in gallons per hour.

N = number of joints in pipeline tested.

D = nominal diameter of pipe in inches.

P = test pressure, psi.

- 6. All joints showing visible leaks shall be properly repaired. Any cracked or defective pipes, tubes, fittings, valves, or hydrants discovered in consequence of this pressure test shall be removed and replaced by the CONTRACTOR with sound material, and the test repeated.
- 7. Retest repaired joints, pipes and fittings until system is tight and test results are satisfactory to the ENGINEER.

3.03 PIPE SCHEDULE

- A. PVC Pipe:
 - 1. Pipe sizes 4" or less, PVC1120, SDR-21 pressure class 200 psi.
 - 2. Pipe sizes 4" through 12", PVCO "Ultra-Blue", pressure class 200 psi.
- B. PE Tubing:
 - 1. PE tube size 3" or less, PE 4710, CTS SDR-9 pressure class 200 psi; or PE 4710, IPS/SIDR-7 pressure class 200psi.
- C. End connections to be push-on joints unless otherwise indicated on the Drawings.

- D. Repair and/or replacement of existing water lines damaged during construction: Material generally matches existing or at least quality required by this section.
- E. Provide sizes as shown on the Drawings and as provided for in the Bid Schedule.

3.04 SCHEDULE

- A. Provide sizes as shown on the Drawings.

END OF SECTION

SECTION 33 01 10

DISINFECTION OF DOMESTIC WATER SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide personnel, equipment and supplies to disinfect and test all potable water systems, including water lines, water storage reservoirs, water wells and new plumbing systems, including flushing at completion of treatment.

1.02 RELATED WORK

- A. Section 33 14 00: Water Systems

1.03 REFERENCES

- A. AWWA Standards (Most Current Revision Shall Govern)
 - 1. B300, Hypochlorite's
 - 2. B301, Liquid Chlorine
 - 3. C651, Disinfecting Water Mains
 - 4. C652, Disinfection of Water-Storage Facilities
 - 5. C654, Disinfection of Wells
- B. AWWA Manuals (Most Current Revision Shall Govern)
 - 1. Manual M12, Simplified Procedures for Water Examination

1.04 QUALITY ASSURANCE

- A. Regulatory Agency Requirements: Comply with applicable state requirements.

1.05 SUBMITTALS

- A. Disinfection Program; submit the following to be used during the program, subject to approval by the ENGINEER:
 - 1. Compliance with Standards: i.e. ANSI/AWWA C651

2. Cleaning Equipment.
3. Type and form of disinfectant to be used.
4. Method of chlorination.
5. Method of dichlorination (as required), equipment used.
6. Flushing method & locations, drainage facilities if applicable.
7. Testing laboratory.

B. Test Reports: submit two copies as follows:

1. Disinfection report; include:
 - a. Date issued, project name and location.
 - b. Treatment CONTRACTOR'S name, address, and phone number.
 - c. Type and form of disinfectant used.
 - d. Time and date of disinfectant injection start.
 - e. Time and date of disinfectant injection completion.
 - f. Test locations.
 - g. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
 - h. Time and date of flushing start.
 - i. Time and date of flushing completion.
 - j. Disinfectant residual after flushing in ppm for each outlet tested.
2. Bacteriological report; include:
 - a. Date issued.
 - b. Project name and location.
 - c. Laboratory's name, certification number, address, and phone number.
 - d. Time and date of water sample collection.
 - e. Name of person collection samples.
 - f. Test location.
 - g. Time and date of laboratory test start.
 - h. Coliform bacteria test results for each outlet tested.
 - i. Certification that water conforms or fails to conform to bacterial standards or fails to conform to bacterial standards of the Federal Safe Drinking Water Act.
 - j. Bacteriologist's signature.

1.06 PROJECT DELIVERY, STORAGE AND HANDLING

A. Project against damage and contamination.

- B. Maintain caution labels on hazardous materials.
- C. Maintain storage room dry and with temperatures of uniform as possible between 60 degrees F (15.6 C) and 80 F (26.7 C).

PART 2 PRODUCTS

2.01 MATERIALS

- A. Disinfectant, conforming to ANSI/AWWA B301:
 - 1. Liquid chlorine (100% available chlorine)
 - 2. Sodium Hypochlorite, liquid (5%-15% available chlorine)
 - 3. Calcium Hypochlorite, granular, tablet. Do not use type intended for swimming pool disinfection.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to starting work, verify that the domestic water system is completed and cleaned.
- B. Do not start work until conditions are satisfactory to the OWNER.
- C. Ensure existing system isolated from that portion to be disinfected.

3.02 ACTIVE SYSTEM ISOLATION

- A. Prior to disinfection of new systems, the new water supply system shall be isolated from the existing water supply system to ensure disinfection solutions do not enter the actively operating system.
- B. All pipe network fittings and tools to be in water or fitting interior contact, which are to be used for direct existing system connections shall be swabbed or bathed in a 1% hypochlorite solution immediately prior to construction.
- C. All temporary pipeline connections to the active distribution system shall be through an approved reduced pressure zone backflow preventer. See AWWA C651 Figure 1 for reference.

SYSTEM TREATMENT

- D. Water Distribution and Transmission System: Residual Chlorine Concentration in accordance with Section 4.4 "Methods of Chlorination", AWWA C651
1. *General:* Three methods of disinfection include: chlorination tablet or granules, continuous feed, and slug.
 - a. Tablet or granule method shall provide a free chlorine residual of not less than 25 mg/L after 24 hours. Pipeline must always be kept clean and dry before introducing disinfection. Water shall be introduced at 1 ft/s or less in velocity.
 - b. The continuous-feed method shall provide a free chlorine residual of not less than 10 mg/L after 24 hours.
 - c. slug method shall provide a 3-hr exposure of not less than 50 mg/L free chlorine.
- E. Water Storage Reservoir: Residual Chlorine Disinfection in accordance with Section 4.3 "Methods of Chlorination", Per AWWA C652.
1. *General:* Three methods of disinfection include: full tank, high concentration wall spray, and two-step bottom high concentration process.
 - a. Full tank method shall introduce sodium hypochlorite to provide a free chlorine residual of not less than 10 mg/L after 24 hours. Tank to be completely full.
 - b. Wall spray method shall provide a minimum free chlorine residual 200 mg/L to be sprayed on all interior surfaces. The floor shall be rinsed prior to filling. Provide ventilation for all interior tank disinfection work.
 - c. The two-step bottom process method shall provide a 6-hr exposure of not less than 50 mg/L free chlorine for 5% of the tank volume. Then complete tank filling to its maximum level, maintaining a minimum of 2 mg/L for an additional 24-hour period.
- F. Water Wells: Per AWWA C654.
- G. New Building Plumbing Systems: Per local or State Plumbing Code.

3.03 BACTERIOLOGICAL TEST

- A. Take samples where and when required by referenced standards and codes. Two consecutive sets of samples shall be taken at least 24 hours apart at each sample location. At least one set of samples shall be taken from every 1,200 feet of water main, plus one set from the end of the line and at least one set from each branch.

- B. Analyze water samples in accordance with "Standard Methods for the Examination of Water and Wastewater", latest edition, published by American Water Works Association.
- C. Analyze water samples as otherwise required or allowed by referenced standards or codes. Test results shall certify that the water sampled is free of coliform bacteria contamination and is equal to or better than the bacteriologic water quality found in the distribution system.
- D. All test records shall be forwarded to ENGINEER and OWNER for review and final approval. Upon negative results of two consecutive samples system may be activated with OWNER concurrence.

3.04 FLUSHING

A. Preliminary Flushing:

1. Prior to chlorinating, the main shall be flushed to eliminate air pockets and remove particulates. Maintain minimum 2.5 ft/s velocity during all flushing activities. Refer to AWWA C651 Table 3 for reference of flow requirements for various pipe diameters.
2. Adequate drainage must be provided during flushing operations.

B. Final Flushing

1. After the applicable retention period, remove all water used for disinfection from tested reaches prior to putting into service. Inspect the discharge location and determine if the highly chlorinated discharge will cause damage to the surrounding environment. If necessary, the discharge shall be treated with a neutralizing chemical.
2. The need for dichlorination may vary from site to site and is subject to approval by the OWNER/ENGINEER.
3. Any flushed water containing residual chlorine concentrations higher than 100 mg/L shall be treated with neutralizing chemicals as required to meet this limitation.
4. Flushing should continue until chlorine measurements show the concentration leaving the flush point is no higher than the normal operating residual.

3.05 OPERATIONS

- A. Do not put any facilities into service until all tests are complete and test reports are submitted to the ENGINEER/OWNER.

END OF SECTION

SECTION 33 30 00

SANITARY SEWERAGE SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Pipes, fittings, sewer service lines and appurtenances for sanitary sewer collection and non-pressure drain lines.

1.02 RELATED WORK

- A. Section 31 23 33: Trenching, Backfilling, and Compacting
- B. Section 33 05 13: Sewer Manholes

1.03 REFERENCES

A. ASTM:

1. A746: "Ductile Iron Gravity Sewer Pipe."
2. D1248: "Polyethylene Plastics Molding and Extrusion Materials."
3. D1784: "Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl (PVC) Compounds."
4. C14: "Concrete Sewer, Storm Drain and Culvert Pipe."
5. D2104: "Polyethylene (PE) Plastic Pipe."
6. D3034: "Type PM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings."
7. D3212: "Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals."
8. F477: "Elastomeric Seals (Gaskets) for Joining Plastic Pipe."
9. F794: "Polyvinyl Chloride (PVC) Ribbed Gravity Sewer Pipe and Fittings."

B. ANSI:

1. A21.4: "Cement-Mortar Lining for Cast Iron and Ductile Iron Pipe Fittings for Water."
2. A21.11: "Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings."

1.04 SUBMITTALS

- A. Manufacturer's installation recommendations.

1.05 HANDLING AND STORAGE OF PIPE AND APPURTENANCES

- A. Pipe, valves, and other appurtenances shall, unless otherwise directed, be unloaded, hauled, and laid as follows:
 - 1. Pipe and appurtenances shall be lifted by hoists with broad well-padded contact surfaces or rolled on skidways in such a manner to avoid shock.
 - 2. Under no circumstances shall pipe or appurtenances be dropped.
 - 3. Pipe must not be rolled or skidded against pipe already on the ground.
- B. The Contractor shall be responsible for the safe storage of material furnished by or to him and accepted by him, and intended for the work, until it has been incorporated in the completed project.
- C. Installation:
 - 1. In distributing material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
 - 2. Pipe shall be handled in a manner that only a minimum amount of damage to the pipe exterior will result. Damaged piping shall be repaired in a manner satisfactory to the Engineer or replaced.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Ductile Iron:
 - 1. Pipe and fittings: ANSI/ASTM A746.
 - 2. Joints: ANSI 21.11 push on unless otherwise scheduled.
 - 3. Corrosion protection:
 - a. Outside coating:
 - i. Shop applied.
 - ii. Bituminous, ANSI/AWWA C110.
 - b. Inside coating:
 - c. Cement mortar lining with bituminous seal coat.
 - d. ANSI A21.4, AWWA C104 unless otherwise scheduled.
- B. PVC non-pressure:
 - 1. Pipe and fittings:

- a. 18" and larger: ASTM F679 and/or UNI-B9.
 - b. 15" and smaller: ASTM D3034, SDR 35 or SDR 26, or ASTM F794.
 - c. Laying length: Standard 20 feet.
 - d. Identification: ASTM classification and SDR size stamped in green ink.
2. Joints:
- a. PVC sleeve and two sealing rings.
 - b. Internally cast bell with one sealing ring.
 - c. Leakproof rubber rings: ASTM D3212 and F477.
 - d. Lubricant: manufacturer's recommendations.
- C. Spirolite, High Density Polyethylene (HDPE):
1. Pipe and fittings:
- a. ASTM D1248.
 - b. High density, high molecular weight polyethylene.
 - c. Type III, Class C, Category 5, Grade P34.
2. Joints:
- a. Bell and spigot end.
 - b. Rubber gasket: ASTM F477, elastomeric type.
 - c. Lubricant: manufacturer's recommendations.
- D. UltraRib, PVC Pipe:
1. 8" and larger.
2. ASTM D1784, D2413, and F-794.
3. Joints:
- a. Bell and spigot.
 - b. Rubber gasket: ASTM D3212.
 - c. Lubricant: manufacturer's recommendations.
- E. Pressure Polyvinyl Chloride (PVC):
1. Pipe and fittings:
- a. ASTM 2241, PVC 1120 or 1220, NSF approved:
 - i. All Sizes: SDR21 or as scheduled.
 - ii. Pressure Rating: Minimum 200 psi or as scheduled.
 - b. AWWA C900:
 - i. All Sizes: SDR14 or as scheduled.
 - ii. Pressure Class: 200 psi or as scheduled.
 - c. AWWA C905 for line sizes 14" and larger: Class 165 psi (min) or as scheduled.
2. Joints:
- a. Gasket bell end: ASTM D3139 for plastic pressure pipes using elastomeric seals.
 - b. Gaskets: ASTM F477, elastomeric.

- c. Solvent-Cement: Manufacturer's standard; use only where specifically scheduled, shown on Drawings, or approved by Engineer.

- F. Concrete:
 - 1. Pipe and fittings:
 - a. Non-reinforced: ASTM C-14.
 - b. Reinforced: ASTM C-76.
 - 2. Joints:
 - a. Spigot groove (confined O-ring): ASTM C-443, 361/AWWA C302.
 - b. Opposing shoulder ASTM C443, 361/AWWA C302.
 - c. Rubber gaskets: ASTM C-443, 361/AWWA C302.
 - 3. Corrosion protection:
 - a. Ameron "T-Lock" lining.
 - b. Engineer-approved equivalent.
 - c. Shall be welded at joints.

- G. Service Wye/Tee: in-line connections required unless not available as an industry standard for a particular size of line.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Section 31 23 33: Trenching, Backfilling, and Compacting
 - 2. Pipe Cutting: measurement taken at site.

- B. Use rigid rubber gasket on exterior of pipe to seal pipe into grout at manholes.

- C. Clean sewer lines of all sand, gravel, dirt, and other foreign materials after installation.

- D. Service Lines as indicated on Drawings:
 - 1. Locations generally determined by Owner or Engineer at time of construction.
 - 2. Service lines extend to the edge of the right-of-way or to the edge of the permanent easement.

3.02 FIELD QUALITY CONTROL

A. Exfiltration Test:

1. Performed on 25% of the reaches of sewer between manholes as selected by Engineer. Should any reaches fail, additional reaches may be added at the Engineer's discretion. All failed reaches shall be repaired and retested.
 - a. Single or multiple reaches may be tested at Contractor's option.
 - b. Provide all necessary piping between the reach to be tested and the water supply, together with all required materials and equipment.
 - c. Methods used, scheduling, and duration of tests must be approved by the Engineer.
 - d. Water or air testing may be used at Contractor's option.
2. Water testing procedure:
 - a. Block off all manhole openings except those connecting with the reach under test.
 - b. Fill the line: minimum depth at upper ends: 4' above invert or 4' above groundwater level, whichever is higher.
 - c. Add and measure water, as required, to maintain a constant level.
 - i. Maximum exfiltration: 100 gallons per day per inch nominal diameter per mile of pipe.
 - ii. Manholes considered section of 48" pipe.

B. Air Testing (acceptable in lieu of exfiltration test)

1. Performed on 25% of the reaches of sewer between manholes as selected by Engineer. Should any reaches fail, additional reaches may be added at the Engineer's discretion. All failed reaches shall be repaired and retested.
 - a. Provide all necessary materials and equipment to perform air tests.
 - b. Methods used, scheduling, and duration of tests must be approved by the Engineer.
 - c. Water or air testing may be used at Contractor's option.
2. Air testing procedure:
 - a. Clean all pipe sections being tested via Engineer approved method. Thoroughly wet the pipe.
 - b. Plug all pipe outlets with pneumatic plugs. The pneumatic plugs shall be able to resist internal testing pressures without requiring external bracing.

- c. Determine the groundwater level surrounding the section of sewer under test. If the groundwater level is above the crown of the pipe the test pressures shall be increased by 0.43 psig for each foot of water above the average elevation of the crown of the pipe. Test pressures shall not exceed 10 psig.
- d. Introduce air slowly to the section of pipe under evaluation until the internal air pressure is raised to 4.0 psig plus any increase required by a high groundwater level.
- e. Allow air to stabilize for two minutes; add air as required.
- f. When the pressure reaches 3.5 psig begin the stop watch. One pound of air loss (2.5 psig pressure gauge reading) must not occur within the minimum times as listed in Table 1:
- g. All manholes must be tested separately.

Table 1. Air test times per pipe diameter and length of pipe.

PIPE DIAMETER (in.)	SPECIFICATION TIME FOR LENGTH (L) SHOWN (min:sec)							
	100 ft	150ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

C. Manhole Test

- 1. Plug the inlet(s) and outlet of the manhole and fill the manhole four feet above the top of the pipe or two feet above the existing ground water level, whichever is greater. Allow one hour for material saturation and then refill to the original level. After two hours measure the final level and calculate the gallons lost.
- 2. The allowable leakage for manholes shall be 0.75 gallons per hour per foot diameter of the manhole.

D. Mandrel Test:

1. Performed on each PVC or Spirolite line.
2. No sooner than 30 days after placement and compaction of backfill, but prior to placement of permanent surface materials.
3. Use a rigid mandrel with diameter of at least 95% of the pipe's specified average inside diameter and length of the mandrel circular portion at least equal to the nominal pipe diameter.
4. Pull the mandrel through the pipe by hand.
5. All pipes exceeding the 5% deflection shall be repaired or replaced by the Contractor at no additional cost to the Owner.

E. Grade Tolerances:

1. Free from noticeable depressions or humps.
2. Invert elevations shall not exceed plus or minus 0.2' from elevations shown on Drawings or which can be computed from Drawings.
3. Shall comply with the lesser of the following:
 - a. Not more than 0.1% difference from grade shown on Drawings.
 - b. Not more than 10% of grade shown on Drawings.

3.03 SCHEDULE

A. Collection Lines:

1. All PVC Sewer Pipe 8" and greater: PVC SDR 26.
2. If water separation is less than 10 feet, Sewer pipe: C900

B. Service Lines: 4" – 6" SCH 40 PVC Pipe

END OF SECTION

SECTION 33 31 18
SEWER LINE INSPECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The work in the section includes performing pre and post construction closed-circuit television video (CCTV) inspection of sanitary sewer lines shown on the drawings. Upstream manhole shall be plugged and the sewer to be inspected shall be essentially dry when performing television inspection. The work shall be performed as follows:
1. Perform pre-construction Closed Circuit Television Video (CCTV) inspection of all sewer lines scheduled for rehabilitation immediately after cleaning to confirm that cleaning is satisfactory and to identify the location of service connections. The pre-construction CCTV inspection shall also confirm the need for and location of any low points requiring rehabilitation.
 2. Post-construction CCTV inspection of the completed rehabilitation work shall be required to confirm compliance with the plans and specifications.
 3. Concerns regarding manhole depth, air quality in the sewers, accessibility of manholes, traffic conditions, and safety are to be the sole responsibility of the Contractor.
 4. The camera system shall include a pan-and-tilt, radial viewing, sewer inspection camera that pans plus or minus 275 degrees and rotates 360 degrees with either automatic or remote focus and iris controls. Camera system shall have an accurate footage counter that displays on the operator's monitor and the videotape the distance of the camera from the centerline of the starting manhole. Camera shall have a height adjustment which allows the lens to always be centered at one-half the inside diameter, or higher, in the sewer being televised. All cameras used shall be color units specifically designed or modified for use in sewer inspection work. The cameras shall be operable in 100% humidity conditions. Camera lighting shall be sufficient for use with camera, in all cases, the complete video system (cameras, lens, power, lighting, cables, monitors and recorders) shall be capable of providing a picture quality acceptable to the Owner and Engineer, and if unsatisfactory equipment shall be removed and no payments will be made for unsatisfactory inspections.

5. The camera shall be pulled through the sewer line in either direction at a speed not greater than 30 feet per minute, stopping as necessary to permit proper documentation of the sewer's condition. Stop and thoroughly inspect each of the following so that the cleaning and condition of the sewer can be readily evaluated, and a decision made for/against renovation or replacement of the sewer main:
 - a. Collapsed pipe, obstructions.
 - b. Structural cracking, with and without deflection
 - c. Missing portions of sewer wall
 - d. Sag and/or excessively deflected joint.
 - e. Cracked and open joints
 - f. Root intrusion
 - g. Protruding joint sealing material
 - h. Corrosion conditions, including exposed aggregate, exposed reinforcement and disintegrated wall exposing the soil surrounding the sewer.
 - i. Protruding lateral joint
 - j. Significant inflow point
6. If, during the inspection operation, the inspection camera will not pass through the entire sewer main section from the manhole the camera was inserted from, then the Contractor shall reset his equipment so that the inspection can begin at the opposite manhole at no addition charge to the Owner.
7. In instances where manual or totally remote electric winches are used to pull the camera through the sewer (i.e., where the recording technician does not directly control the winch's movement), constant, two-way communication shall be set up between the two manholes of the line being inspected to permit the recording technician to communicate clearly with the crew member controlling the camera's movement.
8. Video cassette capacity shall be adequate to record inspection of at least one complete sewer segment between manholes, but no more than 5 segments shall be recorded on a single cassette. Contractor shall not leave gaps in the recording of a segment between manholes. Only segments between manholes on the same reach shall be included on one video tape. Accurate and continuous footage readings shall be superimposed on the video recording for each line inspected by remote inspection methods. Also shown shall be the date of inspection complete with the manhole number designation for each manhole on the line section being inspected. Manhole numbers are shown on the drawings.

9. Video tape recordings shall become the property of the Owner and shall include an audio track recorded by the inspection technician during the actual inspection work describing the parameters of the line being inspected (i.e., its location, depth, diameter, pipe type, etc.) as well as describing connections, defects, and unusual conditions observed during the inspection. Recording shall be on a 4-head VHS format VCR recorded at standard play mode in color. All video tapes shall be in 2-hour format and each shall be professionally labeled. One label shall be placed on the spine and the other on the face of the videotape. Spine information shall include the Contractor's name, project name, tape number, date televised, and date submitted. Cassette face information shall include the name of the street, sewer segment from manhole to manhole listing manhole number designation, pipe length and size, project name, and tape number. For each cassette prepare a TV Inspection Report, which shall become a complete written log of sewer conditions and connections, complete with 5"x7" still photos of areas requiring repairs or that were repaired, all indexed to the footage counter. Contractor shall furnish the Owner two (2) copies and two (2) copy of each video tape cassette produced during the pre-construction CCTV and post-construction inspection phases.

10. DVD from CCTV video Inspection Tapes: Contractor shall prepare and provide digital video discs (DVD) of the sewer inspection videos. DVD shall include a directory listing all collection system segments and by clicking on a segment in that directory the inspection video for that segment shall play. The inspection report for that segment shall also be visible and printable. The Owner shall receive two (2) DVD copies and HIS two (2) copies. Contractor shall provide a minimum of one (1) hour training to Owner in the use of the inspection DVD. An example of a directory is shown below:

Street Name
Segment 1 from MH 1 to MH 9
Segment 2 from MH 10 to MH 22
And so, on

1.02 POST-TELEVISIONING OF COMPLETED SECTIONS

- A. They will provide to the Owner a color video tape and DVD showing the completed work including the condition of the restored service connections prior to requesting payment. Upon completion of the installation work and testing, the Contractor shall restore/clear the project area affected by his/her operations.

1.03 MEASUREMENT AND PAYMENT

- A. Television inspection, videotape recordings, and DVD of the sewer lines shall be paid for at the unit price bid per linear foot as listed in the Bid Schedule. Measurement of the actual number of feet inspected shall be made from center of manhole to manhole.
1. Pre-construction CCTV Inspection of sanitary sewer lines: The cost for CCTV inspection shall include all labor, tools, equipment, and supervision to perform the pre-construction video inspection and provide a quality video in accordance with the specifications complete with the submittals of DVD, TV Inspection Reports, and still photos.
 2. Post-construction CCTV Inspection of sanitary sewer lines: The cost for CCTV inspection shall include all labor, tools, equipment, and supervision to perform the post-construction video inspection and provide a quality video in accordance with the specifications complete with the submittals of DVD, TV Inspection Reports, and still photos. The video shall be a permanent record of the completed improvements made to the sewer main.

END OF SECTION

SECTION 03 30 00
CONCRETE WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Cast-in-place concrete.
- B. Grout.
- C. Reinforcing Steel.
- D. Forms.
- E. Admixtures, embedment's and accessories.

1.02 RELATED WORK

- A. Section 31 23 33: Trenching, Backfill and Compaction
- B. Section 33 05 13: Manholes

1.03 SUBMITTALS

- A. Shop Drawings and Product Data:
 - 1. Concrete mix design.
 - 2. Proposed admixtures.
 - 3. Reinforcing bar lists, fabrication, and placement drawings for structures.
 - 4. Concrete accessories.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Cement and fly ash:

1. Store in moisture-proof enclosures.
 2. Do not use if caked or lumpy.
- B. Aggregate: store to prevent segregation and inclusion of foreign materials.
- C. Reinforcing steel: store on supports that will keep it from coming into contact with the ground.
- D. Rubber and plastic materials:
1. Store in a cool place.
 2. Do not be exposed to direct sunlight.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Forms:
1. The formwork shall be designed in accordance with ACI 347.
 2. Prefabricated:
 - a. Simplex.
 - b. Symons.
 - c. Universal.
 - d. Engineer-approved equivalent.
 3. Plywood:
 - a. PS1, waterproof resin-bonded, exterior type, Douglas Fir.
 - b. Face adjacent to concrete to be Grade C or better.
 4. Fiberboard: FS LLL-B-810, Type IX, tempered, waterproof, screen back, concrete form hardboard.
 5. Lumber:
 - a. Straight, uniform width and thickness.
 - b. Free from knots, offsets, holes, dents, and other surface defects.
 6. Chamfer strips: clear white pine, surface against concrete planed.
 7. Form coating:
 - a. Industrial lubricants "Nox-crete Form Coating."

- b. "L&M Debond."
- c. Protex "Pro-Cote."
- d. Richmond "Rich Cote."
- e. Engineer-approved equivalent.

8. Form ties:

- a. Removable end.
- b. Permanently embedded body type not requiring auxiliary spreaders.
- c. Cones on outer ends.
- d. Embedded portion 1" minimum back from concrete face.
- e. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.

9. Earth cuts shall not be used as forms for vertical surfaces unless indicated on Drawings.

B. Reinforcing Steel:

- 1. Bars: ASTM A615, Grade 60.
- 2. Beam stirrups and columns ties: ASTM A615, Grade 40.
- 3. Column spirals: ASTM A82.
- 4. Welded wire fabric: ASTM A185 or A497.
- 5. Bar supports:
 - a. PS7.
 - b. CRSI Class B.
 - c. Fabricated from galvanized wire.

C. Concrete:

- 1. Cement:
 - a. ASTM C150, Type I or II.
 - b. Use Type III only with prior written approval of Engineer.
- 2. Fly ash:
 - a. ASTM C618, Class C or F.
 - b. One type only per mix design.
- 3. Fine aggregate: clean, natural sand, ASTM C33.
- 4. Coarse aggregate:
 - a. Crushed rock, natural gravel or other inert granular material.

- b. ASTM C33.
 - c. Clay and shale particles no more than 1%.
5. Water: clean, fresh, and potable.
6. Admixtures:
- a. Retarder:
 - i. ASTM C494, Type D.
 - ii. Grace "Duratard_HC."
 - iii. Master Builders "MC_HC."
 - iv. Protex "Protard."
 - v. Sika Chemical "Plastiment."
 - vi. Engineer-approved equivalent.
 - b. Plasticizer:
 - i. ASTM C494, Type A.
 - ii. Grace "WRD A_HC."
 - iii. Sika Chemical "Plastocrete."
 - iv. Engineer-approved equivalent.
 - c. Air entraining agent:
 - i. ASTM C260.
 - ii. Grace "Darex AEA."
 - iii. Master Builders "MB_VR."
 - iv. Protex "AES".
 - v. Sika Chemical "AEK."
 - vi. Engineer-approved equivalent.

D. Accessories:

- 1. Polyethylene film: PS17, 6 mil.
- 2. Membrane curing compound and floor sealer:
 - a. FS TT_C_600, Type I.
 - b. Chlorinated rubber, minimum 18% solids.
 - c. Grace "Dekote".
 - d. Process Solvent "Concrete Treatment ALX_9".
 - e. Protex "Triple Seal Series CRD_18".
 - f. TK Product "Tri_Kote TK-18".
 - g. Engineer-approved equivalent.
- 3. Expansion and contraction joint:
 - a. Elastic.
 - b. Rubber:
 - i. Dumbbell, 9" wide, d" thick with 3/4" bead on each end.
 - ii. WR Grace.
 - iii. U.S. Rubber.
 - iv. William.

- v. Engineer-approved equivalent.
- c. PVC:
 - i. Ribbed or serrated, 9" wide, d" thick with "U" or "O" bulb closed center section.
 - ii. WR Grace.
 - iii. WR Meadows.
 - iv. Vinylex.
 - v. Engineer-approved equivalent.
4. Exterior expansion joint material: asphalt-impregnated fiberboard, ASTM D994.
 5. Bond break joint material: 30 lb. asphalt-saturated felt, ASTM D226.
 6. Interior slab construction joint material: preformed 20-gauge steel or as indicated on Drawings.
 7. Bearing Pads:
 - a. Neoprene: Durometer 70, minimum thickness ½" unless otherwise noted.
 - b. Compressed asbestos fibers and synthetic rubber elastomer with graphite lubricant:
 - i. Chesterton.
 - ii. Nicolet Industries.
 - iii. Engineer-approved equivalent.
- E. Grout:
1. Non-shrink, non-metallic grout:
 - a. Factory pre-mixed requiring only water addition in the field.
 - b. Master Builders "Special LL-713 Grout."
 - c. Sauereusen Cements "F-100 Level Fill Grout."
 - d. US Grout "Five Star Grout."
 - e. The Upco Corp "Upcon."
 - f. Engineer-approved equivalent.
 2. Epoxy Grout:
 - a. Three-component epoxy resin system:
 - i. Two liquid epoxy components.
 - ii. One inert aggregate filler component.
 - iii. Each component is furnished in separate packages at job site.
 - b. Adhesive:
 - i. Ceilcote "HT648 Grout".

- ii. Exxon Chemical "Excoweld 2505."
 - iii. Sika "Sikadur Hi-Mod."
 - iv. Engineer-approved equivalent.
- c. Aggregate:
 - i. Ceilcote "HT648."
 - ii. Exxon Chemical "Excoweld 2510."
 - iii. Sika "Colman Quartzite Aggregate."
 - iv. Engineer-approved equivalent.
3. Concrete grout mix: Section 2.03.

2.02 CONCRETE MIX

- A. Comply with ASTM C94.
- B. Water to Portland Cement Ratio: Maximum 0.50.
- C. Slump: Maximum 4" unless otherwise scheduled.
- D. Compressive Strength: 28 days at 4000 psi unless otherwise scheduled or shown on the Drawings.
- E. Volumetric Air Content: 4.5% ±1.5%; air may be omitted for interior slabs to be trowel finished.
- F. Admixtures:
 - 1. Content, batching method and time of introduction in accordance with the manufacturer's recommendations for compliance with this specification.
 - 2. Include a water-reducing admixture.
 - 3. Calcium chloride shall not be used.
- G. Coarse Aggregate:
 - 1. Maximum nominal dimension ¾".
 - 2. Maximum nominal dimension 1½" for members greater than 18".
- H. Consistency:
 - 1. Suitable for the placement conditions.

2. Slump uniform.
 3. Aggregate floating uniformly throughout the concrete.
 4. Flow sluggishly when vibrated or spaded.
- I. Adjust mix in field with Engineer's approval, as required to meet specifications.

2.03 CONCRETE GROUT

- A. Water to Portland Cement Ratio: Maximum 0.55.
- B. Slump: 6" ± 1" unless otherwise scheduled.
- C. Compressive Strength: 28 days at 2500 psi, unless otherwise scheduled or shown on the Drawings.
- D. Volumetric Air Content: None.
- E. Admixtures:
1. Content, batching method and time of introduction in accordance with the manufacturer's recommendations for compliance with this specification.
 2. Include a water-reducing admixture.
 3. Calcium chloride shall not be used.
- F. Reinforcement: fiber mesh reinforcing in accordance with manufacturer's recommendation for shrinkage crack control.
- G. Coarse Aggregate: maximum nominal dimension 3/8".
- H. Consistency:
1. Suitable for the placement conditions.
 2. Slump uniform.
 3. Aggregate floating uniformly throughout the concrete.
 4. Flow sluggishly when vibrated or spaded.
- I. Adjust mix in field with Engineer's approval, as required to meet specifications.

2.04 FABRICATION

A. Reinforcing Steel:

1. Fabricate in accordance with ACI 315 and 318 except as specified or indicated on Drawings.
2. Accurately fabricated.
3. Free from loose rust, scale and contaminants that would reduce bond.
4. Fabrication Tolerances:
 - a. Sheared length: $\pm 1"$.
 - b. Depth of truss bars: $+0"$, $-\frac{1}{2}"$.
 - c. Stirrups, ties and spirals: $\pm \frac{1}{2}"$.
 - d. All other bends: $\pm 1"$.

2.05 PREPARATION OF GROUT

A. Non-shrink, non-metallic grout:

1. Mix in a mechanical mixer.
2. Use no more water than necessary to produce flowable grout.

B. Epoxy grout: mix in accordance with manufacturer's instructions.

C. Concrete grout: same as for concrete.

PART 3 EXECUTION

3.01 INSTALLATION

A. Forms:

1. In accordance with ACI 347.
2. Mortar tight.
3. Exposed concrete surfaces free from irregularities.
4. True to line, grades and dimensions shown on the Drawings.
5. Rigid and properly braced.

6. Ties arranged so that metal will not show or discolor concrete surface.
 7. Bevel or chamfer exterior corners.
 8. Coat forms with acceptable release material.
 9. Dirt forming of vertical faces is prohibited.
- B. Reinforcing Steel:
1. Remove rust, scale, grease, or any coating that would impair bond to concrete.
 2. Provide support to provide minimum cover and spacing.
 3. Provide splice lengths as required by ACI 318.
- C. Embedment's:
1. Accurately placed for the purpose intended.
 2. Remove rust, scale, and other foreign matter before placing concrete.
- D. Concrete:
1. Place within 75 minutes of time transport leaves the batch plant.
 2. Place concrete on compacted moist surfaces, free from standing or running water.
 3. Concrete to be conveyed and placed to prevent segregation of the coarse aggregate.
 4. Cold weather concreting: comply with ACI 306.
 5. Hot weather concreting: comply with ACI 305.
- E. Expansion and Contraction Joints: provide as indicated on the Drawings.
- F. Finishing:
1. Float finishes on buried surfaces and concrete grout.
 2. No special concrete or cement mortar topping allowed for slab finish.

3. Slabs are brought to true and even finish by screening, floating, and finishing to produce a smooth, impervious surface, free from blemishes.
 4. Unless otherwise specified or shown in the Drawings, a steel trowel finish shall be applied.
 5. Excess water shall not be present when the finish is made.
 6. Seal all snap tie holes with mortar on all buried and exposed surfaces.
 7. Exposed surfaces rubbed to uniform finish and texture.
- G. Curing: cure concrete by an approved method which will keep surfaces adequately wet or protected from moisture loss for the curing period.
- H. Repairing Defective Concrete:
1. Repair defects in formed concrete surfaces within 24 hours.
 2. Replace defective concrete within 48 hours.
 3. Cut out and remove to sound concrete honeycombed or otherwise defective concrete.
 4. Cut edges square to avoid feathering.
 5. Comply with Chapter 9, ACI 301.
 6. Perform repair work so as not to interfere with thorough curing of adjacent concrete.
 7. Adequately cure repair work.
- I. Tolerances
1. Variation from plumb:
 - a. In lines and surfaces of columns, piers, walls, and artists:
 - i. In any 10 feet of length 1/4 inch
 - ii. Maximum for the entire length 1 inch
 - b. For exposed corner columns, control-joint grooves, and other conspicuous lines:
 - i. In any 20-foot length 1/4 inch
 - ii. Maximum for the entire length 1/2 inch
 2. Variation from level or from the grades shown or specified:
 - a. In slab and beam soffits, ceilings, arises, measured before removal of supporting shores:

- i. In any 10 feet of length 1/4 inch
- ii. In any bay or any 20-foot length 3/8 inch
- iii. Maximum for the entire length 3/4 inch
- b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
 - i. In any bay or in 20-foot length 1/4 inch
 - ii. Maximum for the entire length 1/2 inch

3.02 FIELD QUALITY CONTROL

- A. Perform Field Control Test:
 - 1. Tests by qualified personnel.
 - 2. Make tests in presence of Engineer.
 - 3. Provide all equipment, supplies, and the services of one or more employees, as required.
 - 4. The test frequencies specified are minimum; perform additional tests as required by the job conditions.
- B. Slump: perform a test for each load in accordance with ASTM C143 unless waived at time of placement by Engineer.
- C. Air Content: test one sample from each batch from which test cylinders are made in accordance with ASTM C231.
- D. Compression Tests:
 - 1. Make one set of five cylinders from every load or batch or portion thereof.
 - 2. Make, cure, store, and deliver cylinders in accordance with ASTM C31.
 - 3. Record with each set:
 - a. Date and time of day the cylinders were made.
 - b. Location in the work where the concrete represented by the cylinders was placed.
 - c. Delivery truck or batch number.
 - d. Air content.
 - e. Slump.
 - 4. Testing laboratory will:
 - a. Test one cylinder in each set for seven days.
 - b. If seven-day strength is less than 2,000 psi, test one cylinder for 14 days.
 - c. Test two cylinders from each set for 28 days.

- d. If compressive strength does not reach specified compressive strength at 28 days, test remaining cylinder at 56 days.
- e. Do not test or discard the remaining cylinder until so instructed by the Engineer.
- f. Engineers will evaluate in accordance with ACI 214 and 318.
- g. Test in accordance with ASTM C39.

E. Specific Use of Concrete:

- 1. Concrete used solely for blocking of water line valves or fittings will not require testing.
- 2. It shall, however, be subject to acceptance by the Engineer as to its suitability for its intended purpose.

END OF SECTION

SECTION 09 97 23
COATINGS FOR SANITARY SEWER STRUCTURES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. All labor, materials, equipment and services necessary to complete the installation of corrosion protection for concrete wastewater structures and manholes and ductile iron piping in wastewater lift station wet wells.

1.02 REFERENCES

- A. ASTM D638 - Tensile Properties of Plastics.
- B. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics.
- C. ASTM D695 - Compressive Properties of Rigid Plastics.
- D. ASTM D4541 - Pull-off Strength of Coatings Using a Portable Adhesion Tester.
- E. ASTM D2584 - Volatile Matter Content.
- F. ASTM D2240 – Durometer Hardness, Type D.
- G. ASTM D543 - Resistance of Plastics to Chemical Reagents.
- H. ASTM C109 - Compressive Strength Hydraulic Cement Mortars.
- I. ACI 506.2-77 - Specifications for Materials, Proportioning, and Application of Shotcrete.
- J. ASTM C579 - Compressive Strength of Chemically Setting Silicate and Silica Chemical Resistant Mortars.
- K. ASTM C267 – Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes.
- L. SSPC SP-13/NACE No. 6 – Surface Preparation of Concrete.
- M. ASTM - The published standards of the American Society for Testing and Materials, West Conshohocken, PA.

- N. NACE - The published standards of National Association of Corrosion Engineers (NACE International), Houston, TX.
- O. AMPP – Association for Materials Protection and Performance
- P. SSPC - The published standards of the Society of Protective Coatings, Pittsburgh, PA.
- Q. NASSCO – National Association of Sewer Service Companies, Marriottsville, MD – Manhole Assessment Condition Program (MACP) and Pipeine Assessment Conduction Program (PACP)
- R. ICRI Technical Guideline No. 03732 – Selecting and specifying Concrete Surface Preperation for Sealers, Coatings, and Polymer Overlays.

1.03 SUBMITTALS

- A. Make submittals in accordance with the standard general conditions and the general requirements in the project specifications:
- B. Product Data:
 1. Technical data sheet on each product used.
 2. Material Safety Data Sheet (MSDS) for each product used.
 3. Copies of independent testing performed on the coating product indicating the product meets the requirements as specified herein.
 4. Technical data sheet and project specific data for repair materials to be topcoated with the coating product(s) including application, cure time and surface preparation procedures.
- C. Contractor Data:
 1. Current documentation from coating product manufacturer certifying Contractor’s training and equipment complies with the Quality Assurance requirements specified herein.
 2. Two (2) recent references of Contractor indicating successful application of coating product(s) of the same material type as specified herein, applied by spray application within the municipal wastewater environment.

PART 2 PRODUCTS

2.01 QUALITY ASSURANCE

- A. Coating product(s) shall be capable of being installed and cured properly within the specified environment(s). Coating product(s) shall be resistant to all forms of

chemical or bacteriological attack found in municipal sanitary sewer systems; and, capable of adhering to the substrates and repair product(s).

- B. Repair product(s) shall be fully compatible with coating product(s) including ability to bond effectively to the host substrate and coating product(s) forming a composite system.
- C. Contractor shall utilize equipment for the spray application of the coating product(s) which has been approved by the coating product manufacturer; and, Contractor shall have received training on the operation and maintenance of said equipment from the coating product manufacturer.
- D. Contractor shall be trained by, or have their training approved and certified by, the coating product manufacturer for the handling, mixing, application and inspection of the coating product(s) to be used as specified herein.
- E. Contractor shall be trained in the use of testing or inspection instrumentation and knowledgeable of the proper use, preparation and installation of the coating product(s) to be used as specified herein.
- F. Contractor shall initiate and enforce quality control procedures consistent with the coating product(s) manufacturer recommendations and applicable NACE or SSPC standards as referenced herein.

2.02 DELIVERY, STORAGE AND HANDLING

- A. Materials are to be kept dry, protected from weather and stored under cover.
- B. Protective coating materials are to be stored between 50 deg F and 90 deg F. Do not store near flame, heat or strong oxidants.
- C. Protective coating materials are to be handled according to their material safety data sheets.

2.03 SITE CONDITIONS

- A. Contractor shall conform with all local, state and federal regulations including those set forth by OSHA, RCRA and the EPA and any other applicable authorities.
- B. Confined space entry, flow diversion and/or bypass plans shall be presented by Contractor to Owner as necessary to perform the specified work.

2.04 SPECIAL WARRANTY

- A. Contractor shall warrant all work against defects in materials and workmanship for a period of one (1) year, unless otherwise noted, from the date of final acceptance of the project. Contractor shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said one (1) year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

2.05 EXISTING PRODUCTS

- A. Standard Portland cement or new concrete (not quick setting high strength cement) must cure a minimum of 28 days prior to application of the coating product(s).
- B. Remove existing coatings which may affect the performance and adhesion of the coating product(s) prior to application of the coating product(s). For existing coatings which are well bonded to the existing concrete or piping, surface shall be roughened to provide adequate surface profile for mechanical bond by the new protective coating.
- C. Thoroughly clean and prepare existing products to effect a seal with the coating product(s).
- D. Maintain strict adherence to the protective coating manufacturer's recommendations with regard to proper surface preparation and compatibility with existing coatings.

2.06 REPAIR AND RESURFACING PRODUCTS

- A. Repair products shall be used to fill voids, bugholes, and/or smooth transitions between components prior to the installation of the coating product(s). Repair materials must be compatible with the specified coating product(s) and shall be used and applied in accordance with the manufacturer's recommendations.
- B. For Concrete Surfaces: Resurfacing products shall be used to fill large voids, lost mortar in masonry structures, smooth deteriorated surfaces and rebuild severely deteriorated structures.
- C. For Concrete Surfaces: The following products may be accepted and approved if approved by the manufacturer(s) for suitability and compatibility in topcoating with the specified coating product(s) for use within the specifications:

1. 100% solids, solvent-free epoxy grout, including the specified coating product(s).
2. Factory blended, rapid setting, high early strength, fiber reinforced, non-shrink repair mortar that can be trowelled or pneumatically spray applied, such as Quadex Inc. Aluminaliner or Hyperform.
3. Polymer modified or enhanced cementitious patch and repair materials, including Quadex Inc. Hyperform.

2.07 COATING PRODUCTS

- A. Manufacturer: Quadex, LLC. 18150 Imperial Valley Dr. Houston, Texas 77060 713-750-9081, or FAX 884-804-7996, or Engineer approved equal.
- B. Product: Structure Guard– 100% solids, high-build epoxy system exhibiting the following characteristics:
 1. Product Type: amine cured epoxy
 2. VOC Content (ASTM D2584): 0%
 3. Compressive Strength, psi (ASTM D695): 13,300 (minimum)
 4. Tensile Strength, psi (ASTM D638): 8,700 (minimum)
 5. Flexural Modulus, psi (ASTM D790): 507,000 (minimum)
 6. Adhesion to Concrete, mode of failure (ASTM D4541): Substrate (concrete) failure
 7. Chemical Resistance (ASTM D543/G20) all types of service for:
 - a. Municipal sanitary sewer environment
 - b. Sulfuric acid, 70%
 - c. Sodium hydroxide, 50%

2.08 COATING APPLICATION EQUIPMENT

Manufacturer approved heated plural component spray equipment. Hard to reach areas, primer application and touch-up may be performed using hand tools.

2.09 EXAMINATION

- A. Appropriate actions shall be taken by Contractor to comply with local, state and federal regulatory and other applicable agencies with regard to environment, health and safety during work.
- B. All structures to be coated shall be readily accessible to Contractor.
- C. New Portland cement concrete structures shall have endured a minimum of 28 days since manufacture prior to commencing coating installation.
- D. Any active flows shall be dammed, plugged or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated. Any equipment shall be locked-out according to site safety and OSHA requirements.

- E. Temperature of the surface to be coated should be maintained between 40 and 120 deg F.
- F. Specified surfaces should be shielded to avoid exposure of direct sunlight or other intense heat source. Where varying surface temperatures do exist, coating installation should be scheduled when the temperature is cooling.
- G. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify Owner, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Concrete Surfaces:
 - 1. Oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the coating to the substrate shall be removed in accordance with SSPC-SP 1.
 - 2. Concrete and/or mortar damaged by corrosion, chemical attack or other means of degradation shall be removed so that only sound substrate remains.
 - 3. Choice of surface preparation method(s) should be based upon the condition of the structure and concrete or masonry surface, potential contaminants present, access to perform work, and required cleanliness and profile of the prepared surface to receive the coating product(s).
 - 4. Surface preparation method, or combination of methods, that may be used include high pressure water cleaning, water jetting, abrasive blasting, shotblasting, grinding, scarifying, detergent water cleaning, hot water blasting and others as referenced in NACE No. 6/SSPC SP-13. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface suitable for the specified coating product(s).
 - 5. Infiltration shall be stopped by using a material which is compatible with the repair products and is suitable for topcoating with the coating product(s).
 - 6.

3.02 APPLICATION OF REPAIR AND RESURFACING PRODUCTS

- A. Areas where rebar has been exposed and is corroded shall be first prepared in accordance with Specification Section 03 30 00. The exposed rebar shall then be abrasive blasted and coated with coating product specified.
- B. Repair products shall be used to fill voids, bugholes, and other surface defects which may affect the performance or adhesion of the coating product(s).
- C. For concrete surfaces: Resurfacing products shall be used to repair, smooth or rebuild surfaces with rough profiles to provide a concrete or masonry substrate suitable for the coating product(s) to be applied. These products shall be installed to minimum thickness as recommended within manufacturers published guidelines. Should structural rebuild be necessary, these products shall be installed to a thickness as specified by the Engineer.
- D. Repair and resurfacing products shall be handled, mixed, installed and cured in accordance with manufacturer guidelines.
- E. All repaired or resurfaced surfaces shall be inspected for cleanliness and suitability to receive the coating product(s). Additional surface preparation may be required prior to coating application.

3.03 APPLICATION OF COATING PRODUCTS

- A. Application procedures shall conform to the recommendations of the coating product(s) manufacturer, including environmental controls, product handling, mixing, application equipment and methods.
- B. Spray equipment shall be specifically designed to accurately ratio and apply the coating product(s) and shall be in proper working order.
- C. Contractors qualified in accordance with Section 1.03 of these specifications shall perform all aspects of coating product(s) installation.
- D. Prepared surfaces shall be coated by spray application of the coating product(s) described herein unless otherwise recommended by the coating product manufacturer.
- E. Coating thickness shall be in relation to the profile of the surface to be coated as recommended by the coating product manufacturer.
- F. Subsequent topcoating or additional coats of the coating product(s) shall occur within the product's recoat window. Additional surface preparation procedures will be required if this recoat window is exceeded.

- G. Coating product(s) shall interface with adjoining construction materials throughout the manhole structure to effectively seal and protect concrete or masonry substrates from infiltration and attack by corrosive elements. Procedures and materials necessary to affect this interface shall be as recommended by the coating product(s) manufacturer.
- H. Sewage flow shall be stopped, bypassed or diverted for application of the coating product(s) to the invert and interface with pipe materials.

3.04 TESTING AND INSPECTION

- A. During application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used. Measurements shall be taken, documented and attested to by Contractor for submission to Owner.
- B. After the coating product(s) have set in accordance with manufacturer instructions, all surfaces shall be inspected for holidays with high-voltage holiday detection equipment. Reference NACE SPO0274 High-Voltage Electrical Inspection of Pipeline Coatings or ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates. All detected holidays shall be marked and repaired by according to the coating product(s) manufacturer's recommendations. Documentation on areas tested, results and repairs made shall be provided to Owner by Contractor.
- C. Visual inspection shall be made by the Project Engineer and/or Inspector. Any deficiencies in the finished coating shall be marked and repaired according to the procedures set forth herein by Contractor.
- D. The municipal sewer system may be returned to full operational service as soon as the final inspection has taken place.

END OF SECTION