2022 Water Main and Sewer Technical Specifications

ILLINOIS AMERICAN WATER

Prepared by:

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ILLINOIS AMERICAN WATER

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SECTION 01000

SUMMARY OF WORK

PART 1 GENERAL

1.1 WORK UNDER THIS CONTRACT

A. Furnish all labor, materials (except as herein noted), equipment and means to construct the project as described in the Bid Documents and shown on the Drawings. The Work includes, but is not limited to, the following:

1. Pavement removal, including saw cutting, as required.
2. Construction and maintenance of bridges and other structures as required for traffic control.
3. Furnishing of flagmen, traffic warning and control as required.
4. Sheeting, bracing and support of trench and adjoining ground where necessary.
5. Furnish and install pipe restraint as required.
6. Handling drainage and water removal.
7. Guarding the site and materials.
8. Unloading, loading, hauling, distributing, laying and testing the pipe and appurtenances.
9. Furnishing materials not provided by the owner to the site (see section 1.03).
10. Rearranging sewer lateral and other pipes and ducts where necessary.
11. Excavation and backfilling of trenches and pits.
12. Restoration of paved and concrete surfaces including curbing.
13. Removal of surplus excavated material and debris.
14. Installation of required pipe, fittings and appurtenances
15. Performance of vacuum/ pressure and leakage tests.
16. Grout abandon facilities.
17. Site cleaning.
18. Maintenance of street or other surfaces for the required period of time.
19. Ground restoration and planting.
20. Submit schedules, shop drawings and as-built records.
21. Erosion and sediment control.
22. Call for locates.
23. Permits as required by OWNER.
24. Mandrel Testing.
25. Flushing and Chlorination as required.

B. Please refer to the Standard General Conditions of the Construction Contract for definitions of the OWNER, CONTRACTOR, ENGINEER and other terminology that may be used in this specification.

C. The above general outline of principal features does not in any way limit the responsibility of the CONTRACTOR to perform all Work and furnish the required materials, equipment, labor and means as shown or required by the Contract Documents.

D. Materials, equipment, labor, etc., obviously a part of the Work and necessary for the proper operation and installation of same, although not specifically indicated in the Contract Documents, shall be provided as if called for in detail without additional cost to the OWNER.

1.2 LOCATION

A. Work is to be performed on OWNER's property and/or public rights-of-ways or easements shown on the drawings and described in the Specifications. Work shall be performed by the CONTRACTOR within these limits.

B. It is the obligation and responsibility of the CONTRACTOR to determine the exact limitations of the rights-of-way and/or easements and any conditions limiting or affecting the use of the right of way by the OWNER and/or the CONTRACTOR. All agreements respecting rights-of-way and the easements that are available to the OWNER can be made available upon request. The CONTRACTOR agrees to indemnify and hold harmless the OWNER against any claims made by any property owner, including any claim that the CONTRACTOR has failed to keep CONTRACTOR work, equipment, materials, or workmen within the limits authorized by the right-of-way and/or easement or any claim that the CONTRACTOR has failed to comply with any condition or requirement, or agreement respecting the right-of-way and/or easement.

C. Some of the locations shown or described in the Contract Documents, such as lateral connections, are approximate and it is the responsibility of the contractor for pinpointing the exact locations.

1.3 WORK BY OWNER

A. OWNER or the OWNER's Resident Project Representative (RPR) shall perform certain items of Work related to this project which include the following:

1. Mark locations of existing laterals, valves, mains, etc.

2. Other work, if any, as described below.
   a. Operate all existing valves necessary to shut-off and reactivate the existing pipelines
   b. Communicate with customers regarding project

1.4 OWNER FURNISHED PRODUCTS

A. All products shall be provided by CONTRACTOR unless specifically stated in plans or contract. Products furnished to the site and paid for by OWNER may include the following:

1. Pipe
2. Fire Hydrants
3. Meters

B. OWNER's Responsibilities:

1. Arrange for and deliver OWNER reviewed shop drawings, product data, and samples, to CONTRACTOR.

2. Arrange and pay for product delivery to site.

3. On delivery, inspect products jointly with CONTRACTOR.

4. Submit claims for transportation damage and replace damaged, defective, or deficient items.

5. Arrange for manufacturers' warranties.

C. CONTRACTOR's Responsibilities:

1. Review OWNER reviewed shop drawing's product data, and samples.

2. Receive and unload products at site; inspect for completeness or damage, jointly with OWNER.

3. Handle, store, install and finish products.

4. Repair or replace items damaged after receipt.

5. Arrange for manufacturers inspections, service, start-up services and training.

1.5 WORK SEQUENCE

A. Work shall be scheduled, sequenced and performed in a manner which minimizes disruption to the public and plant operations and shall not interrupt or impact the Water Company’s ability to operate and maintain service of the existing facility. During the construction periods coordinate construction schedule and operations with the Water Company, Inspectors and Engineer.

B. Allow for construction and schedule constraints in preparing the construction schedules required under Section 01300 – Submittals. The schedule shall include the CONTRACTORs activities necessary to satisfy all constraints included and referenced in the Contract Documents.

C. The CONTRACTOR is responsible for sequencing the work. It is a requirement that the CONTRACTOR's sequence result in the minimum number and duration of total or partial outages. The listing of Schedule Requirements identified below does not mean that all constraints or special conditions have been identified. The list does not substitute for the CONTRACTOR's coordination and planning for completion of the work within the Contract Time in the Agreement. The sequence is general in nature and meant to depict a possible approach by the CONTRACTOR that would minimize plant downtime and permit timely completion of the project.

1.6 CHANGE PROCEDURES

A. The OWNER may issue to CONTRACTOR a Proposal Request which includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Times for executing the change and the period of time during which the requested price will be considered valid. CONTRACTOR will prepare and submit an estimate within 15 working days. The estimate shall contain a detailed breakdown of the labor, equipment, material, subcontract, equipment rental, contingencies, overhead, and profit costs associated with the requested change. The estimate shall also include any requested adjustments to Contract Times including the window of time the OWNER has to render a decision on the matter.

1.7 DEFINED TERMS

A. Terms used in these Specifications which are defined in the General Conditions of the Contract Documents shall have the meanings assigned to them in the General Conditions.

1.8 ABBREVIATIONS

A. Where any of the following abbreviations are used in the Contract Documents, they shall have the meaning set forth opposite each.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
IEEE	Institute of Electrical and Electronics Engineers, Inc.
AISC	American Institute of Steel Construction
AMCA	Air Moving and Conditioning Association
ANS	American National Standard
ANSI	American National Standards Institute
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood-Preservers' Association
AWWA	American Water Works Association
CS	Commercial Standard
IBR	Institute of Boiler and Radiator Manufacturers
IPS	Iron Pipe Size
JIC	Joint Industry Conference Standards
NBS	National Bureau of Standards
NEC	National Electrical Code; Latest Edition
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
Fed.Spec.	Federal Specifications issued by the Federal Supply Service of the General Services Administration, Washington, D.C.
125lb ANS	American National Standard for Cast-Iron Pipe
250lb ANS	Flanges and Flanged Fittings, Designation B16.1-1975, for the appropriate class
AWG	American or Brown and Sharpe Wire Gage
NPT	National Pipe Thread
OS&Y	Outside Screw and Yoke
Stl.WG	U.S. Steel Wire, Washburn and Moen, American Steel and Wire or Roebling Gage
UL	Underwriters' Laboratories
USS Gage	Untied States Standard Gage
WOG	Water, Oil, Gas
WSP	Working Steam Pressure

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 FIELD SURVEY WORK

A. Unless otherwise provided in the Supplementary Conditions, the OWNER shall provide engineering surveys to establish reference points for construction as provided in Article 4.05 of the General Conditions. Utilizing OWNER's reference points, establish the initial control base line and all control benchmarks to be utilized throughout the project. Base line shall be set in accordance with all lines, dimensions, reference points, and elevations given in the Contract Drawings.

B. If a discrepancy between the information as presented in the Contract Drawings and any existing survey grid work, benchmarks, structures, etc., notify the OWNER immediately. New construction shall not commence until accurate control base lines and benchmarks have been established.

C. Throughout the course of the project, set all additional stakes which are needed for offset stakes, reference points, slope stakes, pavement and curb line and grade stakes, stakes for structures, sewers, utilities, roadway drainage, pipe underdrains, paved gutter, fence, culverts, or other structures, supplementary benchmarks, and any other horizontal or vertical controls necessary to secure a correct layout and construction of the work. Stakes for line and grade for pavements, curbs, storm drains, sewers, etc., shall be set at twenty-five (25) foot maximum intervals. Base lines shall be staked in such manner as to clearly define them for the project.

D. The finished work shall conform to the lines, grades, elevations and dimensions called for in the Contract Documents. The Work shall be subject to checking by the OWNER, but any inspection or checking of CONTRACTOR's layout by the OWNER and the acceptance of all or part of it shall not relieve the CONTRACTOR of his responsibility to secure the proper dimensions, grades, elevations and locations on the several parts of the Work. The CONTRACTOR shall exercise care in the preservation of stakes, monuments and benchmarks and shall have them reset at his expense when they are lost or displaced.

E. Prior to the commencement of any Work activity, the contractor shall survey and layout the Work to be performed and advise the OWNER of any conflicts, obstructions, concerns, etc. that will prevent completion of such work in accordance with the requirements of the Contract Documents. If the CONTRACTOR fails to conduct such survey and layout or if the survey and layout fails to identify a conflict, obstruction, etc., which it reasonably should have, and a conflict, obstruction, concern, etc., is discovered, the CONTRACTOR shall bear the cost of any standby time for labor and/or equipment which occurs pending the OWNER's direction and the cost of rework of any Work installed which is affected by the conflict, obstruction, etc.

F. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the Work, verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

3.2 COORDINATION AND MEETINGS

A. Coordinate work, to phase the construction operations, and provide, install and maintain any temporary connections necessary to prevent interference to operation of OWNER's facilities. Any construction work requiring the shutdown of facilities must be scheduled and performed only at such times as shall be authorized by the OWNER. Such Work must be completed during the specific periods authorized by the OWNER. It may be necessary that Work will be performed during several shutdown periods and/or during periods of premium time payment to accomplish the desired construction. All costs to perform the CONTRACTOR's work, including premium time payments, shall be borne by the CONTRACTOR and are included in the Contract Price

B. Additionally:

1. Coordinate scheduling, submittals, and work of the various sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

2. Verify the utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

3. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

4. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

5. Coordinate completion and clean-up of Work of separate sections in preparation for substantial completion and for portions of Work designated for OWNER's partial occupancy.

6. After OWNER occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of OWNER's activities.

C. Job Progress Meetings

Progress meetings will generally be held monthly. CONTRACTOR's attendance shall be required.

1. Schedule - The OWNER will establish the meeting place, time and date, notify participants and administer the meeting. CONTRACTOR shall notify major subcontractors and suppliers, as appropriate.

2. Attendance

   a. OWNER's representative
   b. CONTRACTOR's project manager and project superintendent
   c. ENGINEER and/or resident project representative.
   d. Subcontractor, as appropriate to the agenda
   e. Suppliers, as appropriate to the agenda
   f. Other parties as determined by OWNER.

3. Agenda

   a. Review minutes of previous meeting.
   b. Review of work progress since previous meeting.
   c. Review field observations, problems, and/or conflicts.
   d. Review problems which impede construction schedules.
   f. Review of off-site fabrication, delivery schedules.
   g. Review corrective measures and procedures to regain projected schedule.
   h. Review revisions to construction schedules.
   i. Review plan progress, schedule, during succeeding work period.
   j. Review coordination of schedules.
   k. Review submittal schedules; expedite as required.
   l. Review maintenance of quality standards.
   m. Review proposed changes for:
      - Effect on construction schedule and on completion date
      - Effect on other contracts of the project
   n. Other business

4. Minutes – ENGINEER will prepare and distribute copies to participants and OWNER for review at the next meeting.

–END OF SECTION 01000–

SECTION 01075

BASIS OF PAYMENT

PART 1 GENERAL

1.1 SCOPE

Work to be performed under this Contract shall be paid in accordance with the Bid Schedule submitted with the Bid. When applicable, and authorized by OWNER, additional work will be paid for in accordance with the supplementary unit price schedule, of the Bid. The cost of labor, equipment, materials, or work called for in the Specifications, shown on the Drawings, or necessary for a complete and satisfactory installation, but which are not specifically mentioned in this Section shall be included in the appropriate supplementary unit price by the CONTRACTOR at no additional expense to the OWNER.

1.2 SUPPLEMENTAL UNIT PRICE ITEMS

A. Lawn Restoration

Payment will be adjusted per square foot for Lawn Restoration. The Work is described in Specification Section 02820 – Lawn Restoration

B. Service Renewal – Meter Setter

Payment will be adjusted per each for Service Renewal – Meter Setter. The Work includes replacing the meter setter as determined by the OWNER/ENGINEER and in accordance with Specification Section 15200 – Service Lines.

C. Service Renewal – Meter Box

Payment will be adjusted per each for Service Renewal – Meter Box. The Work includes replacing the meter box as determined by the OWNER/ENGINEER and in accordance with Specification Section 15200 – Service Lines.

D. Service Renewal – Meter Box Frame and Lid

Payment will be adjusted per each for Service Renewal – Meter Box Frame & Lid. The Work includes replacing the meter box frame and lid as determined by the OWNER/ENGINEER and in accordance with Specification Section 15200 – Service Lines.

1.3 ALLOWANCE ITEMS

Not Used

1.4 LUMP SUM ITEMS

A. Mobilization and Demobilization

Payment will be made at the Contract Unit Price per lump sum for Mobilization and Demobilization. The work shall consist of the assembling and setting up for the project, including but not limited to the CONTRACTOR's general plant, including CONTRACTOR's general offices, shops, plants, storage areas, temporary signs, sanitary and any other facilities, as required by the Specifications Section 01500 Temporary Facilities, Section 01700 Project Closeout and special requirements of the Contract, as well as by local or State Law and regulation. The cost of any other initial expense required for the start of work will be included in the item.

B. Insurance (and Bonds)

Payment will be made at the Contract Unit Price per lump sum for Insurance and Bonding. This item includes bonds and insurance as required in the Contract Documents.

C. Traffic Control

Payment will be made at the Contract Unit Price per lump sum for Traffic Control. This item includes providing all material, labor, and equipment to provide a safe and effective traffic control, signage, flaggers, etc., as needed to serve the project and as required by local permits or regulations.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

–END OF SECTION 01075–

SECTION 01100

ALTERNATIVES

PART 1 GENERAL

1.1 RELATED WORK

A. Alternative equipment and/or materials must be listed in the Bid. Failure to submit information on alternative equipment and/or materials as requested by the OWNER is cause for rejection of the proposed alternative and only the specified equipment and/or materials will be permitted to be incorporated in the finished project.

B. All alternative equipment and/or materials offered in the Bid must comply with the detailed requirements of the Drawings and Specifications and shall be covered by the specified guarantees and warranties. If it is determined that the alternative equipment and/or materials do not conform to the Specifications, such proposed alternative shall not be accepted and installation of the specified equipment and/or materials shall be required.

C. No alternative materials and/or equipment will be incorporated in the finished project except an alternative accepted in writing by OWNER pursuant to the requirements of this Section 01100. Acceptance by OWNER of any such alternative shall not relieve CONTRACTOR of responsibility for assuring that any such alternative will, after installation or incorporation in the Work, conform to any performance requirements and other information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

1.2 SUBMITTALS

A. Specified equipment and materials have been used to prepare the Drawings. Changes in piping, wiring, structure, etc., necessary to accommodate alternatives accepted by OWNER shall be submitted to the OWNER for approval.

1.3 PAYMENT

A. All installation costs necessitated by the selection of alternative equipment and material shall be included in the Contract price and any modifications as stated in the Bid.

PART 2 PRODUCTS

Not Used.

PART 3 Execution

Not Used.

–END OF SECTION 01100–

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 BEFORE STARTING WORK

A. Preliminary Progress Schedule.

In accordance with Section 2.05 of the General Conditions, prepare and submit to the OWNER for approval, a preliminary construction progress schedule. This submittal is to be made within ten (10) days from the Notice of Award. The construction work shall be detailed to an extent that progress can be readily monitored.

B. Shop Drawings and Samples Submittal Schedule

The Preliminary Progress Schedule shall contain activities including submittal and review of shop drawings and material samples. The shop drawing and sample submittal schedule required per Paragraph 7.14 of the General Conditions shall be developed by sorting these activities from the progress schedule. The schedule shall be presented in a report format containing the following:

1. Activity number
2. Activity description (including reference to the appropriate specification section)
3. Early and Late start dates
4. Early and Late finish dates
5. Total and free float
6. Successor activities

C. Schedule of Values

The Bid Schedule will be used as the Schedule of Values for this project.

D. Schedule of Property Unit Values

Not Used.

E. Cash Flow Schedule

Accompanying the CPM Schedule required above, submit to the OWNER for approval a Cash Flow Schedule. The Cash Flow Schedule shall show the amounts of money by months which will be required to reimburse the CONTRACTOR for Work performed during each month of the Contract Times. The sum of all the monthly cash requirements shall equal the Contract Price. The

monthly cash requirements shall be proportioned based on the CPM Schedule. The initial cash flow schedule shall depict monthly cash requirements based on the early start dates of the CPM Schedule as well as the monthly cash requirements based on late start dates of the CPM Schedule. The approval cash flow schedule will be developed by the OWNER and will reflect the scheduled performance as of the date of approval. This process of approving cash flow schedules will occur with each required schedule update.

The approval Cash Flow Schedule will be used by the OWNER to program funds for progress payments. Monthly payments will be made in accordance with the Contract Agreement, but at no time will the aggregate amount of payments exceeds the accumulated amount of payments for the same period of the approval Cash Flow Schedule.

F. Preconstruction Digital Recording

If required by the OWNER, Prior to mobilization at the site, furnish to the OWNER a video recording of all planned construction areas, material storage areas, areas adjacent to these areas, including but not limited to, streets, driveways, sidewalks, curbs, ditches, fencing, railing, visible utilities, retaining structures and adjacent building structures. The purpose of the recording is to document existing conditions and to provide a fair measure of required restoration. Care should be taken to record all existing conditions which exhibit deterioration, imperfections, structural failures or situations that would be considered substandard.

The recording shall be high quality, color and in a digital format. Temporary lighting shall be provided as necessary to properly record areas where natural lighting is insufficient (indoors, shadows, etc.). The recording shall include an audio soundtrack to provide the following information:

- detailed description of location being viewed referenced to Contract Drawings (ie. station no., building designation, pipeline route etc.)
- direction (N, S, E, W, looking up, looking down, etc.) of camera view
- date, time, temperature, environmental conditions at time of taping.

Any areas not readily visible by the recording shall be described in detail. Unless otherwise approved by OWNER, recording shall not be performed during inclement weather or when the ground is covered partially or totally with snow, ice, leaves, etc.

Prepare and provide as many copies/formats as are necessary to satisfy the requirements of this section. The original recording shall be submitted to the OWNER accompanied by a detailed log of the contents of each video. The recording will be maintained by the OWNER during construction and may be viewed at any time upon request. Upon final acceptance, the recording will become the permanent property of the OWNER.

1.2 FINALIZING SCHEDULES

A. Prepare to present and discuss at the preconstruction meeting, the schedules submitted in accordance with this specification. Unless additional information is required to be submitted, the OWNER will, within 15 working days of the preconstruction conference, provide comments. Then, resubmit the affected schedules addressing the OWNER's comments.

1.3 REQUIREMENTS FOR CONFORMING WITH SCHEDULE

A. If, in the opinion of the OWNER, work falls behind the progress schedule, the steps shall be taken, as necessary, to improve progress, and OWNER may require an increase to the number of shifts and/or overtime operations, days of work, and/or the amount of construction planned, and to submit for approval such supplementary schedule or schedules as may be deemed necessary to demonstrate the manner in which the agreed rate of progress will be regained, all without additional cost to the OWNER. An updated cash flow schedule will be required in this occurrence and will be provided with the supplementary schedules referenced above.

1.4 UPDATING SCHEDULES

A. Submit to the OWNER monthly updates of the schedules required per this specification section.

B. Progress and shop drawing schedule updates shall reflect the progress to date by providing actual start dates for activities started, actual finish dates for completed activities, and identifying out of sequence work, schedule logic changes and any circumstances or events impacting the current schedule. The updates shall also contain best estimates of the remaining duration for activities not complete as of the date of the update. All graphic presentations, reports and computer discs required per the initial submittal of these schedules shall be provided with each update.

C. Updated as necessary the schedule of values and cash flow schedules to reflect any changes.

1.5 ADJUSTMENT OF PROGRESS SCHEDULE AND CONTRACT TIMES

A. If there is a desire to make changes to the method of operating which affect the approved progress schedule, notify the OWNER in writing stating what changes are proposed and the reason for the change. If the OWNER approves these changes, revise and submit for approval, without additional cost to the WONER, all of the affected portions of the schedule.

B. Shop drawings and samples which are not approved on the first submittal or within the schedule time shall be immediately rescheduled, as well as any work which fails to pass specified tests or has been rejected.

C. The Contract Times will be adjusted only for causes specified in the General Conditions. In the event a request to adjust the Contract times is desired, furnish such justification and supporting evidence as the OWNER may deem necessary for a determination as to whether such an entitled to an adjustment of Contract Times under the provisions of the General Conditions is warranted. The OWNER will, after receipt of such justification and supporting evidence, make findings of fact and will advise in writing thereof. If the OWNER finds that any adjustment of the Contract Times is entitled, the OWNER's determination as to the total number of days adjustment shall be based upon the currently approved progress schedule and on all data relevant to the adjustment. The actual delays in activities which, according to the progress schedule, do not affect the Contract completion date shown by the critical path in the network will not be the basis for an adjustment of Contract Times.

D. From time to time it may be necessary for the progress schedule and/or Contract Times to be adjusted by the OWNER to reflect the effects of job conditions, weather, technical difficulties, strikes, unavoidable delays on the part of the OWNER and other unforeseeable conditions which may indicate schedule and/or Contract Times adjustments. Under such conditions, the OWNER shall require the rescheduling of the work and/or Contract Time to reflect the changed conditions, and the schedule shall be revised accordingly. No additional compensation shall be made for such changes except as provided in the General Conditions. Unless otherwise directed, take all possible actions to minimize any extension to the Contract Times and any additional cost to the OWNER.

1.6 SHOP DRAWINGS

A. Promptly supply to the Engineer for approval, shop drawings with details and schedules for all items contained in the list of required Shop Drawings included at the end of this Section, or for other items as may be required by the Engineer.

B. The OWNER will specify the number of copies and submittal format including digital and electronic. Submittals shall include all drawings, schedules, and brochures for approval. Black line prints, blue line prints or reproducible transparencies are required. Blueprints (white lines on a blue background) are not acceptable. Each submittal shall have the job name on it and the appropriate specification section or contract drawing reference.

C. Shop drawings shall be numbered with the Water Company's file number XXXX-XXXX Rev. _____. Detailed procedures for numbering will be outlined at the pre-construction meeting.

D. Each copy of the submittals made to the Water Company for approval shall be prepared by the CONTRACTOR and shall have an identifying title stamp as follows:

_____-American Water
_____ Division - _____ District
_____(Project Title)
Specification Section _____
Shop Drawing No. ___-___-___ Rev. _____

E. As required by the General Conditions, each copy of the submittals shall also be stamped with the CONTRACTOR's approval indicating that the shop drawing has been reviewed for conformance to the Contract Documents and has been coordinated with all other work and/or trades. Identify and bring to the attention of the OWNER any deviations to the Contract Documents contained in the submittal. For shop drawings being resubmitted, identify and bring to the attention of the OWNER any revisions other than those originally requested by the OWNER.

Submittals smaller than 8½x11 inches shall be secured to paper 8½x11 inches.

Submittals will be returned, stamped with the following classifications:

1. "Approved" – There are no notations or comments on the submittal and, in Owner's opinion, the submittal meets the requirements of the Contract Documents and the equipment may be released for production.

2. "Approved as Noted" – Notations have been made on the submittals to insure conformance with the Contract Documents. The equipment may be released for production in accordance with the notations.

3. "Not Approved" – The submittal does not meet the requirements of the Contract Documents. Submit the specified product.

4. "Revise and Resubmit" – When the material submitted is incorrect or insufficient to review properly and it is necessary to see the complete package again.

5. "Resubmit Record Copy" – Used with the review action "Approved As Noted". The resubmittal shall incorporate notations.

F. Where a submittal indicates a departure from the Contract which the ENGINEER deems to be a minor adjustment in the interest of the OWNER not involving a change in Contract Price or extension of Contract Times, the ENGINEER may approve the submittal but the approval will contain, in substance, the following notation:

"The modification indicated on the attached submittal is approved in the interest of the OWNER to effect an improvement for the Project and is accepted with the understanding that it does not involve any change in the Contract Price or Times; that it is subject generally to all Contract stipulations and covenants; and that it is without prejudice to any and all rights of the OWNER under the Contract Bonds."

G. It is emphasized that the ENGINEER's approval of submitted data is for general conformance to the Contract Drawings and Specifications, but subject to the detailed requirements of Drawings and Specifications. Although the ENGINEER may check submitted data in more or less detail, such checking is an effort to discover errors and omissions in CONTRACTOR's drawings and to assist in coordinating and expediting site work, and shall in no way relieves the CONTRACTOR of the responsibility to engineer the details of the Work in such manner that the purpose and intent of the Contract will be achieved, nor shall such detail check by the ENGINEER be construed as placing on the ENGINEER, any responsibility for the accuracy, and for proper fit, functioning and performance of any phase of the Work included under this Contract.

1.7 SAMPLES

A. When required by the OWNER or where noted in other Sections of these Specifications, samples or materials shall be submitted for approval.

B. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

C. Submit samples of finishes from the full range of manufacturer's standard colors, textures, and patterns for ENGINEER's selection.

Include identification on each sample, with full project information.

Submit the number or samples specified in individual specification sections; one of which will be retained by ENGINEER.

Reviewed samples which may be used in the Work are indicated in individual specification sections.

1.8 PROGRESS PAYMENTS

A. The detailed arrangement for submittal of progress payments shall be discussed at the preconstruction meeting and will be in accordance with Article 14 of the General Conditions. In general, progress payments shall be submitted monthly in a format acceptable to the OWNER. The progress payment request shall be based on the approved schedule of values and should provide the number of unites completed, total dollar value completed, dollar value completed prior to the

current payment, and the amount requested for this progress payment for each line item contained in the schedule of values.

Progress payment requests for material and/or equipment suitably stored but not yet incorporated into the work shall be accompanied by a copy of the appropriate manufacturers invoice, shipping order, bill of lading, etc. and the progress payment amount shall be the direct cost to the CONTRACTOR, or subcontractor, for such material and/or equipment. Payment will not be made if, upon inspection by the OWNER, it is determined that the material and/or equipment does not conform to the requirements of the Contract Documents including proper storage, receipt of approved shop drawings, receipt of any special guarantees, Bonds, insurance coverage, any evidence of damage or imperfections, etc.

1.9 CONTRACTOR'S DAILY REPORTS

A. If requested by the OWNER or the Resident Project Representative (ENGINEER), prepare and submit daily reports containing the following information:

- number of craftsmen and hours worked of each subcontractor,
- number of hours worked by each trade,
- number of hours worked of each type of equipment,
- description of work activities performed,
- description of any material or equipment deliveries,
- description of obstructions encountered,
- temperature and weather conditions.

1. Downtime due to equipment failure.
2. Detail cause for work delays

B. The daily reports shall be submitted on a daily basis, by the end of the next business day.

C. Information provided on the daily report shall not constitute notice of delay or any other notice required by the Contract Documents. Notice shall be as required therein.

1.10 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

Not Used

1.11 CONSTRUCTION PHOTOGRAPHS

A. Provide construction photographs taken within the first three working days of each month. Take a minimum of twelve (12) digital exposures each and submit digital copies of each exposure.

B. When work is complete take twelve (12) additional digital photographs and submit electronic copies of each exposure.

C. Employ a mutually acceptance commercial photographer who has shown OWNER samples of his/her work. Photographer shall be equipped at all times to make either interior or exterior exposures.

D. Digital copies shall be in JPG (Joint Photographic Experts Group) format.

E. Consult with ENGINEER for instructions concerning view required at each specified visit to the site. Provide digital copies on computer disks or thumb drive.

F. Deliver photographs monthly to OWNER or the Resident Project Representative (ENGINEER).

1.12 PROJECT RECORD DOCUMENTS (BY CONTRACTOR)

A. The CONTRACTOR shall complete and maintain on-site one set of the following Record Documents, which shall record all actual revisions to the Work concurrent with construction progress and shall be available upon request (during working hours or on the next business day) by the OWNER or the Resident Project Representative (ENGINEER):

1. Drawings;
2. Specifications;
3. Addenda;
4. Change orders and other modifications to the Contract;
5. Approved Shop Drawings and other submittals.
6. Field sketches.

B. The Record Documents shall be updated daily (red-line markups). The OWNER reserves the right to stop Work at CONTRACTOR’s expense until red-line markups are up to date. Red-line markups shall contain but are not limited to the following information.

C. Store Record Documents separate from documents used for construction.

D. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. manufacturer's name and product model and number,
2. product substitutions or alternates utilized,
3. changes made by addenda and modifications.

E. Record Drawings, Documents and Shop Drawings: Legibly mark each item to record actual construction including:

1. Original Drawings with Red-Line markings including measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements as stated in Section 010004 Submittals.
2. Field changes of dimension and detail
3. Pipe restrained joint lengths
4. Actual fitting and valve locations with horizontal dimensions measured from permanent structures.
5. Depths that exceed the minimum cover
6. Details not on original Drawings.
7. Pre and Post Construction videos
8. Electronic photographs
9. Others as required in other sections of the Specifications.

F. Submit documents to OWNER with final Application for Payment.

G. The OWNER will issue a notice of Final Completion to the CONTRACTOR when the Work is in-service and up-to-date Record Documents have been provided by the CONTRACTOR.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

–END OF SECTION 01300–

SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.1 WATER SUPPLY

A. If reasonably available, water for the purpose of this Contract will be supplied by the OWNER. All necessary meters, temporary piping and valves in connection with such water supply shall be furnish and install by the CONTRACTOR.

B. The OWNER reserves the right to impose limitations upon use of water as the OWNER determines may be necessary to assure continued ability to meet the demands of its customers and the volumes and pressures required for fire protection. Any water required in excess of the quantities the OWNER provides shall be furnished by the CONTRACTOR at cost.

1.2 TEMPORARY LIGHTING

A. Provide and maintain lighting for construction operations and lighting to exterior staging and storage areas after dark for security purposes.

1.3 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing buildings.

1.4 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition. Remove waste materials, debris, and rubbish from site weekly and dispose off-site. Reference the Storm Water Pollution Prevention Plan (SWPPP) for additional site cleaning requirements.

1.5 SANITARY FACILITIES

A. Provide suitable temporary facilities and enclosures for the use of workmen and shall maintain same in a sanitary condition.

B. The CONTRACTOR's sanitary arrangements shall not endanger the OWNER's facilities or other facilities.

1.6 DUST CONTROL

A. Take all necessary measure to control dust from operations, and to prevent spillage of excavated materials on public roads.

B. Remove all spillage of excavated materials, debris or dust from public roads by methods approved by the Engineer.

C. Sprinkle water at locations and in such quantities and at such frequencies as may be required by the Engineer to control dust and prevent it from becoming a nuisance to the surrounding area.

D. Dust control and cleaning measures shall be provided at no additional cost to the OWNER.

1.7 USE OF PROJECT SITE

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

–END OF SECTION 01500–

SECTION 01600

PRODUCTS

PART 1 GENERAL

1.1 PROTECTION OF MATERIAL AND EQUIPMENT

A. The interior of all pipe and accessories shall be kept free from dirt and foreign matter at all times.

B. After valves and hydrants have been inspected, properly store them prior to use In order to prevent entry of foreign material that could cause damage to the seating surfaces, the valves and hydrants shall be stored in a fully closed position unless recommended otherwise by the manufacturer Resilient seated valves shall be stored in accordance with the manufacturer's recommendations This may include storage with protective covers for rubber seats and in marginally open condition valves and hydrants should be stored indoors.

C. If valves must be stored outdoors, protect the operating mechanism, such as gears, motor, actuators and cylinders, from weather elements Valve ports and flanges must be protected from the weather and foreign materials If valves are subject to freezing temperatures, all water must be removed from the valve interior and the valve closed tightly before storage, unless specifically recommended otherwise by the manufacturer valves shall be stored on pallets with the discs in a vertical position to prevent rainwater from accumulating on top of the disc, seeping into the valve body cavity and freezing and cracking the casting.

1.2 SERVICING EQUIPMENT

A. Check all equipment upon acceptance to determine if oil reservoirs are full and areas to be greased are properly packed with grease Provide the proper grease or oil for use in lubricating the required areas in the equipment Perform any service to equipment while in storage, or installed pending acceptance, per manufacturer's requirements, industry standards or as stated specifically in the technical specifications.

1.3 MATERIAL/EQUIPMENT FURNISHED BY OWNER

A. Certain material and equipment will be furnished by the OWNER as noted in the Contract Documents Responsibility for material and/or equipment furnished by the OWNER shall begin upon the CONTRACTOR's acceptance of such material and/or equipment at the point of delivery to him All material and equipment shall be examined and items found to be defective in manufacture and/or otherwise damaged shall be rejected at the time and place of delivery to him The OWNER will thereupon repair or replace the damaged items.

B. After acceptance of material and/or equipment by CONTRACTOR at point of delivery to him, CONTRACTOR shall be responsible for the proper storage, handling, servicing and installation of such material and/or equipment in accordance with manufacturer's recommendations, industry standards or specific requirements of the Contract Documents Any material and/or equipment found to be defective prior to acceptance by the OWNER Construction Manager or OWNER assigned competent person shall be repaired or replaced by contractor at no additional cost to OWNER unless CONTRACTOR submits proof that such defect was latent and could not have been detected by CONTRACTOR when performing his duties and responsibilities under these Contract Documents.

C. CONTRACTOR's vs. OWNER's responsibilities for providing guarantees or warranty and manufacturer's representatives for service, inspection, certification of installation, installation, field training, start-up, etc. for material and/or equipment furnished by OWNER shall be as follows unless otherwise specified: The OWNER will provide the warranty and CONTRACTOR is responsible for providing manufacturer's representatives for all necessary field service, start-up service, installation certifications, installation, field training of OWNER's personnel, etc. for OWNER furnished material and/or equipment as required for acceptance of such material and/or equipment in the completed project.

PART 2 PRODUCTS

2.1 GENERAL

A. Unless otherwise specifically provided for in these Specifications, all equipment, materials, and articles incorporated in the work shall be new, in current production and the best grade obtainable consistent with general construction usage.

2.2 COORDINATION OF DIMENSIONS

A. Verify and make necessary corrections to construction dimensions so that all specified and/or alternative equipment, which is approved by the OWNER, can be installed and will function within the intent of the Contract Drawings and Specifications Promptly notify the OWNER of all necessary corrections required.

2.3 SAFETY AND HEALTH REQUIREMENTS

A. All materials, equipment, fixtures and devices furnished shall comply with applicable Laws and Regulations.

B. All equipment furnished and installed under this Contract shall be equipped with suitable and approved safety guards and devices required for the safety of the public and operating personnel Such guards and safety devices shall be in accordance with the latest requirements of safety codes approved by the American National Standards Institute as well as the safety requirements of applicable Laws and Regulations Where said safety codes of the ANSI are incompatible with applicable Laws and Regulations, said Laws and Regulations shall prevail.

PART 3 EXECUTION

3.1 INSTALLATION

A. Material and equipment shall be installed in accordance with the appropriate Sections of these Specifications.

–END OF SECTION 01600–

SECTION 01700

PROJECT CLOSEOUT

PART 1 GENERAL

1.1 TESTING OF FACILITIES

A. Produce a first-class job and all Work shall be tested under operating conditions and pressures. Any leaks or malfunctions shall be repaired to the satisfaction of the OWNER at no additional expense to the OWNER. This provision with reference to leakage shall also apply to water tightness of buildings.

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for OWNER's inspection. Provide submittals to OWNER that are required by governing or other authorities. Submit Application for final payment identifying total adjusted Contract sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final inspection. Clean debris from drainage systems. Clean site; sweep paved areas, rake clean landscape surfaces. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work:

1. Contract drawings
2. Specifications
3. Addenda
4. Change orders and other modifications to the Contract
5. Reviewed shop drawings, product data, and samples

B. Store record documents separate from documents used for construction. Record information concurrent with construction progress.

C. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number
2. Product substitutions or alternates utilized
3. Changes made by addenda and modifications

D. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to finish floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract Drawings.

E. Submit documents to OWNER with final Application for Payment.

1.5 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.

1.6 GUARANTEES AND WARRANTIES

A. The CONTRACTOR expressly warrants that all workmanship and materials performed or furnished under this Contract will conform to the Specifications, Drawings, samples and other applicable descriptions furnished or adopted by the CONTRACTOR and with all applicable laws, provisions and requirements of the Contract Documents. The CONTRACTOR shall remedy any defects due to faulty materials or workmanship which shall appear within a period of one (1) year from the date of acceptance of the work hereunder and pay for any damage to other work resulting therefrom. The OWNER shall give notice of observed defects with reasonable promptness. The CONTRACTOR warranty hereunder is in addition to, and not in limitation of, any obligations found elsewhere in the Contract Documents, any special guarantees provided by the CONTRACTOR or his suppliers, and any obligations imposed by law.

B. In addition to the above requirements, the CONTRACTOR shall assign material and equipment guarantees and warranties from all manufacturers and suppliers to the OWNER and deliver copies of such guarantees and warranties and the assignments thereof to the OWNER in order to assure the OWNER of the full benefit of such guarantees and warranties.

C. CONTRACTOR shall be responsible for scheduling a follow-up warranty inspection with OWNER ten (10) months following final acceptance.

1.7 RESTORATION

A. Restore and/or replace paving, curbing, sidewalks, gutters, shrubbery, fences, sod or other disturbed surfaces and structures to a condition equal to that before the work began and to the satisfaction of the OWNER and shall furnish all labor and materials incidental thereto.

1.8 PUNCH LIST

A. OWNER will prepare a final punch list upon CONTRACTOR's completion of Work. CONTRACTOR shall address all punch list item to the satisfaction of the OWNER prior to leaving the site.

1.9 MAINTENANCE OF SURFACES

A. Following the certification of completion by the OWNER, maintain the surfaces of paved and unpaved trenches and adjacent curbs and gutters, sidewalks, fencing, sod and other disturbed surfaces for a period of one (1) year thereafter or as required by State, county or local authorities unless otherwise stipulated by the OWNER. Supply all material and labor required for the maintenance of the trench surfaces and structures and perform the work in a manner satisfactory to the OWNER.

B. This requirement does not apply to ongoing, routine maintenance that may be required for landscaping purposes, i.e., cutting of grass, or watering of vegetation once it has been accepted as complete.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

–END OF SECTION 01700–

SECTION 01800

TRAFFIC REGULATION

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish and install all traffic barricades, markers, signs, and controls. Provide flagmen, traffic police and other facilities required by the Federal, State and local government authorities and the OWNER to protect general public and maintain the existing roads, streets and highways. Payment for this Section will be covered under the lump sum TRAFFIC CONTROL.

B. Traffic control methods and materials shall conform to the latest editions of applicable State DOT Standard Specifications for Road and Bridge Construction and USDOT Manual on Uniform Traffic Control Devices for Streets and Highways.

C. Prior to the start of construction, assign one individual at a supervisory level who will be responsible for maintenance and protection of traffic. See General Conditions Article 7.

D. Competent traffic personnel suitably attired for safety shall be employed at every location where the CONTRACTOR's equipment is working immediately adjacent to, or is entering, leaving or crossing, active traffic lanes. The traffic personnel shall be employed continuously for the full time such conditions exist.

E. Special attention shall be given for the protection of pedestrians. Ingress and egress shall be maintained for all properties abutting the pipeline.

F. Notify the State and local police, ambulance services and fire departments of daily traffic diversions.

G. Be fully responsible to complete all obligations of the Contract regardless of any restrictions which may be imposed by Federal, State or local authorities. The OWNER makes no warranty or representation that the CONTRACTOR will be permitted to divert or barricade traffic.

1.2 MAINTAINING TRAFFIC

A. Traffic Diversion: Whenever it is necessary to divert traffic from its normal channel into another channel, such diversion shall be clearly marked by cones, drums, barricades or temporary guardrail. If the markers are left in place at night, suitable lights shall be provided and maintained. Per IDOT Standard

B. One Way Traffic: Whenever one way traffic is established, at least two (2) flagmen shall be provided and adhere to all requirements of the local police and street regulator having jurisdiction. Per IDOT Standard.

C. Street Closing: When permitted by Federal, State or local authorities having jurisdiction, the CONTRACTOR may close streets to through traffic for minimum periods of time. Notify and secure the permission of the local police and fire departments and such other public authorities and, if required by any law, ordinance or regulation, the occupants of all premises bordering the streets. Give all occupants reasonable notice with respect to the closing of any street, in whole or in part, even when not required by any law, ordinance, or regulation. Schedule work such that the time the street is closed is kept to a minimum and, whenever possible, make suitable preparations for access by local residents, school buses, and mail delivery vehicles. Provide access for police, fire, ambulance and emergency vehicles at all times. Fire hydrants and other public utility valves shall be kept accessible at all times.

D. Communications of street closings: Based on the project scope, scheduling or staged (better defined word, for moving) street closing, as determined by the OWNER, additional communication by the CONTRACTOR may be required. This includes the use of radio and newspaper.

1.3 TRAFFIC SIGNALS AND CONTROLS

A. The installation and operation of all traffic signals and traffic control devices shall conform to the requirements of Federal, State and local government highway departments. The replacement of pavement markings disturbed during construction, or the installation of temporary markings is the sole responsibility of the CONTRACTOR.

B. To protect persons from injury and to avoid property damage, adequate barricades including flasher and reflectorized construction signs and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic and pedestrians to use the trenched area.

C. When permitted to close a street to traffic, furnish, erect, maintain and remove barricades, suitable and sufficient red lights, and other lights or reflecting material at the limits of the project, where side streets intersect, and at other points of public access to the project. Furnish, erect and maintain advance warning signs and barricades on side street at the first street intersection beyond the one closed by construction indicating "Street Closed, One Block Ahead". Furnish, erect, maintain and remove detour marking signs on temporary routes. By IDOT Standards and other signage as required by the OWNER.

1.4 TRENCH AND STORED MATERIALS MARKINGS

A. Before completion of each day's work, in traveled areas, the pipe trench shall be completely backfilled and tamped, and the necessary temporary paving installed. ¾-inch stone will be used in sidewalk and walkway areas and blacktop in driveways. These areas are not to be left open, impassable or unsafe through the night. In the event that the pipe trench cannot be completely backfilled and tamped, temporary

bridges and crossings shall be used to accommodate through traffic and the general public. The job site will be left in a neat and satisfactory condition at the end of each day. The requirements of this Section are in addition to any requirements of Federal, State or local laws, rules, regulations or ordinances or any requirements found elsewhere in the Contract Documents.

B. Equipment and material stored on the street shall be marked at all times. At night any such material or equipment stored between the side ditches, or between lines 5 feet behind any raised curbs, shall be clearly outlined with light or other dependable warning devices that are approved by the OWNER. In addition, provide any other lights, barricades, etc., that may be needed for the protection of pedestrian traffic.

1.5 OTHER REQUIREMENTS

A. Trucks and/or trailers used as protective vehicles to protect workers or work equipment from errant vehicles on roadways with posted speed limits of 50 MPH or greater shall be equipped with Truck-Mounted Attenuators conforming to the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features".

B. The protective truck must be positioned a sufficient distance in front of the workers or equipment being protected to allow for appropriate vehicle roll-ahead, but not so far that errant vehicles will travel around the vehicle and strike the workers/equipment. Attenuators should be in the full down-and-locked position.

C. For stationary operations, the truck's parking brake should be set and, when possible, the front wheels turned away from the work site. Turning the front wheels should be based on specific conditions at the site such that the after-impact trajectory is into a safe area.

D. If the regulation of traffic and controls are not being provided in accordance with this Section 01800 Traffic Regulation, and the public is inconvenienced or its safety is being endangered, in the judgment of the OWNER, the OWNER may take such steps as it deems advisable to provide such services and all costs in providing such services will be deducted from any payment which may be due or may thereafter become due the CONTRACTOR.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

–END OF SECTION 01800–

SECTION 01900

AS-BUILT DOCUMENTATION

PART 1 GENERAL

1.1 SCOPE OF WORK

Where identified as a product of the Work, provide as-built drawings adhering to the criteria provided here and in the special conditions.

A. Recording the Information – Provide the Record As-Built information in both Electronic and Hardcopy mediums, with the exception of the Field Sketches. The Field Sketches are not required to be in the electronic format. The electronic medium format shall be specified by American Water in the RFP or during the preconstruction meeting.

B. Coordinate System and Datum – Specified in RFP. Provide the required survey coordinates captured through traditional survey or post-processed or RTK GPS (survey grade). GPS locations captured with a recreational GPS receiver that does not allow for post-processed or real time correction will not be acceptable. The drawing features included shall be as noted herein.

C. Submitting the Information – When the Record information is ready, submit Electronic and Hardcopies of all the information, including sketches to the OWNER for approval. All files associated with the post-processing of GPS data including raw and post-processed GPS data shall be included in the submitted deliverable to AW (if required). These files can include but not be limited to: .ssf GPS data, import files, export files, and correction files.

   A GIS Mapping As-Built may have predetermined milestone project deliverables. The delivery schedule shall be determined by OWNER during the preconstruction meeting.

   The electronic information shall be provided to the OWNER via the electronic file transfer process or medium as indicated by the OWNER. This could be CD, flash drive or cloud storage transfer or email. The electric information shall be labeled with the following information:

   American Water (State and District)
   Facility (Installation Name) Project (Name)
   (Street) and (Town)

D. The Information Process – The OWNER will approve the submission and 'red line' any information needing to be corrected or added and return it for resubmission. When the submittal is approved by the OWNER, the CONTRACTOR shall provide one electronic copy containing all approved Record As-Built information and one hardcopy of all approved Record As-Built information (binder clipped together, not bound).

Initial submission must be provided within (14) calendar days of the 'Construction Completion' date, not including the restoration work. The OWNER will return the submission within (7) calendar days of receipt. The approved final submission must be provided within twenty-eight (28) calendar days from the 'Construction Completion' date, not including the restoration work.

PART 2 PRODUTS

2.1 TYPES OF AS-BUILT FORMATS

Type of work performed will determine which as-built format deliverable is required. Format will be indicated in the RFP.

A. Red-line Markups (field sketches) – Submit all field sketches following the project outline below, regardless of project size. Required on smaller projects.

1. Markups drawn on an AW base map or drawing provided by Base DPW/ACE. If no map provided, a GPS coordinate located on drawing of general project area and nearby streets and buildings clearly noted for reference.

2. Red-line drawing not required to be to scale.

3. North Arrow on drawing.

4. Measurements in feet from known fixed locations (i.e. building corners, curbs) to all valves, fittings, hydrants or manholes.

5. AW Project name, project ID, date, CONTRACTOR name and CONTRACTOR contact information provided on drawing.

6. Provided in Adobe .pdf format in either A size (8.5 x 11 in) or B size (11 x 17 in) page.

B. Construction Drawing Set – Required for larger non-phased construction projects.

1. Signed and sealed drawings supplied in AutoCAD 2010 or newer version specified in RFP. The base drawing shall be drawn in Model Space at a scale of 1 to 1, in real world coordinates and all plotting, labeling and dimensioning shall be drawn from Paper Space. Templates shall not be modified or resized due to Optical Scanning requirements. The layering convention and color scheme shall follow the samples provided.

2. Number of hard copy drawing set(s) delivered to be determined at preconstruction meeting (minimum of 1).

3. All asset locations (including but not limited to mains, sewer lines, valves, fittings and junctions) collected through traditional survey or GPS survey (mapping or survey grade). All GPS locations shall be collected with real-time

correction or post processed with differential correction software, i.e. Trimble Pathfinder Office (most current version).

4. All assets taken out of service and abandoned or demolished shall be clearly denoted and labeled as such on the plans.

5. All assets (including but not limited to mains, sewer lines, hydrants, valves, fittings and junctions) shall be clearly represented on drawings with coordinates and top of surface and/or invert elevations (when applicable) labeled on drawing.

6. As-builts shall be provided with +/- 0.1' horizontal accuracy and +/- 0.01' for vertical accuracy unless otherwise specified in the RFP or during the preconstruction meeting.

7. Output GPS files (.ssf), import logs and correction files, including raw and post-processed data of each GPS survey, shall be included in deliverable.

8. Coordinate system and horizontal and vertical datums of deliverable specified in RFP.

9. Drawing set meets the "Plan Review and Approval Requirements" of the American Water Design Guide for Water and Wastewater Facilities.

C. GIS Mapping Format As-Builts – Required for multi-phased projects constructed over large areas over several months or years. These projects require coordination between AW and the CONTRACTOR to deliver accurate as-builts that adhere to all government regulatory requirements and meet AW quality standards.

1. Deliverable comprised of construction drawing set, derived from GIS in .pdf format, and GIS data in a file geodatabase format including .mxd map project (and associated map files, i.e. lyr files) files for all maps in the construction set. Hard copies of the drawing set shall be provided with the deliverable. Number of copies determined during the preconstruction meeting or as specified in the RFP.

2. All GIS deliverables created and delivered in most current ArcGIS version, unless specified by AW.

3. All asset locations (including but not limited to mains, sewer lines, hydrants, valves, fittings and junctions) collected through traditional survey, mapping or survey grade GPS. All GPS locations shall be collected with real-time correction and post processed with differential correction software.

4. All assets taken out of service and abandoned or demolished shall be clearly denoted and labeled as such within the GIS mapping system as a separate layer.

5. As-builts shall be provided with +/- 0.1' horizontal accuracy and +/- 0.01' for vertical accuracy.

6. Output GPS files (.ssf), import logs and correction files, including raw and post-processed data of each GPS survey, shall be included in deliverable.

7. Unless otherwise specified in the RPP, Coordinate system and horizontal and vertical datums must be as below.

   For projects in our Northern, Eastern Divisions, Rosiclare and Hardin County service areas use the following coordinate system:
   - System: US State Plane NAD 1983
   - Zone: Illinois West 1202
   - If applicable, use the Geoid Model 12

   For projects in the Western, Central and Southern Division (except Hardin County and Rosiclare service areas) use the following coordinate system:
   - System: US State Plane NAD 1983
   - Zone: Illinois East 1201
   - If applicable, use Geoid Model 12

8. Benchmark requirement. A data point shall be collected at an NGS-listed benchmark daily. Nearby NGS-listed benchmarks can be located using the following website: http://www.ngs.noaa.gov/NGSDataExplorer/

9. Vertical only benchmarks are not allowed.

10. Attribute data format outlined at pre-construction meeting. Format will follow (AW FORMAT REQUIRED) unless otherwise specified by AW during the preconstruction meeting. Required asset details will be specified in a GIS As-Built Scope of Work document, which will be finalized by the OWNER after the preconstruction meeting.

11. Delivery schedule of GIS data determined at pre-construction meeting.

12. FGDC compliant metadata included using AW template provided.

13. Drawing set meets the “Plan Review and Approval Requirements” of the AW Design Guide for Water and Wastewater Facilities.

PART 3 EXECUTION

3.1 General information required – At a minimum, all As-Built record drawings shall contain the following information:

A. North Arrow with North at the top of the drawing.

B. Face of curb lines, easement lines, edge of pavement (EOP) or right-of- way lines.

C. All objects located shall be referenced to other objects with (3) perpendicular measurements. All such measurements shall be from permanent existing structures, such as catch basins, manholes, buildings, etc. (no utility poles).

D. The proposed pipeline ‘line’ designation shall be shown in bold or heavier line style per template and sample.

3.2 Additional information required – At a minimum, all As-Built record drawings shall contain the following information:

A. Title Sheet (including American Water location, Project Name, Design Consultant Engineering Company name, Project date, County and Town.

B. Each drawing shall include only the work along one street block (transmission mains excluded), and the intersecting street corners with the distance to the center line of each intersection. Include Match Lines if multiple drawings are required.

C. If more than one drawing is required, include an overall site plan of the whole project with a drawing key.

D. Pipe diameter and material. Sanitary/Combined systems include slope.

E. Bill of Materials with arrow identifying where installed.

F. Date the water main was put ‘In-service’ (data provided by OWNER or Utility Manager).

G. Include valve, hydrant and tap/service identifying numbers for each. Numbering system data to be furnished by AW during the design and/or review process.

H. Reference the Point of Connection where the new main pipeline connects to existing AW facilities and provide dimensions to nearest existing appurtenance.

I. If project continues from an existing stub, a dimension from the center line of the nearest street intersection and existing line valve shall be included. Provide coordinates for the referenced existing valve.

J. If the project is a continuation of a previous project, reference the previous project reference number.

K. All valves, tees, manholes, vaults, hydrants, lift stations, horizontal/vertical bends, restraint locations, and the start and end of the new water main and sewer lines shall be located with coordinates in the specified format and identified and labeled on the Drawings.

L. All rim and invert elevations for manholes shall be labeled on the as-builts unless specified by OWNER to not be collected.

M. The invert in, invert out, and slope of all gravity sewers shall be labeled on the as-builts unless specified by OWNER to not be collected.

N. All connections, wet cuts and fittings not required to have coordinates shall be dimensionally located.

O. Indicate abandoned pipe with type of material and length (if applicable).

P. Indicate and locate buried valves (if applicable) with coordinates in the specified format.

Q. CONTRACTOR shall provide a GPS or traditional survey line location every 100 LF, unless otherwise specified by OWNER.

R. At abrupt changes in pipe elevation, provide a referenced drawing showing the profile of the work and list the material used.

S. Provide the depth from finish grade to top of pipe every 300 lf, and at the start and end of a new main.

T. Name of CONTRACTOR and Construction Inspector (full last name) on the project (locate in title block)

U. For projects where buildings are constructed, as-built plans shall include detailed mechanical drawings of all interior appurtenances, including mechanical piping, pumps, valves, and electrical boxes.

V. Projects involving the construction of lift stations shall have as-builts that denote the quantity and location of valves, piping, and all other appurtenances. In addition, the wet well operating levels shall be included on the as-built plan.

–END OF SECTION 01900–

SECTION 02000

SITE PREPARATION

PART 1 GENERAL

1.1 SUMMARY

This section includes preparing the site for construction including dewatering; identification, location, and protection of existing utilities and structures, exploratory excavation; and clearing and grubbing.

1.2 SCOPE OF WORK

A. Dewatering – See Section 02110

B. Existing Utilities and Structures – See Section 02600

C. Exploratory Excavation – See Section 02600

D. Clearing and Grubbing – See Section 02010

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PERMITS

The CONTRACTOR shall obtain and pay for any permits required for site preparation.

A. Dewatering – Convey all trench water to a natural drainage channel or storm sewer without causing any property damage. Discharge shall be in strict accordance with State and/or Local requirements. Dispose of silt and debris which accumulates during construction in strict accordance with State and/or Local requirements.

B. Notification of Utilities – Notify the applicable State Agency with jurisdiction over underground facilities and/or all utility companies that construction work under this Contract will pass through containing their underground facilities. Notify these parties in advance to support the construction work (minimum 72 hours). All excavation in the vicinity of existing underground utilities shall be performed in accordance with applicable regulations.

C. Clearing and Grubbing – Comply with State and Local code requirements when disposing of trees, shrubs and all other materials removed under this Specification Section. Burning of logs, stumps, roots, cuttings and other material on the site will not be permitted.

3.2 OBSTRUCTIONS BY OTHER UTILITY STRUCTURES

A. See Section 02600

3.3 REPAIRS TO/RELOCATION OF EXISTING UTILITIES

A. See Section 02600

3.4 WATER MAIN AND WATER SERVICE LINE PROTECTION FROM SEWERS

A. See Section 02600

3.5 EXPLORATORY EXCAVATION

3.6 See Section 02010 CLEARING AND GRUBBING

A. See Section 02010

3.7 BASIS OF PAYMENT

Site Preparation will be considered incidental to the water main installation. No additional compensations will be provided for Site Preparation.

No additional compensation will be allowed for any reasonably anticipated dewatering operation, overtime, equipment rental or any other expense incurred due to the occurrence of ground water, surface water or water from possible leakage of existing buildings, structures and piping in the vicinity of the CONTRACTOR's operations. If CONTRACTOR believes unreasonable, unanticipated wet conditions exist, immediately contact OWNER to decide appropriate measures and to determine whether CONTRACTOR is entitled to additional compensation.

–END OF SECTION 02000–

SECTION 02010

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 PROTECTION

A. Protect existing trees, shrubs and bushes located outside the clearing limits from damage for the life of this Contract.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with all Federal, State, and local code requirements when disposing of trees, shrubs and all other materials removed under this Section. Coordinate all clearing work with utility companies as necessary.

1.3 DISPOSAL FEES

A. Bear all expenses to obtain a suitable disposal area, haul to the disposal area, pay disposal fees, and dump at the disposal area. Coordinate with OWNER for use of base landfill or compost area, where available.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Provide all materials and equipment required to complete all clearing and grubbing in accordance with this Section.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

A. Clear and grub the minimum area required to provide space for construction operations.

B. Clear and grub the work site within easement and/or clearing limit lines shown on the Drawings or as shown elsewhere in the Contract Documents. Remove those items that are designated for removal or obstruct construction. This includes, but is not limited to; trees, downed timber, shrubs, bushes, vines, roots, stumps, undergrowth, rubbish, paving materials, debris, and all other objectionable materials. Site objects outside clearing limits shall not be removed. Only those portions of the construction area which are absolutely necessary and essential for construction shall be cleared. Minimize the length of time of ground disturbance as much as practical, especially within environmentally sensitive areas. Ground shall not be cleared and grubbed until immediately prior to construction.

C. Notify the OWNER of locations where additional trees and shrubs will interfere with installation of facilities. Do not remove additional trees or shrubs without written permission of the OWNER. Conduct operations to minimize disturbance of trees and shrubs. Trim trees and roots in accordance with the best horticultural practices, including sealing cuts to preserve the tree.

3.2 CLEARING (IMPROVED AREA)

A. Remove site improvement objects such as signs, lawn ornaments, etc. which interfere with construction. Removed site improvement objects shall be stored in a manner to protect objects for reinstallation after construction is complete. Provide temporary traffic control signs when permanent signs are removed for construction. Temporary signs shall be worded to match permanent signs, except as necessary to be compatible with construction operations.

B. Remove pavement, curb and sidewalk in accordance with applicable State Standards for Road and Bridge Construction and as specified in the Contract Documents. Saw cuts may be eliminated where paving abuts curb or roadway expansion joints or construction joints, and pavement can be removed without damaging or disturbing curbs or remaining pavement. Remove sidewalks in full squares only. Saw cut sidewalks if no true joint exists.

3.3 DISPOSAL

A. Burning of logs, stumps, roots, and other material on the site will not be permitted.

B. All materials obtained as a result of the clearing and grubbing operations shall be disposed of in accordance with the requirements of the applicable governing agencies at the expense of the CONTRACTOR.

C. Chipping of brush materials is permitted. However, CONTRACTOR shall bear all costs to dispose of the resultant chips at an approved location.

–END OF SECTION 02010–

SECTION 02100

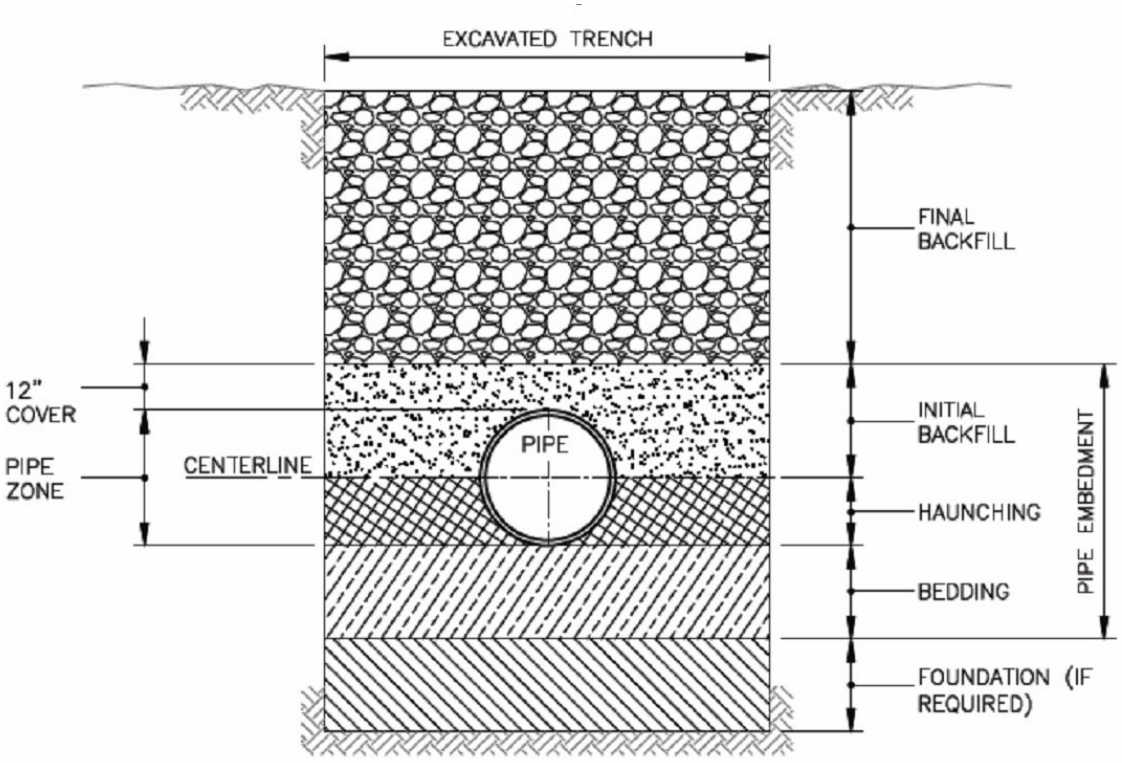
TRENCHING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.1 SUMMARY

This section includes trenching, backfilling and compacting at locations and elevations shown on the Drawings and as needed to meet requirement of Contract Documents. Furnishing and installing identification tape and location wire over the centerline of water mains, hydrant branches, and trenched services as indicated in this specification or noted in the Drawings.

1.2 DEFINITIONS



A. Foundation – A foundation is necessary only when native soils are unstable. For such conditions, the trench is over-excavated and a layer of supportive material is placed and compacted to provide a firm foundation for the subsequent pipe embedment materials. Must be approved by the OWNER prior to over-dig.

B. Embedment – This zone is the most important in terms of pipe performance. It is divided into the following sub zones:

1. Bedding – Typically six inches of supportive, compacted material. This zone provides even support for the pipe and brings it to grade.

2. Haunching – Extends from the bottom of the pipe to the centerline of the pipe. It provides the most resistance to pipe deflection. Specifying proper materials and compaction are most important for this zone.

3. Initial Backfill – Extends from the spring line to a point above the top of the pipe. This zone provides some pipe support and helps to prevent damage to the pipe during placement of the final backfill. The cover extends from the top of the pipe to the top of the initial backfill. The depth of cover should be as much as necessary to protect the pipe during placement of the final backfill. Twelve inches is a common depth of cover.

C. Final Backfill – This zone extends from the top of the initial backfill to the top of the trench. This zone has little influence on pipe performance, but can be important to the integrity of roads and structures. See specification Section 02100 – Trenching, Backfilling and Compacting for description of backfill and bedding materials.

1.3 REFERENCES

Refer to current standards:

A. ASTM: American Society for Testing and Materials

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

C. Standard Specifications for Water and Sewer Construction in Illinois

1.4 DEFINITIONS

A. All backfill materials (to be used for backfill, haunching, and bedding depending on local requirements), including common fill and selected fill, ¾-inch clean granular fill, ¾-inch modified stone, ¾-inch minus granular fill, and sand (meter pits only) shall be approved by the OWNER prior to placing the materials in the pipe trench. Test all backfill materials, whether obtained from the trench excavation or from an off-site source, as directed by the OWNER.

B. Submit samples of the materials to an approved testing agency for analysis as required by the OWNER. Submit the testing agency's test results and report to the OWNER. The report must state that the materials meet the requirements of these Specifications and the Specifications of Federal, State and Local authorities (where applicable).

C. Provide flowable fill in areas where it is required by the local street regulator and other areas specified in the Drawings.

D. Submit in accordance with Section 01300.

1.5 SITE CONDITIONS

A. Contours, topography and profiles of the ground shown on the Drawings are believed to be reasonable approximations and are not guaranteed.

B. The CONTRACTOR accepts the construction site with the conditions that existed at the time of bidding.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE

A. ¾ inch clean granular fill material shall meet the sieve analysis requirements of AASHTO as follows: 1-inch sieve passing 100%, ½-inch sieve passing 0-5%, and sieve size No 4 passing 0-1%. This material may be wrapped in filter fabric (trench bottom, side, and over top of clean granular fill), as directed by the OWNER, to prevent the migration of finer grained soils into this material or the migration of this material into the trench bottom or sidewall.

B. ¾ inch Minus or Modified granular fill material contains additional fine material and may be used as noted in specific pipe specifications. Material shall meet the sieve analysis requirements of AASHTO as follows: 1-inch sieve passing 100%, ¾-inch sieve passing 80-90%, No 4 sieve passing 25-50%, No 10 sieve passing 0-20% No 200 passing sieve 0-5%.

C. Construction Drawing Set - Required for larger non-phased construction projects.

2.2 FINE AGGREGATE

A. Fine Aggregate shall be natural or manufactured sand, or a combination thereof, free from injurious amounts of salt, alkali, vegetable matter or other objectionable material. The fine aggregate shall conform to the following gradation:

Sieve Size	**% Passing**
3/4 inch	100
No. 200	0-10

2.3 COMMON FILL

A. Common fill is suitable for final backfill.

B. Common Fill shall be earth materials entirely free of: vegetation; trash; lumber; and frozen, soft or organic materials. No stones or rocks larger than the sizes listed below will be permitted in the Common Fill:

Common Fill-Type A: No stones or rocks larger than 1-inch

Common Fill-Type B: No stones or rocks larger than 4-inches (measured longest dimension). At the discretion of the OWNER and depending upon the quality of the material, stones and rocks up to a maximum of 6 inches may be allowed on the area one foot above the pipe.

C. Common fill material may be obtained from the trench excavation provided it has been tested in accordance with the requirements of Specification Section 02210.1.04 above and approved by the OWNER. Furnish the necessary approved common fill materials from an off-site source whenever approved material obtained from the trench excavation is insufficient to complete the backfill.

2.4 FILTER FABRIC

Filter fabric shall be porous, non-woven fabric with multiple layers of randomly arranged fibers minimum 4.0 ounce per square yard.

Filter fabric shall be non-woven, synthetic fiber material with sieve design to prevent the select material in the pipe bedding and haunching from migrating into the surrounding soils. The material shall have a minimum: thickness of 15 mils, tensile strength of 130 lbs, elongation at break of 64%, and trapezoidal tear strength of 70 lbs. Acceptable manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.5 FLOWABLE FILL

A. Flowable fill is suitable for use as backfilling for utility trenches. The basic requirements for furnishing, mixing, and transporting flowable fill are as follows. Materials shall conform to the following standards: Cement ASTM C 150, Fly Ash ASTM C 618, Class C or Class F. Fine Aggregate shall be natural or manufactured sand, or a combination thereof, free from injurious amounts of salt, alkali, vegetable matter or other objectionable material. It is intended that the fine aggregate be fine enough to stay in suspension in the mortar to the extent required for proper flow. The fine aggregate shall conform to the following gradation:

Sieve Size	% Passing
3/4 inch	100
No. 200	0-10

If a flowable mixture cannot be produced, the sand may be rejected.

B. The following are given as typical mix designs for trial mixes. Adjustments of the proportions may be made to achieve proper solid suspension and optimum flowability. Admixtures may be used if desired to improve the characteristics of the mix, as approved by the OWNER. The suggested quantities of dry material per cubic yard are as follows:

Option 1
Cement 50 lbs., Fly Ash 250 lbs., Fine Aggregate 2910 lbs., Water approximately 60 gallons

Option 2
Cement 100 lbs., Fly Ash 250 lbs., Fine Aggregate 2800 lbs., Water approximately 60 gallons

Option 3
Cement 100 lbs., Fly Ash 300 lbs., Fine aggregate 2600 lbs., Water approximately 70 gallons

C. Consistency may be tested by filling an open-ended three-inch diameter cylinder six inches high to the top with flowable fill. The cylinder shall be immediately pulled straight up and the correct consistency of the flowable fill shall produce a minimum eight-inch diameter circular-type spread with no segregation.

Materials are to be measured by weight and/or volumetric methods. The flowable fill may be mixed in a central concrete mixer, a ready-mix truck, or by other acceptable methods. The flowable fill shall be transported to the point of placement in a revolving drum mixer or in an agitator unit.

PART 3 EXECUTION

3.1 CONSTRUCTION EQUIPMENT

All backfilling and materials handling equipment shall have rubber tires when mains are located in or adjacent to pavements. Crawler equipment shall be permitted when there is no danger of damaging pavement or when construction conditions require with the OWNERS approval. It is the CONTRACTOR's responsibility, to repair, at their expense, any damages due to the use of any equipment to complete the Work.

3.2 NOSE, DUST AND ODOR CONTROL

Conduct all construction activities so as to eliminate all unnecessary noise, dust and odors.

3.3 PROTECTION OF TREES

Take special care to avoid damage to trees and their root system. Open trenching shall not be used for areas marked on the Drawings and designated "ROOT PROTECTION ZONE". In these areas, methods to be used include tunneling or boring. In other areas where established trees are to remain with roots in the path of the trench line, the OWNER shall direct acceptable means to install pipe through tree roots. In these areas, methods to be used shall include careful cutting (not ripping or tearing) of larger tree roots. In all cases, operate equipment within the limb spread in a manner which will not injure trees, trunks, branches or their roots. Pay particular attention when employing booms, storing materials, and handling excavated materials.

3.4 TRENCH SUPPORT

Support open cut excavation for mains where trenching may cause danger to life, unnecessary damage to street pavement, trees, structures, poles, utilities, or other

private or public property. Support the sides of the excavation by adequate and suitable sheeting, shoring, bracing or other approved means in accordance with all applicable Federal, State, County, Municipal, and OSHA rules and regulations during the progress of the Work, whenever and wherever it is necessary. Maintain the trench support materials and equipment in place until backfilling operations have progressed to the point where the supports may be withdrawn without endangering life or property.

3.5 TRENCH EXCAVATION AND BOTTOM PREPARATION

A. General Excavation shall consist of the satisfactory removal and disposal of all material taken from within the limits of the Work contracted, meaning the material lying between the original ground line and the finished ground line as shown on the Drawings regardless of whether the original ground line is exposed to air or is covered by water. Excavation below existing ground line to enable any required construction or removals is included. It is distinctly understood that any reference to earth, rock, silt, debris or other materials on the Drawings or in the Specifications is solely for the OWNER's information and shall not be taken as an indication of classified excavation or the quantity of earth, rock, silt, debris or other material encountered.

General Excavation includes excavation to the lines and grades indicated on the Drawings or established in the field by the OWNER. Backfill over-excavated areas with approved fill material. All labor and materials shall be furnished at the CONTRACTOR's expense.

Keep all excavations free from water. Maintain groundwater a minimum of 6 inches below excavations. Remove soil which is disturbed by pressure or flow of groundwater and replace with free draining material.

Remove pavement over excavations made in paved roadways by saw cutting, milling, or removal by a trench machine. Cut the full depth of the pavement with straight lines and squared edges.

Dispose of excess excavated materials and excavated materials unsuitable for backfilling off site. Furnish the OWNER with satisfactory evidence that an appropriate disposal site was used.

B. Rock Excavation

1. If the Contract includes a unit price for rock excavation, it includes the removal, hauling, stockpiling and/or proper disposal the rock per the specification Section 01075 Basis of Payment. Rock is defined as:

   - Boulders, or pieces of concrete or masonry, having a volume of one cubic yard or more;
   - Material which cannot be loosened or broken down by ripping with a hydraulic ripper or other OWNER approved devices and equipment designed to remove rock; or
   - Material that requires systematic blasting, backhoe ramming, barring, or wedging for removal.

Notify the OWNER promptly upon encountering rock. The OWNER's determination as to whether the material meets the definition of rock and OWNER's measurement of the volume of rock removal for which the CONTRACTOR is entitled to payment will be final and conclusive. No payment will be made for rock removed without OWNER's approval.

Strip rock for measurements as directed by the OWNER. No payment will be made for rock excavated or loosened before measurement. Only rock actually removed will be paid for, and in no case will payment be made for rock removal beyond the payment limits shown for a standard trench or more than 12 inches beyond the edge of a pipeline or 8 inches below its bottom for pipes of nominal OD 24 inches and less, unless such rock has been removed at the direction of OWNER.

C. Blasting Rock is not allowed unless expressly permitted by the OWNER. Notify the OWNER in advance of blasting activity. Provide evidence to the OWNER that the proposed blasting will comply fully with Laws or Regulations.

Do not blast where limited or prohibited by any Federal, State or Local laws or regulations, or in violation of any limitation or restriction contained in any right-of-way, or wherever specifically prohibited in any Drawing or other Contract Document. Do not blast within forty (40) feet of any pipe or structure without specific permission from the OWNER. Properly cover blasts and protect the pipe or structure. Warn all persons in the vicinity. Blasting shall be at the risk of the CONTRACTOR who shall be liable for all damages to persons or property. Secure and pay for all necessary permits. Perform whatever pre-blast surveys and investigations that may be required by the circumstances and/or by Federal, State or Local laws.

Prepare a blasting plan and submit it to the OWNER for approval prior to commencing any blasting work. The plan shall state all procedures and methods which will be used to monitor and mitigate the effect or impact of the proposed blasting work.

Employ an experienced blaster holding a blasting license issued by the applicable State to carry out the blasting work. Use, handle, and store explosives as prescribed by the applicable State and Federal regulations. Keep all explosives in a safe place at a sufficient distance from the Work so that, in case of accident, no damage will occur to any part of the Work. CONTRACTOR shall be held responsible for and shall pay for all damage caused by blasting operations or accidental explosion.

–END OF SECTION 02100–

SECTION 02105

HYDRO EXCAVATION AND POTHOLE EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

This section includes providing all labor, materials, and equipment to excavate utilizing hydro excavation techniques for excavation near existing utilities, to facilitate pothole investigations and/or exploratory test pits.

1.2 DEFINITIONS

Hydro Excavating – The technique for excavating the earth's surface using water under pressure.

Pneumatic Excavating – The technique for excavating the earth's surface using air under pressure.

Vacuum Excavating – The technique for excavating and removing the earth's surface using vacuum.

Hydro Vacuum Excavating Unit – Truck or trailer equipped with high-pressure water pumps, vacuum pumps and a separator holding tank to receive excavated spoils.

Pneumatic Vacuum Excavating Unit – Truck or trailer equipped with high pressure air compressor, vacuum pumps and a separator holding tank to receive excavated spoils.

Spoils – Excavated material that may include, water, mud, soil and debris.

Pothole Excavation – Using a limited hydro or vacuum excavation to determine the actual vertical, horizontal and condition of underground infrastructure to include size and material.

Exploratory Excavation – The removal of surface soil, sometimes in several locations, to verify the underground infrastructure or for the purpose of obtaining information on subsurface conditions.

1.3 RELATED WORK

A. Specification Section 02000 – Site Preparation

B. Specification Section 02100 – Trenching and Backfill

C. Specification Section 02600 – Existing Utilities and Structures

D. Specification Section 02610 – Pavement Restoration

E. Specification Section 02820 – Lawn Restoration

1.4 REFERENCES

Refer to current standards:

A. ASTM: American Society for Testing and Materials

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

C. Standard Specifications for Water and Sewer Construction in Illinois

PART 2 EXECUTION

2.1 PERMITS

The CONTRACTOR shall obtain and pay for any permits required for site preparation.

A. Notification of Utilities – Notify the applicable State Agency with jurisdiction over underground facilities and/or all utility companies that construction work under this Contract will pass through containing their underground facilities. Notify these parties in advance to support the construction work (**minimum 72 hours**). All excavation in the vicinity of existing underground utilities shall be performed in accordance with applicable regulations.

2.2 OPERATION AND SAFETY RULES

The operation of hydro or pneumatic vacuum excavation equipment shall conform to the following items to ensure a safe and productive work environment:

A. Operator(s) must be thoroughly familiar with and follow the operator's procedure and operator's handbook guidelines. Individuals operating the hydro or pneumatic vacuum excavation equipment shall be qualified per this specification and the site's operating procedure.

B. All tasks shall be reviewed to insure the proper equipment/attachments for the job are used.

C. All employees other than the individuals using the hydro or pneumatic vacuum excavation equipment will maintain a safe distance from the task being performed.

D. Employees operating motor vehicles shall have a valid operator permit.

E. Employees' driving/riding in the cab of the hydro or pneumatic vacuum excavation truck are required to use a restraint system (seatbelts) when the vehicle is traveling.

F. The hydro or pneumatic vacuum excavation equipment must not be used for any purpose other than that for which it was designed. Accessories other than those manufactured for use with the equipment shall not be used without prior approval from the manufacturer and site safety personnel.

G. The wheels of the hydro or pneumatic vacuum excavation equipment shall be choked prior to operating the equipment.

H. The hydro or pneumatic vacuum excavation equipment shall not be operated beyond its specified capabilities as outlined in the operator's manual without special approval.

I. Steel toe rubber boots, hardhat, hearing protection, ANSI approved safety glasses with rigid side shields, rubber gloves and slicker suit are minimum personal protective equipment to be worn at all times when performing hydro or pneumatic vacuum excavating operations. The operators of the high-pressure water or air nozzle and the vacuum pipe shall wear face shields. Note: Nomex will be required under slicker suit in all Nomex required areas.

J. Never leave the hydro or pneumatic vacuum excavation equipment running and unattended.

K. A spotter will be required when the view to the rear of the hydro or pneumatic vacuum excavation equipment is obstructed or when positioning/repositioning equipment in highly congested areas.

L. Drivers of the hydro or pneumatic vacuum excavation equipment shall follow all applicable aspects of any site excavation specifications, guidelines and procedures around safe vehicle usage.

M. Keep the suction line away from your body and especially your face.

N. Use caution when making any adjustments on the unit while it is running or operating. Stop the engine and then make adjustments.

O. Keep hands away from moving parts.

P. Complete a specific job safety analysis sheet identifying all hazards associated with task.

Q. When working close to the edge of an excavation and a potential fall hazard exists a plan shall be in place and addressed on appropriate site forms.

R. A danger/do not operate tag shall be placed on the hydro or pneumatic vacuum excavation equipment, if it is deemed unsafe to operate, until repairs can be made.

S. Operator shall secure all connections starting at the source and follow through to the loading site.

T. Do not exceed the recommended RPM found in the owner's handbook.

U. When changing from "vacuum mode" to "pressure mode" vent tank to "0" Hg first, if required by manufacturer.

2.3 OPERATION

When setting up the hose, it is best to take the shortest straight line possible from the vacuum source to the loading area. If the distance encompasses more than 50 feet during “dry” product loading, it is best to run the set-up line with “hard pipe” as long as possible using gradual turns where possible. When the loading area is reached, then a lightweight flexible hose can be used as a “work whip”. Refer to owner’s handbook on guidelines for hose set-up.

Positioning and maneuvering of the loading hose is a very important task. Proper handling will maximize the performance of the vacuum source. Refer to operator’s handbook on specific hose handling tips.

Operators shall follow the guidelines around “loading dusty products and powders” located in the owner’s handbook.

Minimum and maximum operating settings for the equipment are as follows:
Water Pressure: 1,500 to 2,500 psig
Water Flow Rate 4 to 10 gpm (hydro excavation rigs) 38 gpm max. (combo rigs)
Vacuum Rate: 2,500 to 4,500 cfm (minimum)
Vacuum Capacity: 14 to 28 inches Hg

The operator(s) of the unit are responsible for equipment care while it is being used and following the guidelines for safe operation when:

A. Filling the vacuum pump with service liquid

B. Engaging the main vacuum pump

C. To engage the auxiliary vacuum pump and hydraulic system

D. Operating automatic cyclone clean-out

E. To disengage main vacuum pump

F. To open the rear door. Refer to rear control panel description

G. To close the rear door. Refer to rear control panel description

2.4 BASIS OF PAYMENT

A. Hydro Excavation. The work included in this Section will be paid for at the Contract Unit Price per cubic yard.

B. Exploratory Excavation. The work included in this Section will be paid for at the Contract Unit Price per cubic yard.

C. Pothole Excavation. The work included in this Section will be paid for at the Contract Unit Price per each Pothole as described below.

1. Pothole Excavation – Pavement. The work included in this Section will be paid for at the contract unit cost per each including the cost of pavement restoration. No additional payment shall be made for pavement restoration.

2. Pothole Excavation – Lawn. The work included in this Section will be paid for at the contract unit cost per each including the cost of lawn restoration. No additional payment shall be made for lawn restoration.

–END OF SECTION 02105–

SECTION 02110

DEWATERING

PART 1 GENERAL

1.1 GENERAL

A. Should groundwater be encountered, furnish and operate pumping equipment of sufficient capacity to lower groundwater table and intercepting horizontal water seepage to prevent ground water from entering the excavation.

B. No additional sum will be allowed for any reasonably anticipated dewatering operation, overtime, equipment rental or any other expense incurred due to the occurrence of groundwater, surface water or water from possible leakage of existing buildings, structures and piping in the vicinity of the Contractor's operations. If Contractor believes unreasonable, unanticipated wet conditions exist, immediately contact Project Manager to decide appropriate measures and to determine whether Contractor is entitled to additional compensation.

C. Convey all removed water to a storm sewer without causing any property damage. Discharge shall be in strict accordance with state and/or local requirements.

D. Dispose of silt and debris which accumulates during construction in strict accordance with state and/or local requirements.

1.2 PERMITS

A. The Contractor shall obtain and pay for any permits required for dewatering and disposal.

1.3 SUBMITTALS

A. Shop Drawings

1. Dewatering plan design data and Drawing including the following:

a. Proposed type of dewatering system with complete description of equipment and instrumentation to be used.

b. Arrangement, location, and depths of system components.

c. Pipe sizes and capacities.

d. Filter types and sizes.

e. Water disposal method and location.

f. Surface water control devices.

g. Surface operation, monitoring, and maintenance procedures.

h. Method of monitoring water quality.

i. Signed and sealed by professional engineer.

2. Product technical data including:

a. Dewatering pump data, including the following:

1) Size, capacity, and means of operation of engine and motor.

b. Pumping equipment for control of surface water within excavation.

1.4 PROJECT CONDITIONS

A. Site Information:

1. Data in subsurface investigation reports was used for the basis of design.

a. Conditions are not intended as representations or warranties of accuracy or continuity of soil borings.

b. The Owner or Engineer will not be responsible for interpretations or conclusions drawn from this data by Contractor.

2. Additional test borings and other exploratory operations by be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

3. Site data provided is not contractual and shall be considered "for information only".

PART 2 PRODUCTS

2.1 DEWATERING EQUIPMENT

A. Select dewatering equipment to meet specified performance requirements.

PART 3 EXECUTION

3.1 PROTECTION

A. Erosion Control

1. See Specification Section 02015

2. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.

3. Conduct work to minimize erosion of site. Remove eroded material washed off site.

    a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.

B. Protect existing surface and subsurface features on-site and adjacent to site as follows:

1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.

2. Protect and maintain bench marks, monuments or other established reference points and property corners.

    a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.

3. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.

    a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

    b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.

    c. All repairs to be made and paid for by Contractor.

3.2 DEWATERING

A. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.

B. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable side slope.

1. Employ dewatering specialist for selecting and operating dewatering system.

2. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.

3. Install groundwater monitoring wells as necessary.

4. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.

C. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.

1. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.

2. Discharge water into existing storm sewer system.

3.3 SURFACE WATER CONTRL SYSTEMS

A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area.

B. Divert surface water and seepage water within excavation areas into sumps and pump water into storm drains and settling basins in accordance with requirements of the agencies having jurisdiction.

C. Control and remove unanticipated water seepage into excavation.

–END OF SECTION 02110–

SECTION 02220

CASING INSTALLATION (STEEL)

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing steel casing pipe at locations shown on the Drawings in accordance with any Federal, State, or Local Highway requirements or applicable Railroad requirements, whichever may be more restrictive. See Standard Details for typical casing installation details. This section does not include Horizontal Direction Drilling (HDD) installation method.

1.2 RELATED WORK

A. Specification Section 02210 – Trenching, Backfilling, and Compacting

1.3 REFERENCES

Refer to current standards:

A. AWWA C206 – Field Welding of Steel Water Pipe

B. Railroad Utility Crossing Standards

C. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction

1.4 SUBMITTALS

A. Submit details of proposed installation method for information only, including, but not limited to:

a. Working and receiving shafts.
b. Dewatering.
c. Method of removing soils and installation of casing and carrier pipe.
d. Size, capacity, and arrangement of equipment.
e. Backstop.
f. Shaft base material.
g. Type of cutter head.
h. Method of monitoring and controlling line and grade.
i. Detection of surface movement.
j. Procedure for installing pipe supports, anchors, or placement of grout between carrier pipe and casing pipe.
k. Bulkhead details and proposed positive method of anchoring carrier pipe to prevent flotation.

l. Catalog data for casing spacers when used for temporary support during construction.

m. Procedure for monitoring line and grade.

B. Submit details of jacking or boring pits showing locations, dimensions, and details of sheeting and shoring required.

C. Submit manufacturer's literature for spacers, end seals, and casing vents.

D. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 STEEL CASING PIPE

Casing pipe shall be bare wall steel pipe with a minimum yield strength of 35,000 psi and a minimum wall thickness as listed below:

Casing Outside Diameter (inches)	Highway Crossing Casing Wall Thickness (inches)	Railroad Crossing Casing Wall Thickness (inches)
8.625	0.250	0.250
10.75	0.250	0.250
12.75	0.250	0.250
14	0.250	0.281
16	0.250	0.281
18	0.250	0.312
20	0.312	0.344
24	0.312	0.406
30	0.375	0.469
36	0.500	0.532
42	0.500	0.563
48	0.625	0.625
54	0.625	0.688
60	0.625	0.750
66	0.625	0.813
72	0.750	0.875

Smooth wall steel plates with a nominal diameter of over 54 inches shall not be permitted.

The inside diameter of the casing pipe shall be at least four (4) inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe less than six (6) inches in diameter; and at least six (6) inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe six (6) inches and greater in diameter.

2.2 CASING END SEAL

A. Casing end seals shall be a pull-over type construction and made from minimum 1/8-inch Neoprene with ½-inch wide T-304 stainless steel bands for securing the ends of the end seal to the casing pipe and carrier pipe.

B. Acceptable manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.3 CASING INSULATORS

A. The carrier pipe and casing shall be separated by an insulator or casing spacer. Timber skids are not allowed. Casing insulators shall be sized according to the manufacturer's specifications for pipe sizes.

B. Acceptable manufacturers are listed in the most current version of the Supplemental Technical Specifications.

PART 3 EXECUTION

3.1 COMMUNICATIONS

It is the Engineers responsibility to apply for and obtain all required permits before construction.

The CONTRACTOR is responsible for satisfying all scheduling and safety requirements to receive final authorization from grantor of permit.

3.2 ALIGNMENT AND GRADE

Locate pipelines to cross sewers, roadways, or tracks as shown on the drawings. Install the casing pipe on an even grade for its entire length and sloped to one end or as noted in a profile plan if provided. Satisfy a maximum tolerance of 1.5% (18 inches in one hundred feet) with the desired location of the casing or as otherwise required by regulation or specified on the Drawings, whichever is more restrictive.

3.3 WELDING

Connect steel casing sections by welding. Welding shall conform to AWWA Standard C206.

3.4 PROTECTION AT ENDS OF CASING

Block up both ends of casings in such a way as to prevent the entrance of foreign material, but to allow leakage to pass in the event of a carrier break.

3.5 DEPTH OF INSTALLATION

Unless the depth of casing pipe is specified on the Drawings, the casing pipe depth shall be in accordance with highway or railroad requirements.

3.6 CASING INSULATORS

The insulator spacing shall be installed to support the weight of the pipe and contents. As a minimum, an insulator shall be placed a maximum of 3 foot from each side of a joint and evenly spaced along the carrier pipe with 3 insulators per each length of carrier pipe.

3.7 INSTALLATION

A. Installation methods of casing pipes must be approved by the OWNER and governing transportation agency and or regulating authority. Prepare boring or jacking pits and receiving pits in accordance with limitations shown on the Drawings or contained in permits obtained for the Work.

1. Jacking: This method shall be in accordance with the current American Railway Engineering Association Specifications, Chapter 1, Part 4, "Jacking Culvert Pipe Through Fills", except that steel pipe shall be used with welded joints. Conduct this operation without hand mining ahead of the pipe and without the use of any type of boring, auguring or drilling equipment.

   Design the bracing, backstops, and jacks so that the jacking can progress without stoppage (except for adding lengths of pipe).

2. Drilling: This method employs the use of an oil field type rock roller bit, or a plate bit made up of individual roller cutter units, welded to the pipe casing being installed. Turn the pipe for its entire length from the drilling machine to the head to give the bit the necessary cutting action against the ground being drilled. Inject high density slurry (oil field drilling mud) through a supply line to the head to act as a cutter lubricant. Inject this slurry at the rear of the cutter units to prevent any jetting action ahead of the pipe. Advance the drilling machine on a set of steel rails (thus advancing the pipe) by a set of hydraulic jacks. The method can be used to drill earth or rock.

3. Boring: This method consists of pushing the pipe into the fill with a boring auger rotating within the pipe to remove the soil. When augers or similar devices are used for pipe placement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one-half inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.

B. Provide adequate supplies to allow continuous operations to be maintained once operations begin. Additional compensation will not be allowed for problems resulting from failure of CONTRACTOR to maintain continuous operations.

C. Provide ENGINEER and OWNER a minimum 48-hour notice prior to starting the installation.

D. Excavate boring or jacking pits and receiving pits to field verify existing piping locations and depths. If rock is encountered during pit excavation, follow procedures described in Specification Section 02210.

E. Take measures required to protect roadways, railroad tracks, embankments, and other surfaces above installation from settlement or damage of any type.

F. If an obstruction is encountered during installation that stops the forward action of the pipe, and if it becomes evident that it is impossible to advance the pipe, operations will cease and the pipe shall be abandoned in place and filled completely with grout.

G. Bored or jacked installations shall have a bore hole essentially the same as the outside diameter of the pipe. Grout any voids that develop. Also grout around the casing pipe when the bore hole diameter is greater than the outside diameter of the pipe by more than 1 inch.

3.8 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price per linear foot of casing installed. The Contract Unit Price shall include all casing pipe, casing end seals, casing insulators, strapping, skids, anchors, harnesses, etc. as required or as necessary for a complete and satisfactory installation. The Contract Unit Price shall include all excavation (soil) de-watering, jacking, drilling or boring (rock or soil), backfilling, sheeting, bracing, shoring, temporary construction, and all safety measures as necessary for a complete and satisfactory installation. Payment for rock excavation as described in Specification Section 02210. **DOES NOT INCLUDE THE WATER MAIN**.

–END OF SECTION 02220–

SECTION 02225

CASING INSTALLATION (PVC)

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing PVC casing pipe at locations shown on the Drawings in accordance with any Federal, State, or Local, whichever may be more restrictive.

1.2 RELATED WORK

A. Specification Section 02210 – Trenching, Backfilling, and Compacting

1.3 REFERENCES

Refer to current standards:

A. Illinois Administrative Code, Title 35, Subtitle F, Chapter II, Parts 651-654

B. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 in. through 12 in. (100 mm through 300 mm), for Water Distribution

C. AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (350 mm through 1,200 mm), for Water Transmission and Distribution

1.4 SUBMITTALS

A. Submit manufacturer's literature for spacers, end seals, and casing vents.

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 PVC CASING PIPE

PVC casing pipe shall conform to the latest edition of American Water Works Association (AWWA) Standards C900/C905. PVC casing pipe shall have a Dimension Ratio of 25 and shall be certified suitable for potable water products by the National Sanitation Foundation (NSF) Testing Laboratory (NSF Standard No. 61). The size of the pipe casing shall be shown on the Drawings. Bored casings shall be restrained joint PVC.

2.2 CASING END SEAL

A. Casing end seals shall be a pull-over type construction and made from minimum 1/8-inch Neoprene with ½-inch wide T-304 stainless steel bands for securing the ends of the end seal to the casing pipe and carrier pipe.

B. Acceptable manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.3 CASING INSULATORS

A. The use of casing spacers are not required in encasements of less than 30 feet. Encasements greater than 30 feet shall include casing spacers in accordance with Specification Section 02220 – Casing Installation (Steel).

PART 3 EXECUTION

3.1 COMMUNICATIONS

It is the ENGINEERs responsibility to apply for and obtain all required permits before construction.

The CONTRACTOR is responsible for satisfying all scheduling and safety requirements to receive final authorization from grantor of permit.

3.2 ALIGNMENT AND GRADE

Locate pipelines to cross sewers, roadways, or tracks as shown on the Drawings. Install the casing pipe on an even grade for its entire length and sloped to one end or as noted in a profile plan if provided. Satisfy a maximum tolerance of 1.5% (18 inches in one hundred feet) with the desired location of the casing or as otherwise required by regulation or specified on the Drawings, whichever is more restrictive.

3.3 PROTECTION AT ENDS OF CASING

Block up both ends of casings in such a way as to prevent the entrance of foreign material, but to allow leakage to pass in the event of a carrier break.

3.4 DEPTH OF INSTALLATION

Unless the depth of casing pipe is specified on the Drawings, the casing pipe depth shall be in accordance with local requirements.

3.5 BORING INSTALLATION

A. Installation methods of casing pipes must be approved by the Engineer and governing transportation agency and or regulating authority. Prepare boring pits and receiving pits in accordance with limitations shown on the Drawings or contained in permits obtained for the Work.

B. Provide adequate supplies to allow continuous operations to be maintained once operations begin. Additional compensation will not be allowed for problems resulting from failure of CONTRACTOR to maintain continuous operations.

C. Provide ENGINEER and OWNER a minimum 48-hour notice prior to starting the installation.

D. Excavate boring pits and receiving pits to field verify existing piping locations and depths. If rock is encountered during pit excavation, follow procedures described in Specification Section 02210.

E. Take measures required to protect roadways, railroad tracks, embankments, and other surfaces above installation from settlement or damage of any type.

F. If an obstruction is encountered during installation that stops the forward action of the pipe, and if it becomes evident that it is impossible to advance the pipe, operations will cease and the pipe shall be abandoned in place and filled completely with grout.

G. Bored installations shall have a bore hole essentially the same as the outside diameter of the pipe. Grout any voids that develop. Also grout around the casing pipe when the bore hole diameter is greater than the outside diameter of the pipe by more than 1 inch.

3.6 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price per linear foot of casing installed. The Contract Unit Price shall specify and differentiate PVC Casing for separation and PVC Casing for bores. The Contract Unit Price shall include all casing pipe, casing end seals, casing insulators, strapping, skids, anchors, harnesses, etc. as required or as necessary for a complete and satisfactory installation. The Contract Unit Price shall include all excavation (soil) de-watering, drilling or boring (rock or soil), backfilling, sheeting, bracing, shoring, temporary construction, and all safety measures as necessary for a complete and satisfactory installation. Payment for rock excavation as describing in Specification Section 02210. **DOES NOT INCLUDE THE WATER MAIN**.

–END OF SECTION 02225–

SECTION 02230

STREAM CROSSING

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing all labor, materials, and equipment necessary to install stream crossings as shown on the Drawings, as described in the construction documents, as shown on Standard Details, and in accordance with the requirement of the regulating agency. This section includes open cut installation. If trenchless installation is required, see Supplemental Technical Specifications.

1.2 SCOPE OF WORK

A. Install the stream crossings in such a manner as to protect the mains from erosion and to restore, as much as practicable, the stream banks and bottom to their original condition and in compliance with requirements of the regulating agency.

B. Protect the main from erosion by concrete encasement around the pipe or by a sufficient depth of compacted backfill as shown in the Drawings.

1.3 RELATED WORK

A. Specification Section 02210 – Trenching, Backfilling, and Compacting

B. Specification Section 03300 – Cast-in-Place Concrete

C. Specification Section 15000 – Piping – General Provisions

1.4 SUBMITTALS

A. Construction Procedure if not provided as a condition of the regulators stream opening permit.

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CONSTRUCTION PROCEDURE

The CONTRACTOR shall comply with construction procedures if provided as a condition of the regulators stream opening permit. If methodology is not provided through permitting process, provide and submit the same to the OWNER, ENGINEER and all Federal, State and Local authorities having jurisdiction over the stream crossing for their review and approval.

3.2 STREAM BANK RESTORATION

A. Restore the stream banks by backfilling the main trench with mechanically compacted backfill of earth or rip rap, approved by the OWNER and in compliance with regulatory requirements, to the original ground surface (unless new contours are shown on Drawings). The limits of compaction shall extend from the top of bank to top of bank on each side of the crossing as determined by the ENGINEER or as shown on the Standard Details provided.

B. Immediately following the completion of a stream crossing, place straw bales or silt fence along the trench excavation on each stream bank from within two (2) feet of the edge of water to beyond the limits of the excavated trench width as shown on the Drawings and in compliance with regulatory requirements. Straw bales or silt fence shall remain in place until after the stream banks have been fine graded, fertilized and seeded, and the seeding has grown sufficiently to protect the stream banks from erosion and accepted by OWNER or ENGINEER.

3.3 STREAM BOTTOM RESTORATION

Backfill the trench within the stream mechanically compacted earth or riprap that has been approved by the ENGINEER and meeting regulatory requirements. Rip rap placement must be flush with stream bottoms from upstream to downstream. As specified in the plans.

3.4 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price (EA) for each stream crossing. The Contract Unit Price shall include all Work in excess of the normal pipeline installation as described in Sections 15000, 15105, 15120, 15122, and 15125. The Contract Unit Price shall include any specials, anchors, joint harness etc., as required by this specification. In addition, the Contract Unit Price shall include backfill, rip rap (where required), concrete encasement (where required), dewatering, bank stabilization and providing an approved means for holding the pipe in place, constructing of cofferdams, stone backfill, and all restoration. **DOES NOT INCLUDE THE WATER MAIN OR ITEMS OTHERWISE INCIDENTAL TO WATER MAIN INSTALLATION.**

–END OF SECTION 02230–

SECTION 02450

HORIZONTAL DIRECTIONAL DRILLING (HDD)

PART 1 GENERAL

1.1. SCOPE

A. Furnish all labor, materials, tools and equipment as necessary to construct a pipeline crossing by the horizontal directional drilling method. Furnish all labor, equipment, materials and supplies and perform all work necessary to provide OWNER with a complete, finished water main crossing. The finished work includes proper installation testing, restoration of underground utilities and environmental protection and restoration.

1.2. RELATED SECTIONS

Submittals – Section 01300
Excavation, Backfilling and Compaction – Section 02200
Piping – General Provisions – Section 15000
Disinfecting Pipelines – Section 15020

1.3. QUALITY ASSURANCE:

A. The HDD equipment operator(s) shall be trained to operate the specific Horizontal Directional Drilling equipment for the Owner's project with at least 3 years experience in directional drilling obtained within the last five years. All pipe and appurtenances of similar type and material shall be furnished by a single manufacturer.

B. Perform HDD operations under the constant direction of a drilling supervisor who shall remain on site and be in responsible charge throughout the drilling operation. The Contractor's supervisor shall have supervised directional drilling of a minimum of 5,000 linear feet of pipe of a similar or greater diameter, of similar material, over similar lengths, and with similar subsurface conditions.

C. The requirements set forth in this Specification specify a wide range of procedural precautions necessary to insure that the basic, essential aspects of a proper Directional Bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this Specification.

D. Perform the work in general conformance with ASTM Standard F1962-05, current revision, "Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe of Conduit under Obstacles, Including River Crossings."

E. Adhere to the specifications; any changes must be expressly approved by the Engineer's. Approval of any aspect of any Directional Bore operation covered by this

Specification shall in no way relieve the Contractor of its ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

1.4. PROFILES AND TOPOGRAPHY

A. Contours, topography and profiles of the ground as may be shown on the Contract Drawings are believed to be reasonably correct, but are not guaranteed to be absolutely so and are presented only as an approximation. It is the Contractor's responsibility to verify all elevations required to successfully complete the crossing.

1.5. SUBMITTALS

B. Prior to beginning work, submit to the Engineer copies of a report of schedules, calculations, procedures and any supplemental subsurface soil condition investigations performed along the path of the proposed crossing. Number of copies of the report shall be as specified in Section 01300. The report will summarize the subsurface conditions that are known to the Contractor and that his proposed crossing procedure is based upon factual, best available information. If the subsurface conditions are known to the Contractor by previous work or geotechnical studies done in the immediate area, the information shall be recorded in the report along with any additional geotechnical studies performed by the Contractor. The report shall include the following:

1. Subsurface Information

a. Record in the report subsurface conditions known to the Contractor by previous work or prior geotechnical studies performed in the immediate project area.

b. Boring information obtained by the Owner, if any, is listed in the Supplementary Conditions section of these Specifications.

c. Additional borings performed by the Contractor and analysis of soils along the path of the proposed crossing. The Contractor shall be responsible for obtaining and including in his bid price the cost of any additional borings along the pipe alignment which may be necessary to design the proposed directionally drilled crossing.

At a minimum any supplemental borings performed by the Contractor shall include standard classification of soils, standard penetration tests, split spoon sampling and sieve analysis. Test borings shall be performed to a minimum depth of ten (10) feet below the proposed pipe invert unless rock is encountered in which case test borings shall penetrate at least two feet into rock.

2. Drilling Equipment and Methods

a. Submit information on equipment and written procedure with working drawings describing in detail the proposed boring method and the entire operation to be

used. This shall include, but not be limited to, entry and exit pits; settlement pit; size, capacity and arrangement of drilling and pulling equipment; layout of carrier pipe; details and spacing of pipe rollers; type of current head; method of monitoring and controlling line and grade; method of detection of surface movement; and layout of any proposed construction staging areas.

b. In addition, submit for approval nameplate data for the drilling equipment, mobile spoils removal unit, and Material Safety Data Sheets (MSDS) information for the drilling slurry compounds. This must be submitted and reviewed by the Engineer before work can proceed.

3. Piping

Submit shop drawings showing the pipe lengths, design details, joint details, etc. for the Engineer's review. Submittals shall include, but are not limited to, the following:

a. All welding or fusion procedures to be used in fabrication of the different pipe materials and installation methods.

b. Certified records for hydrostatic testing of all pipe materials to be used.

c. An affidavit stating that all pipe materials furnished under this section have been manufactured in the United States of America and comply with all applicable provisions of referenced AWWA standards.

4. Proposed Alignment

Submit a graph in plan and profile plotting the pilot drilling hole alignment to the Engineer for review, including entry/exit angles and radius of curvature. After completion of the crossing, submit a final pipe alignment.

5. Schedule

Time schedule for completing the Directional Bore, including any delays due to anticipated soil conditions.

6. Calculations

a. Submit detailed design calculations for several representative loading conditions for the proposed crossing. If requested by the Engineer, submit calculations to support the design of any particular location of pipe anywhere along the length of the crossing at no additional cost to the Owner.

b. Design calculations shall be presented in a neat, readable format, with all figures, values and units included to facilitate ease of verification.

c. Calculations shall be submitted to demonstrate that the pipe thickness design is sufficient to meet all design criteria specified.

d. Calculations shall address the following loading conditions:

i) Pre-installation:

Hoop and longitudinal stress during hydrostatic test; spanning stress with pipe full of water and supported on installation rollers, and maximum roller / support spacing.

ii) Installation/Post-Installation:

Longitudinal stress from pulling force; longitudinal curvature stress at point of entry and in final position; external pressure from drilling fluid, overburden, and loads from the obstacle being crossed.

iii) Post-Installation/In-Service:

Hoop and longitudinal stress during hydrostatic test; internal working and surge pressure; buckling with internal vacuum.

e. Perform and submit to the Engineer fluids pressure versus overburden strength calculations. These calculations shall be performed to determine minimum acceptable cover requirements and prevent drilling fluids breakout to the ground surface.

f. All calculations shall bear the seal of a Registered Professional Engineer. Licensure in the State that the work is performed is preferred.

C. Approval

1. No work shall commence without approval by the Engineer. Details and design calculations shall be submitted and approved well in advance of the drilling operation to prevent delays in work. All final layout work, including grades, shall be the Contractor's responsibility.

1.6. JOB CONDITIONS:

A. Any nighttime work is strictly regulated and will be allowed only with prior approval granted by the Owner subject to regulatory agencies having jurisdiction. All crossing operations shall be accomplished during daylight hours, unless approved by the Engineer. Crossing work shall not begin after the hour pre-established as the latest starting time that will allow completion during daylight hours, unless approved by the engineer. The Contractor shall provide a Work Plan submittal indicating its proposed hours of operation and length of work week. All work plans shall be subject to compliance with all applicable regulatory requirements for construction activities and any off site impacts.

B. When hazards of night time work are carefully considered and determined to be insignificant, night time work may be allowed only to complete a properly planned

crossing, and only if in the opinion of the Engineer the delay was caused by reasonably unavoidable circumstances, and that such night time work is necessary to avoid placing an undue economic hardship on the Contractor.

C. In emergency situations, or where delay would increase the likelihood of a failure, nighttime work may be allowed to complete a delayed crossing.

D. All operations shall continue on a 24-hour per day basis during pipe pull back.

1.7. COORDINATION OF WORK

A. Coordinate connections to existing pipelines that require shutdown of OWNER facilities. OWNER will designate the time for these connections that could involve work during evenings, nights, Saturdays, Sundays, or holidays. Method of connection and designated times are to cause the least amount of disruption to OWNER'S water service to its customers. The cost for connections is to be included in the contract price. No contract price adjustment will be allowed for overtime, premium time, or other related costs.

1.8. USE OF EXISTING WATER SYSTEMS

A. All use of existing water systems during construction by the Contractor shall be with the approval and direction of the system Owner and its representatives. The Contractor shall be responsible for all permits, fees, temporary piping, temporary meter rental/provisions, temporary backflow preventer rental/provision and other water utility requirements for supplying water during construction. The Contractor shall use the existing water system only at locations, times and conditions as set forth by the system owner or its representatives.

B. If water is not readily available at the site or the Owner cannot provide the volume of flow required by the Contractor, provide potable water as needed from an off-site location at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 PIPE

Unless otherwise specified in the Contract Documents, pipe installed by horizontal directional drilling shall either be high density polyethylene pipe (HDPE), steel pipe, or ductile iron pipe specifically designed for directional drilling. Unless otherwise specified in the Contract Documents, the water main pipe (carrier pipe) shall be installed without a casing pipe.

A. POLYETHYLENE PIPE

1. High Density Polyethylene (HDPE) Pipe, AWWA C-906 compliant, NSF 61 Standard Listed, and furnished in fifty (50) foot lengths.

2. Polyethylene pipe shall be furnished with an outside diameter conforming to ductile iron pipe sizes. Minimum thickness of HDPE pipe shall be determined by the contractor's calculations, but shall not be considering in-service loading shall not be less than DR 11 when measured in accordance with ASTM D-2122.

3. All polyethylene pipe and fittings shall be made of a high-density polyethylene pipe compound with extra high molecular weight that meets the requirements for Type III, Grade P34 Polyethylene material as defined in ASTM D-1248, latest revision.

4. Pipes shall be jointed to one another and to polyethylene fittings by thermal butt-fusion or by socket fusion in accordance with ASTM D-3261.

5. Joining of pipe sections shall be performed in accordance with the procedures recommended by the pipe manufacturer. Joints between pipe sections shall be smooth on the inside and internal projection beads shall not be greater than 3/16-inch.

6. The tensile strength at yield of the butt-fusion joints shall not be less than the pipe. A specimen of pipe cut across the butt-fusion joint shall be tested in accordance with ASTM D-638.

7. Polyethylene pipe shall be joined to ductile iron pipe by the use of flange adapters and back-up rings. Flange adapters shall be butt fused to the polyethylene carrier pipe. The face of the flange adapter shall have a serrated sealing face to assist in holding the flange gasket in place. Flange gaskets shall be full-faced neoprene. Back-up rings shall be Class "D" steel ring flanges in accordance with AWWA C207. Flange bolts must span the entire width of the flange joint, and provide sufficient thread length to fully engage the nut.

8. Installation Curvature: The pipeline curvature shall not have a radius less than as shown in Table 2458-1.

Table 2458-1. HDPE Pipe Deflection Information.

Pipe Diameter (inches)	Minimum Radius of Curvature (feet)	Offset per 20-ft Length (inches)
4	23	9.3
6	34	6.1
8	44	4.6
10	56	3.5
12	67	3.0

B. STEEL PIPE

1. Steel pipe shall meet the requirements of AWWA C-200 and Specification Section 15110.

2. Steel pipe sections shall be connected by welding. All welding shall conform to AWWA C-206, latest revision. Pipe shall be either spiral seam or longitudinally rolled pipe.

3. All steel pipe shall receive an interior and exterior factory coating of fusion-bonded epoxy, 20-mil minimum thickness. Material and application requirements shall be as specified in AWWA C213, latest edition, "Standard for Fusion - Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines".

4. The interior and exterior of field-welded joints shall receive a 25-mil minimum thickness coating of fusion-bonded epoxy, applied in accordance with AWWA C213.

5. Minimum thickness of steel pipe shall be determined by the contractor's calculations, but shall not be less than a diameter to thickness ratio of 180.

C. DUCTILE IRON PIPE

1. Utilize ductile iron pipe equipped with low profile flexible restrained joints such as Flex Ring or TR Flex. Gripping push on joint gaskets, or restrained joint gaskets are not permitted.

2. All ductile iron pipe shall be installed per DIPRA's Horizontal Directional Drilling with Ductile Iron Pipe Handbook to include strict adherence to maximum joint deflection allowances

D. THICKNESS DESIGN

The following design criteria shall be used in calculating pipe thickness for HDPE, steel, or ductile iron pipe:

Working Pressure	As shown on Drawings
Test Pressure	As shown on Drawings
Surge Pressure	Working pressure + 100 psi
Dead Load	Earth cover as shown on Drawings, but not less than 15 ft.
Buckling Design	Considering dead load, internal vacuum, H-20 Wheel Loading and a hydrostatic load over top of pipe to grade.
Max. Allowable Horizontal Deflection	3%
Radius of Curvature	90% of Actual Design Radius
Downhole Friction Factor	1.0
Factor of Safety for Drilling Fluid Density	1.5

The stresses in the pipe shall be calculated for the pre-installation, installation, and post installation loading conditions specified in Part 1 of this Specification Section. Thickness shall be selected so that stresses do not exceed the following under any of the loading conditions.

- All conditions except internal surge pressure — 50% of minimum yield point
- Internal surge pressure condition — 75% of minimum yield point

The contractor shall increase the minimum “in-service” thickness as necessary to support the expected stresses and loadings which are expected to be encountered during the installation of the HDD pipeline. The final selected thickness shall be supported by calculations as required herein. No additional cost shall be considered by the Owner for pipe thickness greater than the specified minimum “in-service” thickness.

E. DEVIATIONS

Should the Contractor choose to submit a bid using material that does not meet all the requirements of these specifications, include a description of the deviation with data showing the magnitude of the deviation. Acceptance of such deviations to these specifications shall be subject to the review and approval of the Owner before a contract can be awarded.

F. INSPECTION OF PIPE

All pipe and fittings used in the work may be factory inspected by a recognized agency engaged by the Owner. Inform the Owner and the inspection agency of the name and address of the manufacturing plant or other sources of materials to be used in the work and shall coordinate with the manufacturer to assure that the inspection agency has access at the manufacturer's plant and adequate assistance and notice so that each item may be examined. All reports will be made to the Owner and the cost of the services of the inspection agency will be borne by the Owner. Such inspection by the Owner shall not relieve the Contractor of his responsibility to furnish materials in accordance with the applicable standards.

2.2 EQUIPMENT

A. General: All equipment for the Directional Bore shall have the capacity, stability, and necessary safety features required to fully comply with the specifications and requirements of this section without showing evidence of undue stress or failure. It shall be the responsibility of the Contractor to assure that the equipment to be used in the Directional Bore is in sound operating condition. Backup equipment shall be required in the event of an equipment breakdown and where the condition of the equipment to be used indicates that routine component replacement or repair will likely be necessary during the Directional Bore.

B. Directional Drilling System: The directional drilling system shall consist of over the road transportable field power unit, mud-mixing and recycling unit, a trailer or carriage-mounted drill unit, and all other support accessory vehicles and equipment. All system components shall be in sound operating condition with no broken welds, excessively worn parts, badly bent, or otherwise misaligned components. All drill pipe, reamers, pull back heads, swivels, drill heads and collars, pipe cradles, pipe rollers, ropes, cables, clamps, and other non-mechanical but essential items shall be in sound condition and replaced immediately when need is apparent. The equipment must be capable of drilling the specified length in a single bore.

1. Mud-Mixing and Recycle Units: The mud-mixing and recycle unit shall be a self-contained system designed to provide a supply of high-pressure Bentonite based cutting fluid to the drill unit. It shall contain a fluid storage tank and a complete Bentonite and drilling fluid additive(s) mixing system. The cutting fluid is to be mixed on site. The cutting fluid shall be formulated for this specific project and anticipated conditions. It shall permit changes to be made to the Bentonite and drilling fluid additive(s) concentrations during drilling in response to changing soil conditions. The field power unit shall contain the power-taken off-driven high pressure cutting fluid pumping system. The recycle units shall be of a capacity to minimize the production of new cutting fluid and maximize the reuse and recirculation of original cutting fluid produced.

2. Directional Drill System: A carriage-mounted version of the drill system shall include a thrust frame. Both the trailer-mounted and carriage-mounted drill system shall be designed to rotate and push 10-foot (3-meter) minimum hollow drill sections into the tunnel being created by the boring head. The drill sections shall be made of a high strength S-grade steel that permits them to bend to a 30-foot (9-meter) radius without yielding. Drill end fittings shall permit rapid makeup of the drill sections while meeting the torque, pressure and lineal load requirements of the system. The boring head itself shall be capable of housing a probe used by the Magnetic Guidance System (MGS) to determine tool depth and location from surface and to orient the head for steering. The MGS shall have a minimum accuracy of plus (+) or minus (-) two (2) percent of the vertical depth.

   The drilling equipment must be fitted with a permanent alarm system capable of detecting an electric current. The system will have an audible alarm to warn the operator when the drill head nears electrified cables. The drilling equipment shall be grounded, protected, and operated in accordance with manufacturer's requirements for electric strike safety.

   The control console shall contain a calibrated display of inclination, azimuth, tool face location, mud pump rates, and torque pressures. The downhole steering system accuracy shall be plus or minus one percent (± 1.0%) of the horizontal bore length such that the difference between actual depth and machine calculated depth is not more than 1 foot per hundred feet.

3. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the Engineer prior to commencement of the work. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the pipe placement satisfactorily without undue

stoppage and to maintain line and grade within the tolerances prescribed by the particular condition of the project. Water sluicing methods, jetting with compressed air, or boring or tunneling devices with vibrating type heads that do not provide positive control of the line and grade shall not be allowed.

C. Spoils Equipment: The cutting fluid removal system shall include a self-contained vacuum truck which has sufficient vacuum and tank capacity to remove excess cutting fluid mixture and cuttings from the project site as required or directed by the Engineer. Spoils are not to be discharged into sewers or storm drains.

The Contractor will contain all drilling and pipe lubricating mud by taking special measures to prevent run-off into adjacent properties and/or waterways. All surplus drilling and pipe lubricating mud will be removed from the site and properly disposed of by the Contractor. The Contractor will also be responsible for all required erosion control measures.

D. Magnetic Guidance System: A Magnetic Guidance System (MGS) probe and location of the drill head during the drilling operation. The tracker shall be capable of tracking at all depths up to one hundred feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The tracker shall be accurate to +/-2% of the vertical depth of the borehole at sensing position at depths up to one hundred feet. Ferrous materials shall not influence or affect the MGS readings or accuracy.

Components: The Contractor shall supply all components and materials to install, operate, and maintain the MGS. This shall include, but not be limited to the following:

- MGS Probe and Interface
- Computer, Printer, and Software
- DC Power Source, Current Control Box, and Coil/Tracking Wire.

The Magnetic Guidance System (MGS) shall be a Tensor TruTracker MGS, or other licensed and industry approved wire guidance system. The Engineer shall be advised of the unit to be used and is subject to his approval. Set up and operate the MGS using personnel experienced with this system. A Walk-over" tracking systems shall not be used, except as approved by the Engineer. Contractor shall provide Engineer with current calibration certification of MGS in accordance with manufacturer's specifications.

E. If equipment breakdown or other unforeseen stoppages occur and forward motion of the directional cutting head is halted at any time other than for reasons planned in advance (addition of drill stems, etc.), the boring path shall be filled with a proper Bentonite solution immediately, or as directed by the Engineer.

F. The boring tool shall have steering capability and have an electronic tool detection system. The position of the tool during operation shall be capable of being determined accurately, horizontally within 1% of the horizontal distance of the borehole and vertically within 2% of the vertical depths of the borehole. The boring tool shall have a nominal steering radius of 9 meters (30 feet).

F. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations.

G. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations. The rig shall be grounded during drilling and pullback operations. There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

2.3 DRILLING FLUIDS:

A. A mixture of Bentonite drilling clay, project specific cutting fluid additives, and potable water is to be used as the cutting fluid (MUD) and over ream hole filler for the Directional Bore. The drilling fluid mixture used shall have the following minimum viscosities as measured by a March Funnel:

Rock Clay	60 sec.
Hard Clay	40 sec.
Soft Clay	45 sec.
Sandy Clay	90 sec.
Stable Sand	120 sec.
Loose Sand	150 sec.
Wet Sand	150 sec.

These viscosities may be varied to best fit the soil conditions encountered as recommended by the drilling mud and fluid additive manufacturer, and as approved by the Engineer.

B. Where sandy or granular materials are encountered, a cement slurry or polymer supplement shall be considered for added strength and stability of the bore and over ream hole.

C. No chemicals or polymer surfactant shall be used in the drilling fluid without written consent of the Engineer, and after a determination is made that the chemicals to be added are not harmful or corrosive to the facility and are environmentally safe. Clay must be totally inert and contain no risk to the environment.

D. Provide Owner, Engineer and have on site at all times the Material Safety Data Sheets (MSDS) for all drilling compounds and chemicals.

2.4 TRACER WIRE

A. Tracer wire shall be as Specified in Section 15130. The wire shall be contiguous except at test stations, valve boxes, and where splicing is required.

B. Tracer wire shall be installed simultaneously with pullback of the HDPE pipe. Wire shall either be wrapped around the pipe or taped to the pipe at 10 foot minimum intervals before installation.

PART 3 EXECUTION

3.1 SITE DISTURBANCE AND SOIL EROSION

A. Sediment barriers shall be constructed as shown on the Drawings or where directed by the Engineer. All soil erosion and sediment control work shall be done in accordance with the Standards for Soil Erosion and Sediment Control for the location where the work is performed. Contractor shall maintain sediment barriers until the project is deemed complete.

B. The Contractor shall be responsible for the preservation of all existing trees, plants, and other vegetation that are to remain within or adjacent to the construction site and shall also be responsible for protecting existing concrete curb, fence, utilities, and other structures that are located within or adjacent to the construction site.

C. The Contractor assumes all liability for environmental damage and cleanup due to inadvertent discharges of slurry or other causes. Slurry materials shall be selected based on the soil conditions encountered to minimize the risk of mud returns.

3.2 PERSONNEL REQUIREMENTS:

A. Provide a competent and experienced supervisor representing the Drilling Contractor who must be present at all times during actual operations. A responsible representative, who is thoroughly familiar with the equipment and type work to be performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual Directional Pilot Hole, over reaming and pullback operations.

B. Have a sufficient number of competent workers on the job at all times to insure the Directional Bore is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual Directional Bore operation must be on the job site at the beginning of work.

C. If HDPE is specified for the carrier pipe, HDPE pipe thermal butt fusion welding is to be completed by a welder certified by the manufacturer of the pipe or pipe welding equipment, in accordance with the Plastic Pipe Institute “Handbook of Polyethylene Pipe,” Polyethylene Joining Procedures, and 49 CFR 192, Subpart F, latest edition.

D. If steel pipe is specified for the carrier or casing pipe, welding shall be performed by certified welders. The CONTRACTOR shall be responsible for the qualification of welders with qualification testing conducted by an independent testing agency in accordance with American Welding Society D1.1 requirements. Results of qualification testing shall be submitted to the ENGINEER for approval. Results of previous qualification tests performed within six months from the date of pipe installation will be acceptable. Results from qualification tests performed prior to six months from the date of pipe installation will not be acceptable. All costs associated with qualification testing shall be included in the unit prices bid.

E. The Engineer and Owner must be notified 48 hours in advance of starting each phase of the work. The Directional Bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made. The Engineer's approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract. It shall be the responsibility of Owner to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.

F. If the Contractor fails to begin the Directional Bore at the agreed time, the Owner will establish the next mutually convenient time to begin. To avoid undue hardship of either party, reasonable and mutual cooperation should be exercised where starting times are concerned. If one party fails to meet the agreed schedule, the other party is expected to consider a delayed start if the installation cannot be completed during daylight hours.

3.3 ALIGNMENT AND GRADE

A. Determine and physically locate the depth, location, and size of all existing underground facilities in the vicinity of the proposed crossings and provide the ENGINEER with a comprehensive report of these facilities before starting any construction. The Contractor shall be held completely and solely responsible for any damages incurred. The kinds, locations and sizes of the existing underground utilities which may be shown on the Contract Drawings are intended only as a guide to the Contractor and are not guaranteed to be even approximately correct. Notify the owners of all existing utilities along the route and in the vicinity of the crossing prior to the construction to include all test borings and excavations.

B. If utilities of unknown depth or other obstructions require grade or alignment deviations from the Plans, the grade and/or alignment may be adjusted with Engineer's approval. All adjustments shall permit gradual bends of the pipe to the original alignment beyond the directional bore section. At unusual site conditions, the Contractor may request a review of site conditions by the Engineer for additional adjustment, and such determination shall be final. An adjustment in alignment, position, or elevation approved by Engineer shall not be cause for an adjustment of costs.

C. Pipe entry and exit points are to be allowed no more than five (5) feet of deviation from the staked centerline. The entry point may be moved up to twenty-five (25) feet further

from the original entry point only with Engineer's approval. Exit point lengths greater than twenty-five (25) feet from the original point require Engineer's approval. Entry and exit points normally will not be allowed closer to the banks of a waterway being crossed. Any installation that deviates from the plan may be rejected and any rejected installation shall be reconstructed at the Contractor's expense.

D. The vertical profile as shown on the drawings is the minimum depth to which the pipeline shall be installed. Contractor may, at his option and with the permission of Owner, elect to install the pipe at a greater depth than shown on the drawings, at no additional cost to the Owner.

3.5 INSTALLATION:

A. The Contractor shall be responsible for providing a Maintenance of Traffic Plan to the Engineer and local traffic law enforcement agency for review. The Maintenance of Traffic Plan shall show the location of all barricades, signs, devices and alternate routes for local traffic and pedestrian safety. Erection of the appropriate safety and warning devices in accordance with the USDOT “Manual of Uniform Traffic Control Devices” (MUTCD) shall be completed prior to beginning work and maintained until all construction is completed and the site restored.

B. Specifically note in the Maintenance of Traffic Plan street intersections that are to remain open as required during the pipe pull-back operation, or traffic detours implemented. Install a temporary sleeve across the street intersections through which the pipe can be pulled or to construct a temporary bridge for the pipe over the intersections as required. No additional payment will be made for temporary structures required in order to permit access through street intersections or the implementation of traffic detours.

C. The cost of restoring pavement, curb, sidewalk, driveways, lawns, storm drains, etc., and other landscaped facilities shall be borne by the Contractor unless otherwise noted.

D. The following is a general outline of steps for the Directional Bore operation:

1. Clear the right-of-way and temporary work space as shown on the drawings. Contractor to install and maintain all soil erosion and sediment control devices, until project completion with approved permanent site stabilization.

2. Lay out the pipe crossing alignment using a qualified land survey team to confirm accurate horizontal distances, either physically measured or shot by Electric Distance Measurement. Entry and exit points shall be located and marked with survey hubs or markers. Payment for survey mark-out shall be included in the price bid under horizontal directional drilling.

3. Haul, string, and assemble restrained pipe. Joint air test the section prior to installation and hydrostatically test the assembled pipeline section, unless otherwise approved by Engineer. If sufficient linear footage of lay down area for

the pipe string is not available, the finished pipeline may be assembled in no more than two sections, with each section joint air tested separately and hydrostatically tested when fully assembled as one piece. The CONTRACTOR will be responsible for ensuring that the drill rig has adequate pullback capacity to overcome the increased frictional resistance resulting from the stoppage of pipe pullback to perform the final weld or fusion of pipe sections. Provide adequate site security and shall be responsible for the integrity of the pipe until after the pullback, final test of the pipeline, and acceptance of the work by the Owner.

All assembled pipe sections shall be securely plugged at the end of each work day. The pipe interior is to be protected at all times against dirt, dust, drilling mud, pipe cuttings, debris, animal access, and other sources of contamination.

4. Provide adequate support rollers for the pipeline during pullback of the pipe string into the pre-drilled hole. The rollers and cradles shall be of a type that will prevent damage to the pipe and will be of sufficient number, as recommended by pipe manufacturer, to prevent over stressing due to sag bends during the pullback procedure. The pipe shall be supported at all times, including pullback, to maintain a free stress arc which limits pipe bending and internal hoop stresses to within manufacturer's limits.

   Pipe which is not properly protected and supported and shows indications of excessive stressing, gouges, cuts, abrasions or other damage which may affect the operational performance intended for the pipe, as recommended by pipe manufacturer, shall be removed from the site and replaced at no additional cost as directed by the Owner or Engineer.

5. Mobilize the drilling equipment, erect the rig, drill a pilot hole, enlarge the hole as necessary to a minimum diameter of 1.5 times the nominal diameter of the pipe, and pullback the prefabricated pipe string under the crossing.

   Prior to beginning the Pilot Hole over reaming, furnish to the Engineer with an as-built plan and profile of the actual crossing to confirm the installation is in compliance with the Contract Documents. Pilot hole alignment shall be accepted by Owner in writing prior to reaming and pipe installation.

   The Contractor shall be responsible for selecting the reaming process to be utilized, whether forward and/or back reaming will be undertaken, and the number of reaming passes to be made.

6. Supply portable mud tanks or construct temporary mud pits to contain excess drill fluids during construction and slurry material displaced by the pipe during installation. Mud pits are to be protected at all times against unauthorized access and be stabilized at all times against surface water runoff and containment berm failure. Pump, haul and dispose of any drill cuttings and excess drill fluids to a

receiving site permitted to accept the spoils, all in a manner consistent with the local and state regulations at no additional cost to the Owner.

7. Pull back the bore pipe in one continuous section and contractor using a swivel to minimize the rotation of the product pipe during pullback. Swivel shall utilize lubricated internal bearings which are fully protected from external contamination and over lubrication. Demonstrate the swivel operation prior to pullback to the Engineer prior to the operation.

8. Use potable water and disinfect all piping and hoses used for water addition to the carrier pipe to counter the pipe flotation during pullback.

9. During pullback, maintain records for submission to Owner indicating job, date, time, constant pipe footage progress, mud flow rates, pulling forces required and torque readings. Document the pull head location for each length of drill stem pipe for as build records.

10. Unless not permitted by the right of way owner, inject a low strength cement slurry into the bore hole for approximately 50 feet at each end of the drilled pipeline. Where cement slurry cannot be used, provide restraint at either end of the pipeline outside the bore to hold the pipe in place. The type of restraint shall be submitted to the Engineer in advance of the work and must be approved by the Engineer prior to the start of construction.

11. Owner and Engineer shall have access at all times to any measuring or gauging devices used for the horizontal drill as well as any drilling logs maintained by the Contractor.

12. In the event that the Contractor must abandon the drill hole before completion of the crossing, the Contractor will seal the borehole with neat cement grout starting at the low point or end of the drill hole and redrill the crossing at no extra cost to Owner.

3.5 PRESSURE TESTING AND LEAKAGE

A. Prior to pullback, perform an allowable leakage test on the full length of pipe after all sections have been welded or fused in accordance with ANSI/AWWA C600, latest revision and as described in Specification Section 15030. A hydrostatic pressure test shall also be performed on the installed pipe in accordance with ANSI/AWWA C600, latest revision and as described in Specification Section 15030.

3.6 CONNECTION TO ADJOINING PIPE

A. Install flange connections from the directionally drilled pipe to adjacent pipe installed by open cut with support by backfill material as per Specification Section 2210. Flange bolts shall be carefully tightened in increments, with a final torque value not exceeding the manufacturer's recommendations. Tightening torque increments shall not exceed 15 foot pounds.

B. Polyethylene and flange gasket will undergo some compression set. Therefore, the flange bolts shall be retightened one hour after the initial assembly, and a second time at least four hours after the second tightening.

3.7 DISINFECTION

A. The carrier pipe shall be disinfected as described in Specification Section 15020 or as otherwise approved in advance by the Engineer.

The carrier pipe can be filled with potable water, pressure tested and disinfected prior to insertion. Provide Engineer with full work plan to employ this alternative.

3.8 AS-BUILT RECORDS

A. The MGS pullback data shall be recorded every pilot hole drill stem length during the actual crossing operation. The Contractor shall furnish “as-built” plan and profile drawings, on the same horizontal and vertical control datum shown on the contract documents, based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation.

3.8 BASIS OF PAYMENT

A. The Work included in this Section will be paid at the Contract Unit Price per linear foot measured without deducting for length of fittings for various sizes of water main installation. The unit price includes furnishing labor, material (except when provided by Owner), and equipment to install water main. Items specified in other Specification Sections that are considered incidental to water main installation shall be included in this Contract Unit Price including, but not limited to, excavation, backfill, shoring, tracer wire, location tape, testing, and disinfection, thrust restraint, and temporary blow-off outlets.

–END OF SECTION 02450–

SECTION 02540

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing all labor, materials, and equipment necessary to provide erosion and sedimentation control including, but limited to, temporary and permanent vegetation covers, mulching, silt fence, and baling at the construction site and all areas disturbed during construction, including borrow areas. In addition to the requirements of these Specifications, comply with all local Conservation District laws, rules and regulations and all other Federal, State, County and local requirements for erosion and sedimentation control.

1.2 RELATED WORK

A. Specification Section 02820 – Lawn Restoration

1.3 REFERENCES

A. Association of Illinois Soil and Water Conservation Districts - Illinois Urban Manual Practice Standards

B. Storm Water Pollution Prevention Plan (SWPPP), if required.

C. Comply with the highest erosion and sedimentation control standards, whether Conservation District, Federal, State or Local. If in doubt as to the applicable standard, notify the Owner and comply with the Owner's directions concerning the prevailing jurisdiction.

1.4 SUBMITTALS

A. Submit plan to comply with regulators and Owner for approval using established best practices.

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 MATERIALS — GENERAL

All materials such as seeds, mulch, silt fencing and bales shall conform to the Specifications of the local Conservation District and all other applicable Federal, State, County and Local requirements.

PART 3 EXECUTION

3.1 GENERAL

A. Construct silt fences, diversion ditches with catch basins and drains as shown on the Drawings prior to any other construction activity.

B. Take precautions to prevent sediment from being tracked onto public or private roadways. Any sediment reaching a public or private road shall be removed before the end of each workday.

C. Drain the settled water from the catch basins to the natural local drains. Clean the catch basins regularly.

3.2 BASIS OF PAYMENT

The Work included in this Section and shown on the Drawings is considered incidental to the water main installation.

–END OF SECTION 02540–

SECTION 02558

IDENTIFICATION/LOCATION GUIDE

PART 1 GENERAL

1.1. SCOPE

A. Furnish and install identification tape and location wire over the centerline of buried potable water mains, hydrant branches, and trenched services as indicated in this specification or noted in the drawings.

PART 2 PRODUCTS

2.1 LOCATION WIRE

A. Location (Tracer) Wire for Polyvinyl Chloride Pipe, Ductile Iron and HDPE (and other pipe where noted in the drawings) Location wire shall be a direct burial #19 AWG Tin Coated CU, Solid, (.0358'' nominal) 300v, 32 MIL HDPE Jacket, woven polyester & water blocking yarns, 1800# break, 38,500 PSI tensile strength. Blue polyethylene jacket complying with ASTM D1248. The wire shall be continuous except at test stations and valve boxes where the splicing shall be encased with a Neptco Connector No. TS-19-LC, and where splicing is required underground it shall be encased with a Neptco Connector No. TS-19-IL. Wire insulation shall be highly resistant to alkalis, acid and other destructive agents found in soil.

B. Location Wire shall be from Neptco Inc, part number RT1802W or approved equal. For splicing onto a fire hydrant use accessory part number – TS-FHC- IWN and for main line lateral use part number TS-19.

C. With direction bore method the Location Wire shall be installed simultaneously with pullback of the HDPE pipe. Wire shall be taped to the pipe at six (6) foot minimum intervals before installation.

D. Location wire to be terminated at each end of a directional bore crossing within a valve box.

2.2 RESTRAINED JOINT MARKING TAPE

A. Joint restraint tape is specifically to warn Water Company workers/contractors that the water main is joint restrained. It is not to be used in place of regular marking tape.

B. Restrained Joint Marking Tape (for with mains that are restrained joint as directed by the Engineer) shall be polyethylene 4-mill thick and 2 ½-inches wide with blue lettering on white background color and imprinted with the words “RESTRAINED JOINT” every 2 foot. The tape shall have an adhesive backer. The tape shall be highly resistant to alkalis, acid and other destructive agents found in soil.

C. Restrained Joint Marking Tape shall be part number MIAM-010 manufactured by St. Louis Paper & Box Company located at 3843 Garfield, St. Louis, MO 63113 and AA Thread Seal Tape Inc. 1275 Kyle Court Wauconda, Il 60084 or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION OF LOCATION WIRE

A. Install location wire with all buried PVC, HDPE and Ductile Iron water lines in accordance with the manufacturer's installation instructions and as specified in Contract Documents.

B. Install the location wire directly on top of the buried pipe.

C. In all pipe installations loop the location wire up into the valve boxes for connection to a locating device. The wire shall be one continuous piece from valve box to valve box up to 1250 feet maximum.

3.2 INSTALLATION OF RESTRAINED JOINT MARKING TAPE

A. Install the restrained joint marking tape by adhering directly to the pipe as it is installed. The marking tape shall be installed along the entire length of pipe, including around the circumference of the bells of all valves and fittings. The pipe must be free of any foreign matter along the surface of the pipe for the marking tape installation. The restrained joint tape shall be applied on the top ¼ of the pipe barrel and clearly visible through the polyethylene encasement.

B. The tape does not adhere in wet or cold conditions. The tape should be stored in temperatures above 50 degrees F until the time of application and the pipe must be free of frost and moisture along the surface of the pipe that is to receive the tape.

–END OF SECTION–

SECTION 02600

EXISTING UTILITIES AND STRUCTURES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Existing Utilities and Structures – Certain information regarding the reputed presence, size, character, and location of existing Underground Facilities such as pipes, drains, sewers, electrical lines, telephone lines, cable TV lines, gas lines, and water lines has been shown on the Contract Drawings and/or provided in the contract documents. This information with respect to Underground Facilities is provided by the OWNER in accordance with conditions described in the General Conditions and for information purposes only. CONTRACTOR is responsible to determine actual location of all utilities in proximity to the Work. Furnish all materials for temporary support, adequate protection, and maintenance of all underground and surface utility structures, supports, drains, sewer and other obstructions encountered in the progress of the Work.

B. Exploratory Excavation – When the OWNER's assets are incorrectly shown on the plans, or marked in the field, it may be necessary to utilize Exploratory Excavation to locate the assets required to advance the construction. Exploratory Excavation may be shown on the plans or as approved by the OWNER.

PART 2 PRODUCTS

Furnish all materials for temporary support, adequate protection, and maintenance of all underground and surface utility structures, supports, drains, sewer and other obstructions encountered in the progress of the work.

PART 3 EXECUTION

3.1 PERMITS

The CONTRACTOR shall obtain and pay for any permits required for site preparation.

A. Notification of Utilities – Notify the applicable State Agency with jurisdiction over underground facilities and/or all utility companies that construction work under this Contract will pass through containing their underground facilities. Notify these parties in advance to support the construction work (**minimum 72 hours**). All excavation in the vicinity of existing underground utilities shall be performed in accordance with applicable regulations.

3.2 OBSTRUCTIONS BY OTHER UTILITY STRUCTURES

A. Support, relocate, remove, or reconstruct existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or drains. The obstruction shall be permanently supported, relocated, removed or reconstructed where they obstruct the grade or alignment of the pipe. CONTRACTOR must do so in cooperation with the OWNERs of such utility structures. Before proceeding, the CONTRACTOR must reach an agreement with the OWNER on the method to work around the obstruction.

B. No deviation shall be made from the required line or depth without the consent of the OWNER.

3.3 REPAIRS TO/RELOCATION OF EXISTING UTILITIES

A. Repair or replace any damage to existing structures, work, materials, or equipment incurred by CONTRACTOR's operations.

B. Repair all damage to streets, roads, curbs sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, trees, shrubs or other public or private property caused by transporting equipment, materials or personnel to or from the work site. Make satisfactory and acceptable arrangements with the persons or agencies having jurisdiction over the damaged property concerning repair or replacement.

C. Repair or replace all utility services broken or damaged at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Use temporary arrangements, as approved by the OWNER, until any damaged items can be permanently repaired. Maintain all items damaged or destroyed by construction and subsequently repaired.

D. Brace and support existing pipes or conduits crossing the trench, or otherwise exposed to prevent trench settlement from disrupting the line or grade of the pipe or conduit. Before proceeding, the CONTRACTOR must reach an agreement with the OWNER or Utility Provider on the method of bracing and support. Repair or replace all utility services broken or damaged at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Use temporary arrangements, as approved by the OWNER, until any damaged items can be permanently repaired. Maintain all items damaged or destroyed by construction and subsequently repaired.

E. Repair or replacement of storm drains or water mains removed or damaged during installation of the sanitary or water line shall be repaired immediately. Repairs or replacement of storm drains or water mains shall meet all local, state and federal requirements.

F. Relocate existing utilities or structures, where necessary, and restore it to a condition equal to that of the original facility. Obtain approval of the OWNER of the utility or structure prior to relocating and/or restoring the facility.

G. See Standard Details for requirements for repair or replacement of sanitary or storm drains removed or damaged during installation of the water main.

3.4 WATER MAIN AND WATER SERVICE LINE PROTECTION FROM SEWERS

A. Water mains and water service lines shall be protected from sewers, sewer laterals, drains, and septic fields in accordance with Illinois Administrative Code, Title 35, Subtitle F, Chapter II, Parts 651-654 and as shown on the Drawings.

B. Notify OWNER if existing site conditions prevent proper protection of water main and water service lines as shown in the Drawings.

3.5 EXPLORATORY EXCAVATION

A. All Exploratory Excavation shall be in accordance with Section 02600 of these specifications and at the direction of the OWNER.

3.6 BASIS OF PAYMENT

Existing Utilities and Structures will be considered incidental to the water main installation. No additional compensations will be provided for Site Preparation. Payment for approved exploratory excavations will be at the Contract Unit Price per each for exploratory excavation at locations as specified on the plans or as approved by the OWNER and OWNER. Backfill for the exploratory excavation will be considered incidental. Exploratory Excavation that is utilized for pipe trench is not eligible for payment as it is considered incidental to the pipe installation.

–END OF SECTION 02600–

SECTION 02610

PAVEMENT RESTORATION

PART 1 GENERAL

1.1 SUMMARY

This section includes providing all labor, tools, material, and equipment to saw cut, remove, and replace pavement which is damaged or disturbed during the course of the Work and as shown on the Drawings. Pavement includes, but is not limited to, roadways, curbs, gutters, ADA ramps, driveways, and sidewalks. Pavement restoration will be at least equal to the type of pavement which existed before the Work began and as required by Local, State or Federal regulations or as directed by OWNER.

1.2 RELATED WORK

A. Specification Section 03300 – Cast-in-Place Concrete

1.3 REFERENCES

Refer to current standards:

A. Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction

PART 2 PRODUCTS

2.1 MATERIAL – GENERAL

Materials of construction for pavement restoration shall be furnished in accordance with applicable Federal, State and Local standards. The CONTRACTOR shall use materials which comply with IDOT Standards for Asphalt Pavement. Portland Cement Pavement material shall comply with Specification Section 03300.

PART 3 EXECUTION

3.1 INSTALLATION

A. Saw or line cut the existing pavement as shown on Standard Details or as required by Local, State or Federal regulations. If saw cut location is within 2 feet of an existing joint, remove the pavement to the joint. The edges of the face of the old pavement or base shall be left vertical. Ragged edges shall be trimmed so as to provide a substantially straight line juncture between the old and new surfaces.

B. Place the pavement replacement to conform in grade to the existing streets, drives or sidewalks. The type of pavement replacement shall be as shown on the pavement replacement details in accordance with applicable Federal, State or Local standards. If there are no such applicable standards, replacement will be made to the depth and type of existing pavement.

C. Roll and tamp in place a 2-inch thick (minimum) course of bituminous material over trenches where temporary pavement is required. Remove temporary pavement prior to placing permanent pavement. The finished temporary surface shall be flush with the adjacent undisturbed surface. Maintain the temporary bituminous surface until the temporary surface is replaced.

D. Before the completion of each day's work, in traveled areas, the pipe trench shall be paved with 6 inches of stabilized base unless another method of pavement restoration is required by the authorized governing body. Final paving shall be placed over the stabilized base and overlapping each side of the trench a minimum of 12 inches and feathered to meet the existing pavement unless another method of pavement restoration is required by the authorized governing body. Final pavement shall not be placed within 20 days after the backfilling has been completed and shall be placed no longer than 45 days after the backfilling has been completed, unless otherwise ordered by the OWNER or ENGINEER.

E. If an excavation within traveled areas is subject to repeated access prior to backfill/final pavement, then the use of steel roadway plates may be required. The use of steel roadway plates shall be in strict accordance all applicable regulations with the Federal, State, County, and/or Local Agency having jurisdiction. Steel roadway plates shall be properly secured such that they are not subject to being "dragged" from place by a braking truck or "pushed" from place by a snowplowing vehicle. When requested the Contactor shall submit load bearing calculations sealed by a Professional Engineer, licensed to practice in the applicable State, demonstrating that the steel roadway plate is properly designed and installed to accommodate HS-20 vehicular loadings.

3.2 MAINTENANCE

Following the certification of completion by the ENGINEER, the CONTRACTOR shall maintain the pavement restoration areas for a period of one year thereafter, or for such greater period as may be required by Federal, State or Local authorities. All material and labor required for such maintenance shall be supplied by the CONTRACTOR, and the Work shall be done in a manner satisfactory to the OWNER at no additional cost to the OWNER.

3.3 BASIS OF PAYMENT

A. Roadways and Driveways. The Work included in this Section will be paid at the Contract Unit Price per square foot (or square yard) of various pavement types at various depths. For example "Concrete Pavement – 6-inch depth" or "Asphalt Pavement – 6-inch depth" or "Driveway Pavement – 4 inch depth." The Contract Unit Price shall include saw cutting and removing existing pavement to the limits

shown on the Drawing and Standard Details; furnishing, installing and removing temporary pavement required; furnishing, installing and removing steel roadway platting; bedding; steel reinforcement; permanent pavement; and finishing complete in place conforming to the requirements of this Specification Section and/or required by Federal, State or Local agencies. **Pavement removed beyond the specified limits will be at the CONTRACTOR's expense.**

B. Sidewalks and ADA Ramps. The Work included in this Section will be paid at the Contract Unit Price per square foot (or square yard) of various pavement types at various depths. For example "Sidewalk – 4-inch depth" or "ADA Accessibility Ramp – 6-inch depth." The Contract Unit Price shall include saw cutting and removing existing pavement to the limits shown on the Drawing and Standard Details; furnishing, installing and removing temporary pavement required; bedding; steel reinforcement; permanent pavement; furnishing, installing and removing ADA truncated domes; and finishing complete in place conforming to the requirements of this Specification Section and/or required by Federal, State or Local agencies.

C. Curb & Gutter. The Work included in this Section will be paid at the Contract Unit Price per linear foot for curb and gutter installed. The Contract Unit Price shall include saw cutting and removing existing pavement to the limits shown on the Drawing and Standard Details, bedding, steel reinforcement, curb & gutter pavement, and finishing complete in place conforming to the requirements of this Specification Section and/or required by Federal, State or Local agencies.

–END OF SECTION 02610–

SECTION 02820

LAWN RESTORATION

PART 1 GENERAL

1.1 SUMMARY

This section includes providing all labor, tools, material and equipment to prepare the ground surface, restore, replace, and maintain lawn areas where surfaces are disturbed as part of the Work. Surfaces shall be restored to conditions equal to that before the Work began and in accordance with local requirements.

1.2 REFERENCES

Refer to current standards:

A. Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction

PART 2 PRODUCTS

2.1 TOPSOIL

Topsoil shall not contain more than 40 percent clay in that portion passing a No. 10 sieve and shall not contain less than 5 percent or more than 20 percent organic matter as determined by loss on ignition of samples oven-dried to constant weight at 212 degrees Fahrenheit.

2.2 FERTILIZER

Fertilizer shall be lawn or turf grade 12-12-12 unless otherwise specified by the ENGINEER.

2.3 SEED AND SOD

Lawn Areas include all areas, whether residential, commercial or office areas, where lawns are, or have been regularly maintained. Lawn areas shall be seeded to match the existing grass as closely as possible.

Where sod is required, the sod shall be green, freshly cut and of good quality with grass free from all noxious weeds. It shall contain all the dense root system of the grass and shall not be less than 1-1/2 inches thick.

2.4 MULCH

Mulch shall be straw reasonably free of weed seed and any foreign materials which may affect plant growth. Other materials may be used if approved by the OWNER or ENGINEER.

2.5 ASPHALT EMULSION

Emulsion shall be non-toxic to plants and shall conform to AASHTO M140 or AASHTO M208.

PART 3 EXECUTION

3.1 APPROVED RESTORATION CONTRACTORS

An approved Lawn Restoration Contractor shall be used for lawn restoration. A list of approved Lawn Restoration Contractors is included in Bidding Documents.

3.2 PREPARATION OF SURFACE

A. If suitable topsoil is available as part of the excavated material it shall be removed, stored, and used to backfill the top 4 inches of the excavation. All grass, weeds, roots, sticks, stones, and other debris shall be removed and disposed of by the CONTRACTOR and the topsoil carefully brought to the finished grade by raking.

B. When there is insufficient topsoil available from the site excavated materials, furnish 4 inches of topsoil to be used as a seed bed in lawn areas as described in Part 2.03 of this Specification Section.

C. The trench backfill may be used as a seed bed where approved by the ENGINEER.

D. After the backfill has been given a reasonable time to settle, it shall be graded off to the finished grade and harrowed to a depth of 3 inches. All grass, weeds, roots, sticks, stones and other debris 2-inches or greater in diameter are to be removed and disposed of by the CONTRACTOR and the soil carefully brought to the finished grade by raking.

3.3 FERTILIZING

Apply fertilizer uniformly to all areas to be seeded at the rate of 1 pound per 100 square feet in topsoil, or 2 pounds per 100 square feet in non-topsoil, or according to manufacturer’s recommendations, whichever is greater. Disk, harrow, or rake the fertilizer thoroughly into the soil to a depth of not less than 2 inches. Immediately before sowing the seed, rework the surface until it is a fine, pulverized, smooth seed bed varying not more than 1 inch in 10 feet.

3.4 SEEDING

Seed immediately after the preparation and fertilization of the seed bed. Mix the seed thoroughly and sow it evenly over the prepared areas at the rate of 3 pounds per 1,000 square feet. Sow the seed dry or hydraulically. After sowing, rake or drag the area to cover the seed to a depth of approximately ¼ inch.

3.5 SODDING

Sod all areas with slopes greater than 10% unless otherwise noted on the Drawings. Sod all areas as noted on the Drawings. Lay sod with tight staggered joints. On slopes, start placement at the foot of the incline. Use wood pegs driven flush to hold sod in place on slopes 4:1 or greater. Use two wood pegs per strip of sod. Roll the sod lightly after placement. Fill any open joints with topsoil and/or sod.

3.6 MULCHING

Place mulching material evenly over all seeded areas within 48 hours of seeding. Place mulch at the rate of approximately 2 tons per acre, when seeding is performed between the dates of March 15 and October 15 of the same year, and at the approximate rate of 3 tons per acre when seeding is performed between the dates of October 15 and March 15 of the succeeding year.

3.7 EMULSION

Keep mulching materials in place with asphalt emulsion applied at a minimum rate of 60 gallons per ton of mulch or by other methods approved by the ENGINEER. When mulch is displaced, immediately repair any damage to the topsoil and fertilizer, re-seed, and re-mulch per the requirements of this Specification Section.

3.8 MAINTENANCE

Carefully maintain, tend, and water all seeded and sodded areas necessary to secure a good turf. Fill, grade, and re-seed or re-sod settled areas. Maintain the condition of the restored areas of vegetation in accordance with the requirements of this Specification Section for a period of one year from the date of final completion of project.

3.9 BASIS OF PAYMENT

The Work included in this Section will be paid as a Lump Sum Contract Price for Lawn Restoration. The Lump Sum price shall include preparing the ground surface, fertilizing, seeding or sodding, mulching, and maintenance. Lawn restoration requiring specialty grasses or care will be paid as a Contract Unit Price per square foot, as determined by the OWNER or ENGINEER, as Lawn Restoration – Special.

–END OF SECTION 02820–

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

This section includes providing all labor, tools, material and equipment to install concrete for thrust blocks, cross blocks, curbs, gutters, sidewalks, driveways and pavement as shown on the Drawings and Standard Details.

1.2 RELATED WORK

A. Specification Section 02610 – Pavement Restoration

1.3 REFERENCES

Refer to current standards:

A. Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction

B. ASTM C150 – Standard Specification for Portland Cement

C. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete

D. ASTM C33 – Standard Specification for Concrete Aggregates

E. ASTM A615 – Standard Specifications for Deformed and Plain Carbon-Steel Bars for

F. Concrete Reinforcement

G. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

H. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

I. ASTM C94 – Standard Specification for Ready-Mixed Concrete

J. American Concrete Institute (ACI) Standard 318 – Building Code Requirements for Reinforced Concrete

K. American Concrete Institute (ACI) Standard 306 – Guide to Cold Weather Concreting

L. American Concrete Institute (ACI) Standard 308 – Guide to Curing Concrete

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement shall be Type I or Type III and conform to "Specification for Portland Cement" ASTM C150.

B. Air-Entraining Agent shall be added in accordance with manufacturer's directions to the normal Portland cement to entrain 4½ percent air ± 1 percent with all other ingredients and strength as specified. Air-entraining admixtures shall conform to "Specifications for Air-Entraining Admixtures for Concrete" ASTM C260.

C. Concrete Aggregates shall conform to "Specifications for Concrete Aggregates" ASTM C33. Coarse aggregates shall be maximum of 1½ inches in size in footings and plain concrete. Pea gravel shall be used for sections 3 inches or less in thickness.

D. Water used in mixing concrete shall be potable water.

E. Reinforcing Bars shall be billet steel grade (60,000 psi minimum yield) and conforming to the requirements of ASTM A615, Grade 60. Reinforcing bars shall be new stock, free from rust, scale or other coating tending to destroy or reduce bond.

F. Welded Wire Mesh shall conform to "Specifications for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete" ASTM A1064.

G. Premolded Expansion Joint Material shall be non-extruding compressible joint material conforming to the requirements of "Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction", ASTM D1751.

2.2 CONCRETE MIXES

Ready-mixed concrete shall conform to "Specifications for Ready-Mixed Concrete", ASTM C94.

A. All concrete mixes shall be capable of producing a dense durable concrete. The compressive strength of the concrete shall be able to attain the following minimum strengths within 28 days:

1. 3,000 psi for sidewalks, driveways, curbs, gutters, thrust blocks, and cross blocks
2. 4,000 psi for roadway pavement

B. Water/cement ratio for the concrete shall not exceed a maximum as shown in the ACI Standard 318, “Building Code Requirements For Reinforced Concrete”, when strength data from field experience or trial mixtures are not available. A workable concrete with minimum slump of 3 inches and a maximum slump of 5 inches shall be produced not exceeding the water/cement ratio.

PART 3 EXECUTION

3.1 FORMWORK

A. Build all forms to be mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incident to the construction operations. Construct and maintain forms to prevent warping and the opening of joints.

B. The forms shall be substantial and unyielding. Design the forms so that the finished concrete will conform to the proper dimensions and contours. Design the forms to take into account the effect of vibration of concrete as it is placed.

3.2 PLACING REINFORCING STEEL

A. Place all steel reinforcement accurately in the positions shown on the Drawings and Standard Details. Secure the steel reinforcement firmly in place during the placing and setting of concrete. When placed, it shall be free from dirt, detrimental rust, loose scale, paint, oil or other foreign material. Tie bars at all intersections when spacing is one foot or more. When spacing is less than one foot in each direction, tie alternate intersections of bars.

B. Maintain distances from the forms by means of stays, blocks, ties, hangers or other approved supports. Continuous high chairs will not be permitted. Furnish all reinforcement in full lengths as indicated on the Drawings and Standard Details. Splicing of bars will not be permitted without the approval of the ENGINEER, except where shown on the Drawings and Standard Details. Stagger splices as far as possible. Unless otherwise shown on the Drawings, bars shall be lapped 36 diameters to make the splice.

C. Lap welded wire mesh at least 1½ meshes plus end extension of wires but not less than twelve (12) inches in structural slabs. Lap welded wire mesh at least ½ mesh plus end extension of wires but not less than six (6) inches in slabs on the ground.

3.3 CONVEYING AND PLACING CONCRETE

A. Convey concrete from the mixer to the forms as rapidly as practical by approved methods which will prevent segregation and loss of ingredients.

B. Clean formwork of dirt and construction debris, drain water, and remove snow and ice. After the forms have been inspected, deposit the concrete in approximately horizontal layers to avoid flowing along the forms. Deposit all concrete continuously or in layers of a thickness such that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the sections. Place the concrete to create a monolithic structure, the component parts of which are securely bonded together. Compact the concrete during placement by suitable means. Work the concrete around the reinforcement and embedded fixtures and into corners and angles of forms, taking care to avoid overworking which may result in segregation.

C. Concrete shall not be dropped into forms from a height greater than 5 feet. If depositing from a greater height, a spout shall be used, or the forms shall be provided with openings to limit the height of drop. Obtain the approval of the ENGINEER before using any method of placing concrete from a height greater than 5 feet.

D. Direct the concrete through chutes to prevent it from striking reinforcement or sides of the form above the level of placement. Avoid segregation and coating of the surfaces with paste which may dry before concrete reaches its level.

E. Submit a concrete mix design to the ENGINEER for approval prior to placing any concrete by pumping.

3.4 THRUST BLOCKING

A. See the thrust blocking Standard Details. Notify the ENGINEER whenever field conditions are noted which are more restrictive than the thrust block design data included on Standard Details.

B. Construct blocking against the vertical face of undisturbed earth or sheeting left in place. Prevent the concrete from enclosing more than half the circumference of the pipe and keep the concrete away from joints or bolts in the piping.

3.5 PLACING CONCRETE IN COLD WEATHER

A. No concrete shall be placed when the atmospheric temperature is below 35 degrees F unless the CONTRACTOR encloses the structure in such a way that the concrete and air within the enclosure can be kept above 60 degrees F for a period of seven (7) days after placing the concrete.

B. If high early strength cement is used, these periods may be reduced, if approved by the ENGINEER.

C. Alternate placement methods may be submitted to the ENGINEER for approval. Alternate methods of placing concrete in cold weather should follow the provisions of ACI 306 and ACI 308.

3.6 OWNER'S FIELD CONTROL TESTING

A. Field control tests shall be performed by ENGINEER or OWNER's testing laboratory personnel, at the expense of the OWNER. CONTRACTOR shall provide access to all facilities and the services of one or more employees as necessary to assist with the field control testing.

B. Air Content. An air content test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C2331.

C. Slump. A slump test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Slump shall be determined in accordance with ASTM C143.

D. Test Cylinders. Compression test specimens shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C31 and C39. Compressive strength tests will be evaluated in accordance with ACI 318 and as specified herein.

E. One set of concrete test cylinders shall be case for each concrete pour. A set of test cylinders shall consist of four or six cylinders depending on the cylinder size selected. Half of the cylinders shall be tested at 7 days, and the remaining half shall be tested at 28 days. All concrete required for testing shall be furnished by, and at the expense of, CONTRACTOR.

3.7 BASIS OF PAYMENT

The basis of payment for pavement replacement is described in Specification Section 02610 – Pavement Restoration. Thrust blocks are considered incidental to the installation of the water main. Cross Blocks will be paid at a Contract Unit price for each.

–END OF SECTION 03300–

SECTION 03400

PRECAST CONCRETE MANHOLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Precast concrete manholes for sanitary sewers or as indicated on the Drawings.

B. Precast concrete sanitary sewer manholes with fiberglass liner or sewer gas resistance epoxy coating where corrosion resistant manholes are specifically required to prevent early deterioration of the manhole.

C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.2 SUBMITTALS

A. Conform to requirements of Section - Submittals.

B. Submit Manufacturer's data and details of following items for approval:

1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.

2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in Paragraph 2.01E of this Specification.

3. Frames, grates, rings, and covers

4. Materials to be used in fabricating drop connections

5. Materials to be used for pipe connections at manhole walls

6. Materials to be used for stubs and stub plugs, if required.

7. Materials and procedures for corrosion-resistant liner and coatings, if required.

8. Plugs to be used for sanitary sewer hydrostatic testing

9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on OWNER Standard Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints.

C. Provide tops to support AASHTO HS-20 vehicle loading, and receive cast iron frame covers, as indicated on OWNER Standard Drawings.

D. Provide detail for manholes larger than 48-inch diameter. provide precast base sections with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise requested by OWNER. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by OWNER.

E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed by manufacturer, to requirements of ASTM C 478 for depth as shown on OWNER Standard Drawings and to resist the following loads.

1. AASHTO HS-20 vehicle loading applied to manhole cover and transmitted down to transition and base slabs

2. Unit soil weight of 120 lbs./ft.^{3} located above portions of manhole, including base slab projections

3. Lateral soil pressure based on saturated soil conditions producing an at rest equivalent fluid pressure of 100 lbs./ft.^{3}

4. Internal liquid pressure based on unit weight of 63 lbs./ft.^{3}

5. Dead load of manhole sections fully supported by transition and base slabs

F. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.

G. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections. Lowest edge of holes or cutouts: For water line manhole, no less than 6-inches above inside surface of floor of base.

2.2 CONCRETE

A. Conform to requirements of Section 03300 (Cast-In-Place Concrete).

B. Channel Inverts: Use concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4,000 psi.

C. Concrete Foundation: Provide concrete with minimum compressive strength of 4,000 psi for concrete foundation slab under manhole base section as indicated on OWNER Standard Drawing.

2.3 REINFORCING BARS

A. Conform to the requirements of Section 03300 (Cast-In-Place Concrete).

2.4 FRAMES AND COVERS

A. Use castings for frames, grates, rings and covers conforming to ASTM A48, Class 35B.

B. Use clean castings capable of withstanding application of AASHTO M306- 40,000 pound proof loading without detrimental permanent deformation.

C. Fabricate castings to conform to shapes and dimensions as shown on OWNER Standard Drawing, and cast with the wording or logo “SEWER” for sanitary sewer and “WATER” for water system frames and covers. Standard dimensions for manhole frames and covers shall be 30-inches in diameter.

D. Castings shall be smooth, clean, and free from blowholes and other surface imperfections. Use clean and symmetrical cast holes in covers, free of plugs.

E. Provide watertight manhole frames and covers when the top of the frame and cover is below the 100-year flood elevation or when subjected to ponding. Watertight manhole frames and covers shall be provided with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.

2.5 DROP CONNECTIONS AND STUBS

A. All manhole drop connections shall be outside drop unless prior written approval from OWNER. Outside drops shall be provided when the invert elevation into the manhole is 24-inches higher than the manhole invert.

1. Pipe material used for outside drops shall be same pipe material as sewer main, or PVC;

2.6 PIPE CONNECTIONS TO MANHOLE

A. Sanitary Sewers.

1. Provide resilient connectors conforming to requirements of ASTM C923.

   Use the following materials for metallic mechanical devices as defined in ASTM C923:

   a. A-Lok or approved equivalent
   b. External clamps: Type 304 stainless steel
   c. Internal, expandable clamps on standard manholes: Type 304 stainless steel, 11-gauge minimum.
   d. Internal, expandable clamps on corrosion-resistant manholes: Type 316 stainless steel, 11 gauge minimum coated with minimum 16 mil fusion bonded epoxy conforming to AWWA C213

2. Where rigid joints between pipe and cast-in-place manhole base are specified, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C923.

2.7 SEALANT MATERIALS

A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame in accordance with ASTM C443.

2.8 CORROSION RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes are required, such as a manhole receiving a force main or manholes located within a 1,000 feet down-stream of a force discharge,sewer gas resistant coating for precast cylindrical manhole section, base sections, and cone sections, or other sewer gas resistant liner as approved by OWNER. Liners relying on mechanically fastened batten strips as primary means of anchorage are unacceptable. All manholes with a corrosion resistant interior coating shall be provided with an exterior bituminous coating in locations where ground water table can reach above the base of the manhole.

2.9 BACKFILL MATERIALS

A. Conform to requirements of Section - Excavation and Backfill for Utilities.

2.10 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.

B. Meet requirements of ASTM C1107 and have a minimum 28-day compressive strength of 7,000 psi.

2.11 VENT PIPES

A. Installed as per plans as indicated by ENGINEER.

B. Vent opening to be located a minimum of 1 foot above 100-year flood plain.

C. Buried Vent Pipes: Provide appropriate size stainless steel pipe or DIP as indicated on the Drawings.

D. Vent Outlet Assembly: Provide detail of vent assembly.

2.12 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of sanitary sewer manholes, including adjustment of manholes to grade. Use only specified materials listed herein.

2.13 MANHOLE LADDER FOR MANHOLES AND MANHOLE STEPS

A. Manhole ladder and steps are prohibited unless required by local regulation.

B. Manhole Ladder: Fiberglass with 300-lbs. rating at appropriate length; conform to requirements of OSHA.

1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.

2. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.

C. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and re-compacted, can be compacted to 95 percent of maximum Modified Proctor Density according to ASTM D 1557 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by OWNER.

3.2 PLACEMENT

A. Install precast manholes to conform to locations and dimensions as shown on Drawings.

B. Place sanitary manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise directed by OWNER.

3.3 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place precast base on 6-inch thick (minimum) foundation of IDOT CA-6 fill or as approved by OWNER, or concrete foundation slab on up to 60-inch manholes.

1. Manholes larger than 60-inch foundation must be approved by ENGINEER.

B. Unstable Subgrade Treatment: Notify OWNER immediately when unsatisfactory material is encountered in the manhole subgrade. With OWNER approval, up to 12-inches of additional undercut may be permitted to achieve suitable foundation. If the additional undercut does not result in a satisfactory foundation, the Contractor shall obtain a bedding design prepared by a Geotechnical ENGINEER licensed in the in which the project is being constructed.

3.4 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.

B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame. No more than 2 adjustments allowed.

C. Seal any lifting holes with non-shrink grout.

D. Precast concrete grade rings shall be permitted to achieve the required grade.

E. Grade rings shall not be permitted to more than 12-inches.

F. External joint wrap all riser joints to ensure seal. No grout is permitted on the interior of manhole riser joints prior to testing.

G. Concrete base must be dry prior to setting any sections above it.

3.5 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.

1. Where smooth exterior pipes, i.e. steel, ductile iron or PVC pipes are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links

mechanically compressed to form watertight barrier.

2. When connecting concrete or cement mortar coated steel pipes, or as an option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp and rubber gasket. Take-up clamp: Minimum of 9/16-inch wide.

B. Ensure no concrete, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.

C. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install water stop gasket around existing pipe at center of precast wall. Join ends of split water stop material at pipe spring line using an adhesive recommended and supplied by water stop manufacturer.

D. Test connection for watertight seal before backfilling, or at direction of OWNER.

3.6 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: 1-inch per foot minimum; 1½-inches per foot maximum.

2. Depth of bench to invert:

a. Pipes smaller than 15-inches: one-half of largest pipe diameter
b. Pipes 15 to 24-inches: three-fourths of largest pipe diameter
c. Pipes larger than 24-inches: equal to largest pipe diameter

3. Invert slope through manhole: 0.17 foot (2-inches) drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawing.

Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.7 DROP CONNECTIONS FOR SANITARY SEWERS

A. Install drop connection when sewer line enters manhole higher than 24-inches above invert of manhole.

3.8 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight cap.

3.9 MANHOLE FRAME LID, COVER AND ADJUSTMENT RINGS

A. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of pre-approved sealant material. Install sealant bed consisting of two beds of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.

B. Wrap manhole frame and adjustment rings with pre-approved external sealing material, minimum 3-inches beyond joint between ring and frame and adjustment rings and precast section.

C. For manholes in unpaved areas, set top of frame flush with existing grade up to a maximum of 12-inches above existing grade, unless otherwise noted. In unpaved areas, encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

D. For manholes located in a floodplain the top of manhole shall be of flat-top construction large enough to accommodate a tripod. Manhole elevations shall be set above the 100-year flood level. Lock down, sealed covers shall be used. Unless approved by OWNER.

E. Manhole covers shall be solid, without vent holes.

3.10 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02100 – Trenching and Backfilling.

B. In unpaved areas, provide positive drainage away from all manhole frames to natural grade. Provide restoration of disturbed areas in accordance with Section 02820 – Lawn Restoration.

3.11 SETOVER (DOGHOUSE) MANHOLE

A. Existing sewer pipe to remain until satisfactory completion of manhole testing.

B. Center of existing pipe shall be flush with concrete shelf that is formed within the manhole.

C. Doghouse manholes shall be constructed as per OWNER Standard Details.

3.12 FIELD QUALITY CONTROL

A. Conduct testing of manholes in accordance with requirements of Section 17040 (Infiltration and Exfiltration Testing Wastewater).

3.13 PROTECTION

A. Protect manholes from damage until Work has been accepted. Repair damage to manholes at no additional cost to OWNER.

–END OF SECTION 03400–

SECTION 03410

MANHOLE REHABILITATION

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This section includes cleaning, plugging, sealing, lining, and general repairs of defective manholes.

B. The CONTRACTOR shall be responsible for furnishing all labor, supervision, materials, and equipment required to complete all manhole rehabilitation work, testing, and surface restoration in accordance with this Specification.

C. It is the intent of this Specification to ensure that the work, as completed, shall meet all applicable codes, ordinances, rules and regulations of every authority having jurisdiction in the area where the construction is located. Failure of the CONTRACTOR to point out items that do not meet such requirements does not relieve the CONTRACTOR or his Subcontractors of the responsibility of meeting them.

1.2 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience or approved by OWNER.

B. CONTRACTOR: Company specializing in performing work of this section with minimum five years documented experience and approved by Manufacturer or approved by OWNER.

1.3 MATERIALS

A. All supplies shall be stored and maintained by the CONTRACTOR in accordance with manufacturer's recommendations. Materials shall not be exposed to adverse conditions prior to the work. All materials shall be kept in a secured area and away from general public access. The CONTRACTOR shall review and maintain all Safety Data Sheets (SDS), product labeling, and technical literature at the project site.

PART 2 MANHOLE REHABILITATION METHODS AND PROCEDURES

2.1 GENERAL

A. All work shall be in strict accordance with all Specifications and Requirements. Application of all products must also be in accordance with Manufacturer's Specifications and recommendations.

B. When freezing temperatures are expected in the area, the CONTRACTOR shall take measures to keep applied materials within product specifications and provide the required heat to the manhole surface before repair work is started and the 24-hour period following application.

C. The invert shall be covered during construction operations to prevent loose materials from collecting in the invert.

D. Bypassing and/or blocking of the flow in the manholes shall be done only with prior approval of OWNER and with strict adherence to Specification 17020-Pumping and Bypassing.

E. Use approved equipment designed and manufactured by the material supplier specifically for the application of all materials in sanitary sewer manholes.

2.2 MANHOLE CLEANING AND PREPARATION

A. The floor and interior walls of the manhole shall be thoroughly cleaned and made free of all foreign materials including dirt, grit, roots, grease, sludge and all debris or material that may be attached to the wall or bottom of the manhole.

B. When grease and oil are present within the manhole, and conditions allow, an approved detergent or muriatic acid may be used integrally with a tempured high pressure cleaning water such as Hotsy.

C. All materials resulting from the cleaning of the manhole shall be removed prior to applying specified coatings.

D. All loose or defective brick, grout, ledges, and protruding ledges shall be removed to provide an even surface prior to application of specified coating.

E. Manhole Steps and Ladders shall be removed prior to rehabilitation work. Steps and ladders shall not be replaced.

2.3 PATCHING

A. Materials

1. Patching material shall be quick setting, fiber reinforced, calcium aluminate, corrosion resistant, cementitious material, mixed and applied according to manufacturer's recommendations and having the following minimum requirements:

Compressive Strength ASTM C109	1,400 psi, 6 hours
Bond ASTM C321	145 psi, 28 days
Cement	Calcium Aluminate
Applied Density	105 lbs./ft^3
Shrinkage ASTM C596	0 percent at 90 percent relative humidity

B. Execution

1. Patching of manhole walls or sewer structures shall be required in areas where large voids exist, such as mortar missing between bricks, around step frames, pipes and spalled concrete. All loose, cracked and corroded material shall be removed from the area to be patched, exposing a sound substrate. A fast-setting polymer mortar shall be applied to dampened surfaces. These products shall be allowed to cure before applying linings.

2. When leaks are not readily identifiable upon completion of cleaning operation, use a blower to dry the manhole interior for positive identification of leaks and weep areas.

3. All infiltration must be stopped by injection using manufactures recommendations as approved by the ENGINNEER/OWNER.

4. Upon setting of sealant coatings remove excess material protruding into inside of manhole.

5. Patching/plugging manhole defects as necessary shall be performed to provide a smooth surface for application of the lining material.

2.4 SEALING ACTIVE LEAKS

Stop active leaks with patching material or infiltration control materials applied according to manufacturer's instructions. Install weep holes as required to localize infiltration during application of patching material or infiltration control material. Plug weep holes after application with infiltration control material before applying liner material.

A. Severe Infiltration Control

Severe infiltration shall be identified in field by the CONTRACTOR and reported to the OWNER. OWNER/ENGINEER will provide direction on appropriate measures to mitigate infiltration.

2.5 REPAIRING INVERT, BENCH AND TROUGH

A. Materials

Materials used for bench and trough repairs shall be a rapid setting, high early strength, non-shrink material conforming to this Section for patching material.

B. Execution

1. Construct invert channels to provide a smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

   a. Slope of invert bench: 1-inch per foot minimum; 1-1/2-inches per foot maximum
   b. Depth of bench to invert:
      - Pipes smaller than 15-inches: one-half of largest pipe diameter
      - Pipes 15 to 24-inches: three-fourths of largest pipe diameter
      - Pipes larger than 24-inches: equal to largest pipe diameter
   c. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

2. Form invert channels with quick setting, fiber reinforced, calcium aluminate, corrosion resistant, cementitious material, mixed and applied according to manufacturer's recommendations and having the following minimum requirements if not integral with manhole base section.

Compressive Strength ASTM C109	1,400 psi, 6 hours
Bond ASTM C321	145 psi, 28 days
Cement	Calcium Aluminate
Applied Density	105 lbs./ft^3
Shrinkage ASTM C596	0 percent at 90 percent relative humidity

3. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

4. Hand mix and use a rapid setting, high early strength, non-shrink patching material to fill all large voids and repair inverts prior to lining of the manhole. For invert repairs, flow must be temporarily restricted by inflatable or mechanical plugs prior to cleaning, or a bypass may be installed in accordance with Specification 17020 – Pumping and Bypassing.

5. The area to be repaired must be cleaned and free of all debris per the guidelines set forth in paragraph 2.2 Manhole Cleaning and Preparation.

6. Mix water shall be clean potable water and require no additives or admixtures for use with cementitious patching materials.

2.6 REPLACING MANHOLE FRAMES AND COVERS

A. Materials

1. Castings

   a. Use castings for frames, grates, rings and covers conforming to ASTM A48, Class 35B.
   b. Use clean castings capable of withstanding application of AASHTO M306 - 40,000 pound proof loading without detrimental permanent deformation, or in accordance with local requirements.

2. Bearing Surfaces

   Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for position in which casting may be seated in frame.

3. Frames and Covers

   a. Provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames. Unless otherwise approved by OWNER.
   b. Provide manhole frames and covers with clear openings that match existing.

B. Execution

1. Remove and dispose of existing frame and cover, unless otherwise directed by OWNER.

2. Install castings according to OWNER's Standard Details, instructions in related specifications, and applicable directions from manufacturer's printed materials.

3. Install riser rings in frames with clean bearing surfaces that are free from rocking. Only one riser ring is allowed.

4. Restore surface to pre-existing condition.

2.7 ADJUSTING MANHOLES TO GRADE

A. Materials

Provide precast concrete manhole sections and adjustment rings conforming to requirements of Section 03400 – Precast Concrete Manholes.

B. Execution

1. Examine existing structure, frame and cover for damage or defects affecting adjustment to grade. Report damage or defects to OWNER.

2. Establish grade with related items with existing grade and finished grade or paving, and relate to established benchmark or reference line.

3. Rebuild adjustment portion of manhole or inlet by adding or removing adjustments. Follow procedures in Section 03400 – Precast Concrete Manholes.

4. Salvage and reuse cast-iron frame and cover if of usable condition.

5. Protect or block off manhole or inlet bottom using wood forms shaped to fit so that no debris or soil falls to bottom during adjustment.

6. Verify that manholes and inlets are free of visible leaks as result of reconstruction. Repair leaks in manner subject to OWNER's approval.

7. Backfill area of excavation surrounding each adjusted manhole, inlet, and valve box and compact according to requirements of Section 02100 – Trenching and Backfilling.

8. Grade ground surface to drain away from each manhole and valve box. Place earth fill around manholes to level of upper rim of manhole frame. Place earth fill around valve box concrete slab.

9. In unpaved areas, restore ground surface in accordance with OWNER Specification 02820 – Lawn Restoration.

2.8 MANHOLE FRAME SEAL

A. Materials

1. Manhole frame sealing includes the sealing of the frame adjustment area with a corrosion resistant aromatic flexible urethane resin coating. The sealing system shall remain flexible and allow vertical movement of the frame up to 0.5-inches.

2. Primer – Flexible Aromatic Urethane Resin Liner Primer minimum requirements:

Hardness ASTM D2240	85
Elongation ASTM D412	400 percent
Tensile Strength ASTM D412	3200 psi
Adhesive Strength ASTM D903	400 lb/in
Tear Resistance ASTM D1004	210 lb/in

3. Final Coat: Flexible Aromatic Urethane Resin Liner Final Coat minimum requirements:

Hardness ASTM D2240	75
Elongation ASTM D412	800 percent
Tensile Strength ASTM D412	1150 psi
Adhesive Strength ASTM D903	175 lbs./in
Tear Resistance ASTM D1004	155 lbs./in

B. Execution

1. Contact surfaces shall be clean, smooth and circular, and free of excessive voids. Remove loose and protruding mortar and brick. Prepare surfaces of the ring adjustment area to include the lower 3- inches of the frame and the top 8-inches of the cone section according to manufacturer's instructions for a total of 12 vertical inches applied at 120 Mil thickness. Greater depths may be covered at the Owner's direction depending on conditions of the manhole.

2. If the masonry surface is rough, irregular, or contains excessive voids and will not provide an effective seal, apply a bed of patching mortar. Allow mortar to cure prior to installing the flexible manhole sealant system per manufacturer's recommendations. The minimum cure time will be 14 days before application of sealant or according to manufacturer's specifications as approved by OWNER

3. Correct active internal leaks prior to installing the flexible manhole sealant system per manufacturer's recommendations.

4. Prepare internal surface by sand blasting casting section to white metal. After sandblasting, check the entire area to remove any loose sand, debris, laitance, dust, dirt, oil, grease or chemical combination. Sand is to be captured and not allowed to enter the manhole.

5. Use of a blower may be required to completely dry the surface as recommended by the manufacturer. Surface of manhole must be completely dry prior to primer application.

6. Mix and apply the adhesive primer to the clean and dry surface according to manufacturer's recommendations. Cover the ring adjustment area, the lower 3-inches of the casting frame and the top 8- inches of the cone section. Allow

for proper drying of the adhesive primer, then apply sealant by brush, as evenly as possible over the entire area and allow to cure per manufacturer's recommendations. Minimum thickness of sealant is 120 Mils.

2.9 CHIMNEY SEALS

A. Materials

Chimney seals shall be designed to provide a watertight, interior, flexible seal between the manhole cover frame and manhole cone section. Seal chimney joints in the same manner as the manhole barrels. On existing chimneys, a corrosion resistant aromatic flexible urethane resin coating can be used on the interior.

B. Execution

1. Precast Manholes shall be sealed from the bottom 2-inches of the steel casting to the top 2-inches of the precast manhole cone and include all grade rings.

2. Brick manholes shall be sealed from the bottom 2-inches of the steel casting to the second level of brick courses of the manhole chimney.

2.10 EPOXY LINING SYSTEM

B. Materials

1. The epoxy manhole liner shall be a chemical resistant (below a pH of 2.0), VOC compliant, moisture tolerant, 100% solids, two (2) component epoxy system with the following properties:

Flexural Strength [ASTM D-790]:	9,000 psi
Compressive Strength [ASTM D-695]:	8,200 psi
Tensile Strength [ASTM D-638]:	6,300 psi
Adhesion:	Concrete Substrate Failure
Abrasion Resistance:	95 mg

C. Execution

1. When indicated in the schedule, the interior surface of the manhole shall be lined with a two component, 100% solids epoxy coating system which provides a durable, high strength, monolithic lining. Provide mixing and application equipment designed for mixing and spraying epoxy coating as recommended by the Manufacturer. The two (2)-part epoxy liner shall be mixed in accordance with the Manufacturer recommendations.

2. The epoxy liner shall be applied in accordance with the manufacturer's recommendations. The surface prior to application may be damp but shall not have noticeable free running water. Materials shall be spray applied per Manufacturer's recommendations to an average thickness of 70 Mils with a minimum thickness of 65 Mils. The final application shall have a minimum of

four (4) hours cure time before being subjected to active flow. The epoxy liner shall be applied from the invert (completely cover the Bench and Invert) to 3-inch onto the manhole frame.

3. During the application, a wet film gauge shall be used regularly to ensure that minimum thickness is being maintained. After the epoxy liner has set (hard to touch), all visible pinholes shall be repaired. Repairs shall be made by lightly abrading the surface and brushing the lining material over the area. All blisters and evidence of uneven coverage shall be repaired according to the manufacturer's recommendations. After the product has set to touch, the surface shall be inspected for pinholes and thin spots using a Holiday Detector capable of 16,000 volts. All pinholes and areas less than one square foot that test to be thinner than 65 Mils may be retouched by hand, but any areas larger than one square foot must be re-sprayed.

2.11 CEMENTITIOUS LINING SYSTEM

A. Materials

1. All cementitious lining materials shall be specifically designed for the rehabilitation of manholes. Liner materials shall be cement based, nylon fiber reinforced, shrinkage compensated, and enhanced with chemical admixtures and monocrystalline quartz (Granusil) aggregates. Liner materials shall be mixed with water per manufacturer's written specifications and applied using equipment specifically designed for either low-pressure spray or centrifugal spin casting application of cement mortars. All cement liner materials must be capable of a placement thickness of 2-inch to 4-inch in a one-pass monolithic application.

   For low to mild hydrogen sulfide environments (pH > 3.0), cementitious lining materials shall be manufactured from Type II Portland Cement, and enhanced with silica fume. Approved material shall be Quadex QM-1s Restore as manufactured by Quadex, Inc., North Little Rock, Arkansas or "preapproved equal". Approved material shall exhibit the following 28-day minimum physical properties.

   Compressive Strength (ASTM C 109) >10,000 psi Flexural
   Strength (ASTM C293) > 1,400 psi
   Bond Strength (ASTM C321) Brick failed before bond Permeability
   (AASHTO T-277) Not to exceed 350 coulombs
   Freeze-Thaw (ASTM C666) No damage in minimum 300 cycles
   Material Wet Density Minimum 142 +/-5 lbs./ft^3

B. Execution

1. The work consists of spray applying and/or centrifugally spin casting a cementitious based liner to the inside of the existing manhole. The necessary equipment and application methods to apply the cementitious based liner materials shall be only as approved by the material manufacturer.

2. Material shall be mixed with water in accordance with manufacturer's specifications. Once mixed to proper consistency, the materials shall be pumped via a rotor-stator style progressive cavity pump through a material plaster hose for delivery to the appropriate and/or selected application device.

3. Spray application of the cementitious material:

    a. Material hose shall be coupled to a low-velocity spray application nozzle. Pumping of the material shall commence and the mortar shall be atomized by the introduction of air at the nozzle, creating a low-velocity spray pattern for material application.

    b. Spraying shall be performed by starting at the manhole invert and progressing up the wall to the corbel and chimney areas.

    c. Material shall be applied to a specified uniform minimum thickness no less than 2-inches. Material shall be applied to the bench area in such a manner as to provide for proper drainage without ponding.

4. Centrifugal spin casting application of the cementitious material:

    a. Material hose shall be coupled to a high speed rotating applicator device. The rotating casting applicator shall then be positioned within the center of the manhole at either the top of the manhole chimney or the lowest point elevation corresponding to the junction of the manhole bench and walls.

    b. The high speed rotating applicator shall then be initialized, and pumping of the material shall commence. As the mortar begins to be centrifugally cast evenly around the interior of the manhole, the rotating applicator head shall be raised and/or lowered at a controlled retrieval speed conducive to providing a uniform material thickness on the manhole walls.

    c. Controlled multiple passes are then made until the specified minimum finished thickness is attained. If the procedure is interrupted for any reason, simply arrest the retrieval of the applicator head until flows are recommenced.

    d. Material thickness may be verified at any point with a depth gauge and shall be no less than a uniform 2-inches. If additional material is required at any level, the rotating applicator head shall be placed at that level and application shall recommence until that area is thickened.

5. Material shall be applied only when manhole is in a damp state, with no visible water dripping or running over the manhole walls.

6. The low-velocity spray nozzle and the centrifugal spin casting head may be used in conjunction to facilitate uniform application of the mortar material to irregularities in the contour of the manhole walls and bench areas.

7. Troweling of materials shall begin immediately following the spray application. Initial troweling shall be in an upward motion, to compress the material into voids and solidify manhole wall. Precautions should be taken not to over trowel. All troweled surfaces shall then be given a light brush finish. Brush shall be kept wet with potable water.

8. It is important that the manhole cover is replaced immediately after troweling and brushing are complete to avoid moisture loss in the material due to sunlight and wind. Lining material may be subjected to active flows or surcharges after an initial set time of 9 to12 hours. Ideal curing is achieved at a temperature of 72° F and 80% humidity. Curing may be affected when ambient conditions within the structure fall below the ideal temperature and/or humidity. Liners may be subjected to additional cleaning after a period of 24 hours at the above stated conditions.

9. Material shall not be applied during freezing weather conditions.

10. Material shall not be placed when the ambient temperature is 37° F and falling or when the temperature is anticipated to fall below 32° F during the next 24 hours.

–END OF SECTION 03410–

SECTION 03500

GREASE TRAPS

PART 1 GENERAL

1.1 SCOPE

Grease traps are required wherever wastewater sources contain animal and/or plant derived grease products.

1.2 SUBMITTALS

Submit shop drawings and manufacturer's literature to the OWNER for approval in accordance with Section –01300 Submittals.

PART 2 PRODUCTS

2.1 MATERIALS

A. Grease traps shall be manufactured in accordance with ASTM C1613 – Standard Specification for Precast Concrete Grease Interceptor Tanks.

B. All grease traps shall be externally located, pre-manufactured, pre-cast concrete units designed specifically for removing FOG (fat, oil, grease) from wastewater.

C. Provide a gasketed/mastic bolt-down manhole frame and cover.

PART 3 EXECUTION

3.1 DESIGN

A. Grease traps are to be designed for peak flow and sized based on required retention time. Retention time shall be based on the manufacturer’s recommendation for operational discharge of less than 100 mg/L of FOG during peak flows.

B. Grease traps shall be designed and certified to operate efficiently at their maximum flow rate in GPM and retain a minimum of twice its rated GPM in pounds of grease.

C. All design calculations and system designs shall be submitted to OWNER for review and approval.

D. Grease traps shall be sized in accordance with Standard PDI-G101 from the Plumbing and Drainage Institute.

3.2 DELIVERY AND STORAGE

A. Inspect materials delivered to site for damage, unload and store with minimum handling.

B. Store materials on-site within enclosures or under protective coatings to protect against inclement weather and direct sunlight.

3.3 INSTALLATION

A. Grease traps shall be installed as shown on the Drawings and in strict accordance with the manufacturer's recommendations.

B. Grease traps shall not be located under pavement but shall be located within five feet of a paved vehicle access for cleaning and inspection, whenever possible.

C. Only waste from grease producing sources shall flow through the grease trap.

All grease traps shall be located upstream of the location where human waste enters the service line. Sanitary wastes and other wastes shall flow through a separate lateral and connect to the receiving main.

3.4 QUALITY ASSURANCE AND TESTING

A. The grease trap shall be fabricated, inspected, and tested for leakage before shipment from the factory as a completely assembled system ready for installation.

B. Conduct pressure and leakage tests as required by Section 17010– Pressure and Leakage Tests.

–END OF SECTION 03500–

SECTION 03510

OIL-WATER SEPARATORS

PART 1 GENERAL

1.1 SCOPE

Oil-water separators are required wherever wastewater sources contain petroleum products.

1.2 SUBMITTALS

Submit shop drawings and manufacturer's literature to the OWNER Project Manager for approval in accordance with Section – 01300 (Submittals).

PART 2 PRODUCTS

2.1 MATERIALS

A. Oil-water separators shall be pre-manufactured, pre-cast concrete units designed specifically for separating petroleum products from wastewater.

B. Provide a minimum storage capacity of 500 gallons.

PART 3 EXECUTION

3.1 DESIGN

A. Oil-water separators are to be designed for peak flow.

B. Oil water separators shall be designed per code.

C. All design calculations and system designs shall be submitted to OWNER/ENGINEER for review and approval.

3.2 DELIVERY AND STORAGE

A. Inspect materials delivered to site for damage; unload and store with minimum handling.

B. Store materials on-site within enclosures or under protective coatings to protect against inclement weather and direct sunlight.

3.3 INSTALLATION

A. Oil-water separators shall be installed as shown on the Drawings and in strict accordance with the Manufacturer's recommendations.

B. Provide ease of access for cleaning and inspection, accounting for vehicle access.

C. If required by Owner, provide services of technical representative of manufacturer available on site during installation of valves.

D. Only waste from oil producing sources shall flow through the oil-water separators. All oil-water separators shall be located upstream of the location where human waste enters the service line. Sanitary wastes and other wastes shall flow through a separate lateral and connect to the receiving main.

3.4 QUALITY ASSURANCE AND TESTING

A. The oil-water separator shall be fabricated, inspected, and tested for leakage before shipment from the factory as a completely assembled system ready for installation.

B. Conduct pressure and leakage tests as required by Section 17040 (Infiltration and Exfiltration Testing Wastewater).

–END OF SECTION 03510–

SECTION 15000

PIPING – GENERAL PROVISIONS

PART 1 GENERAL

1.1 SUMMARY

This section includes general provisions for handling material, general installation requirements, and installation methods to avoid contamination.

1.2 RELATED WORK

A. Specification Section 01600 – Products

B. Specification Section 02000 – Site Preparation

C. Specification Section 15025 – Cleaning Pipelines

1.3 REFERENCES

Refer to current standards:

A. AWWA C600, C605, C906, C105

B. AWWA C217 – Petrolatum and Petroleum Wax Tape Coatings

PART 2 PRODUCTS

2.1 CONTRACTOR'S RESPONSIBILITY FOR MATERIAL

A. Examine all material carefully for defects. Do not install material which is known or thought to be defective.

B. The OWNER reserves the right to inspect all material and to reject all defective material shipped to the job site or stored on the site. Failure of the OWNER to detect damaged material shall not relieve the CONTRACTOR from the total responsibility for the completed Work if it leaks or breaks after installation.

C. Lay all defective material aside for final inspection by the OWNER. The OWNER will determine if corrective repairs may be made, or if the material is rejected. The OWNER shall determine the extent of the repairs.

D. Classify defective pipe prior to OWNER's inspection as follows:

1. Damage to interior and/or exterior paint seal coatings.
2. Damage to interior cement-mortar or epoxy lining.
3. Insufficient interior cement-mortar lining or epoxy thickness.
4. Excessive pitting of pipe.
5. Poor quality exterior paint seal coat.
6. Pipe out of round.
7. Pipe barrel area damaged to a point where pipe class thickness is reduced (all pipe).
8. Denting or gouges in plain end of pipe (all pipe).
9. Excessive slag on pipe affecting gasket seal (DI).
10. Any visible cracks, holes.
11. Embedded foreign materials.
12. Non-uniform color, density and other physical properties along the length of the pipe.

E. The CONTRACTOR shall be responsible for all material, equipment, fixtures, and devices furnished. These materials, equipment, fixtures and devices shall comply with the requirements and standards of all Federal, State, and Local laws, ordinances, codes, rules, and regulations governing safety and health.

F. The CONTRACTOR shall take full responsibility for the storage and handling of all material furnished until the material is incorporated in the completed project and accepted by the OWNER. CONTRACTOR shall be solely responsible for the safe storage of all material furnished to or by the CONTRACTOR until incorporated in the completed project and accepted by the OWNER.

G. Load and unload pipe, fittings, valves, hydrants, and accessories by lifting with hoists or skidding to avoid shock or damage. Do not drop these materials. Pipe handled on skidways shall not be skidded or rolled against another pipe. Handle this material in accordance with AWWA C600, C605 or C906 whichever is applicable.

H. Drain and store fittings and valves prior to installation in such a manner as to protect them from damage due to freezing of trapped water. Drain, store, and protect fittings and valves in accordance with Specification Section 01600.

2.2 PETROLATUM TAPE COATING

A. The tape coating shall be in accordance with AWWA Standard C217. The tape coating shall be a cold applied, saturant tape made from either petrolatum or petroleum wax with a noncellulosic synthetic fiber fabric. The fabric shall be encapsulated and coated on both sides with the petrolatum or petroleum wax. The thickness of the tape shall be no less than 40 mil. The petrolatum or petroleum wax shall be at least 50% of the product by weight. Follow manufacturer’s recommendations for storage and application.

B. The tape coating shall be supplied in sheets, pads or rolls. Pads and sheets shall be sized to fit the area that is to be covered, allowing for an overlap per AWWA Standard C217.

C. Acceptable manufacturers are listed in the most current version of the Supplementary Technical Specifications.

2.3 RUBBERIZED-BITUMEN BASED SPRAY-ON UNDERCOATING

Subject to approval by the OWNER, an alternative corrosion protection for exposed buried metal is an aerosol applied rubberized coating. The material shall be rapid dry and specifically designed for corrosion protection. Follow manufacturer's recommendations for storage and application.

Acceptable manufacturers are listed in the most current version of the Supplementary Technical Specifications.

PART 3 EXECUTION

3.1 INSTALLATION – GENERAL REQUIREMENTS

A. Lay and maintain all pipe to the required lines and depths. Install fittings, valves and hydrants in strict accordance with the Specifications at the required locations with joints centered, spigots home, and all valve and hydrant stems plumb. Do not deviate from the required alignment, depth, or grade without the written consent of the OWNER.

B. Buried steel lugs, rods, brackets, and flanged joint nuts and bolts are not permitted unless specifically shown on the Drawings or approved in writing by the OWNER. Cover all buried steel lugs, rods, brackets, and flanged joint nuts and bolts with approved coating in accordance with AWWA Standard C217 prior to backfilling. Encase the same in polyethylene encasement if the specifications require polyethylene encasement of the pipe.

C. Do not lay pipe in a wet trench, on subgrade containing frost, or when trench conditions are unsuitable for such work. If all efforts fail to obtain a stable dry trench bottom and the OWNER determines that the trench bottom is unsuitable for such work, the OWNER will order the kind of stabilization to be constructed, in writing. In all cases, water levels must be at least 6 inches below the bottom of the pipe. See Specification Section 02000, Site Preparation.

D. Thoroughly clean the pipes and fittings before they are installed. Keep these materials clean until the acceptance of the completed Work. Lay pipe with the bell ends facing in the direction of laying, unless otherwise shown on the Drawings, or directed by the OWNER. Exercise care to ensure that each length abuts the next in such a manner that no shoulder or unevenness of any kind occurs in the pipe line.

E. Do not wedge or block the pipe during laying unless by written order of the OWNER.

F. Before joints are made, bed each section of pipe the full length of the barrel, at the required grade, and at the invert matching the previously laid pipe. Dig bell holes

sufficiently large to permit proper joint making. Do not bring succeeding pipe into position until the preceding length is embedded and secure in place.

G. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying. Take up, such in-place pipe sections found to be defective and replace them with new pipe. Take up, relaying, and replacement will be at the CONTRACTOR's expense.

H. Place enough backfill over the center sections of the pipe to prevent floating. Take all other necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench, or the collapse of the pipeline from any cause. Place enough backfill over the center sections of the pipe to prevent floating. Should floating or collapse occur, restoration will be at the CONTRACTOR's expense.

I. Bedding materials and concrete work for the pipe bedding and thrust restraint shall be as specified in Divisions 2, 3, and 15 as well as Standard Details.

J. Prevent foreign material from entering the pipe while it is being placed. Do not place debris, tools, clothing, or other materials in the pipe during laying operations. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's work, or for other reasons such as rest breaks or meal periods.

K. Cut pipe in accordance with the latest edition of the American Water “Cut-off and Ring Saw Safety Operations Practice.” Grind cut ends and rough edges smooth. Bevel the cut end slightly for push-on connections in accordance with manufacturer’s recommendations.

L. In distributing material at the site of the Work, unload each piece opposite or near the place where it is to be laid in the trench. If the pipe is to be strung out, do so in a straight line or in a line conforming to the curvature of the street. Block each length of pipe adequately to prevent movement. Block stockpiled pipe adequately to prevent movement. Do not place pipe, material, or any other object on private property, obstructing walkways or driveways, or in any manner that interferes with the normal flow of traffic.

M. Exercise special care to avoid damage to the bells, spigots or flanged ends of pipe during handling, temporary storage, and construction. Replace damaged pipe that cannot be repaired to the OWNER's satisfaction, at the CONTRACTOR's expense.

N. Remove all existing pipe, fittings, valves, pipe supports, blocking, and all other items necessary to provide space for making connections to existing pipe and installing all piping required under this Contract.

O. Maintain the minimum required distance between the water line and other utility lines in strict accordance with all Federal, State, and Local requirements and all right-of-way limitations.

P. Provide and install polyethylene encasement for ductile iron pipe in accordance with Specification Section 15130 and Standard Details.

Q. Joint deflection is only allowed on ductile iron pipe. The maximum allowable deflection at the joints for push-on joint pipe shall be the lesser of manufacturer's recommendations or as described in the DIPRA Guideline, Ductile Iron Pipe Joints and Their Uses, as follows:

Size of Pipe (inches)	Deflection Angle	Maximum Deflection (inches)	
		18-ft Length of Pipe	20-ft Length of Pipe
3 – 12	5°	19	21
14 – 42	3°	11	12
48 – 64	3°	N/A	12

R. Use short lengths of pipe (minimum length 3 feet, no more than three short sections), when approved by the OWNER, to make curves that cannot be made with full length sections of pipe without exceeding the allowable deflection. Making these curves will be at no additional cost to the OWNER.

S. Furnish air relief valve assemblies in accordance with Standard Details and at locations shown on the Drawings. Any deviation from the standard detail proposed by the CONTRACTOR must be approved in advance.

T. Exercise particular care so that no high points are established where air can accumulate. If the CONTRACTOR requests a change in the pipe profile solely for ease of construction, and the requested change requires the installation of an air release valve and manhole as determined by the OWNER, the cost of furnishing and installing the air release valve and manhole will be at the expense of the CONTRACTOR.

U. Connection to existing pipelines may require shutdown of OWNER facilities. Closely coordinate construction work and connections with the OWNER through the OWNER. The OWNER, in consultation with the OWNER, may select the time for connection to existing pipelines, including Saturdays, Sundays, or holidays, which, in the opinion of the OWNER, will cause the least inconvenience to the OWNER and/or its customers. Make such connections at such times as may be directed by the OWNER. If not identified in the Bidding documents, this will be considered extra Work to the Contract.

3.2 CONSTRUCTION METHODS TO AVOID CONTAMINATION

A. Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is essential that the procedures of this Specification Section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination.

B. Take precautions to protect the interior of pipes, fittings, and valves against contamination. String pipe delivered for construction to keep foreign material out of the pipe. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Use rodent-proof plugs approved by OWNER, where it is determined

that watertight plugs are not practical and where thorough cleaning will be performed.

C. Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the lower the likelihood of contamination. Complete the joints of all pipe in the trench before stopping work. If water accumulates in the trench, keep the plugs in place until the trench is dry.

D. Do not use contaminated material or any material capable of supporting prolific growth of microorganisms for sealing joints. Handle sealing material or gaskets in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. Deliver the lubricant to the job in closed containers and keep it clean.

E. If dirt enters the pipe, and in the opinion of the OWNER the dirt will not be removed by the flushing operation, clean the interior of the pipe by mechanical means, then swab with a 1% hypochlorite disinfecting solution. Clean using a pig, swab, or "go-devil" only when the OWNER has specified such and has determined that such operation will not force mud or debris into pipe joint spaces. Clean the pipeline in accordance with Specification Section 15025.

F. If the main is flooded during construction, the flooded section must be isolated from the remainder of the installation as soon as practical. Submit a plan to the OWNER on correcting the condition and do not proceed until authorized by the OWNER. Replace or fully clean and disinfect the affected pipe at no additional cost to the OWNER.

3.3 VALVE INSTALLATION

A. Prior to installation, inspect valves for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting, cleanliness of valve ports, cleanliness of seating surfaces, handling damage, and cracks. Correct defective valves or hold for inspection by the OWNER.

B. Set valves and join to the pipe in the manner specified in Specification Section 3.01. Provide valves with adequate support, such as crushed stone and concrete pads, so that the pipe will not be required to support the weight of the valve. Set truly vertical. After field installation of the valve all exposed ferrous restraint materials and external bolts except the operating nut shall receive a layer of petrolatum tape coating or, where approved, rubberized-bitumen based spray-on undercoating applied before backfill. If polyethylene is applied to the pipe, the entire valve shall be encased in polyethylene encasement prior to backfill. The polyethylene encasement shall be installed up to the operating nut leaving the operating nut exposed and free to be operated.

C. Provide a valve box for each valve. Set the top of the valve box neatly to existing grade, unless directed otherwise by the OWNER. Do not install in a way that allows the transfer shock or stress to the valve. Center and plumb the box over the wrench nut of the valve. Do not use valves to bring misaligned pipe into alignment during

installation. Support pipe in such manner as to prevent stress on the valve. See Standard Details for a typical valve box installation detail.

D. Provide valve marking posts, when required by the OWNER, at locations designated by the OWNER.

3.4 THRUST RESTRAINT

A. Provide all plugs, caps, tees, and bends (both horizontal and vertical) with concrete thrust blocking and/or restrained joint pipe as represented on the Drawings and Standard Details.

B. Place concrete thrust blocking between undisturbed solid ground and the fitting to be anchored. Install the concrete thrust blocking in accordance with Specification Section 03300 and Standard Details. Locate the thrust blocking to contain the resultant thrust force while keeping the pipe and fitting joints accessible for repair, unless otherwise shown or directed.

C. Provide temporary thrust restraint at temporary caps and plugs. Submit details of temporary restraint to the OWNER for approval.

D. At connections with existing water mains where there is a limit on the time the water main may be removed from service, use metal harnesses of anchor clamps, tie rods and straps; mechanical joints utilizing set-screw retainer glands; or restrained push-on joints as permitted by OWNER. No restraining system can be installed without the approval of the OWNER. Submit details of the proposed installation to the OWNER for approval. For pipe up to 12 inches in size, use a minimum of two 3/4-inch tie rods. If approved for use, install retainer glands in accordance with the manufacturer's instructions. Material for metal harnessing and tie-rods shall be ASTM A36 or A307, as a minimum requirement.

E. Protection of Metal Harnessing: Protect ties rods, clamps and other metal components against corrosion by hand application of petrolatum tape and by encasement of the entire assembly with 8-mil thick (12 mil thick in corrosive soils) loose polyethylene film in accordance with AWWA C105. Apply tape on all exposed tie rods prior to installing polyethylene.

3.5 BASIS OF PAYMENT

The items described in this Specification Section are considered incidental to the installation of the water main.

–END OF SECTION 15000–

SECTION 15020

DISINFECTING PIPELINES

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing necessary labor, tools, transportation, and other equipment for flushing and disinfecting all pipelines installed under this Contract. Install, and if directed remove, all chlorination taps required for disinfection. The disinfection will be performed under the supervision of OWNER.

1.2 RELATED WORK

A. Specification Section 1000 – Summary of Work

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 15025 – Cleaning Pipelines

1.3 REFERENCES

Refer to current standards:

A. AWWA C651 – Disinfecting Water Mains

B. AWWA B300 and B301

C. AWWA Manual M12

D. *Standard Methods for the Examination of Water and Wastewater*

1.4 SUBMITTALS

A. Submit a plan of disposal of flushed water.

B. Submit in accordance with Section 01300.

1.5 PROTECTION

A. Chlorine disinfection and dechlorination shall be performed under the direct supervision of someone familiar with the physiological, chemical, and physical properties of the form of chlorine used. They shall be trained and equipped to handle any emergency that may arise. All personnel involved shall observe appropriate safety practices to protect working personnel and the public.

B. The forwards of AWWA Standards B300 and B301 contain information and additional reference material regarding the safe handling of hypochlorites and liquid chlorine. The CONTRACTOR's supervision shall be familiar with this information prior to performing any disinfection work.

C. See Specification Section 15025-1.5 for Protection During Flushing and Cleaning.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Furnish liquid chlorine and injection equipment and/or calcium hypochlorite (HTH) as needed to disinfect all pipelines and appurtenances.

B. Liquid chlorine contains 100% available chlorine and is packaged in steel containers, usually of 100 pound, 150 pound, or 1 ton net chlorine weight. Liquid chlorine is to be furnished in accordance with AWWA B301.

C. Calcium hypochlorite is available in granular form or in approximately 5-g tablets and contains approximately 65% available chlorine by weight. The material should be stored in a cool, dry, and dark environment to minimize its deterioration. Do not use calcium hypochlorite intend for swimming pool disinfection, as this material (containing trichloroisocyanuric acid) has been sequestered and is extremely difficult to eliminate from the pipe after the desired contact time had been achieved.

D. Calcium hypochlorite must conform to AWWA B300.

E. Field testing for chlorine and other parameters, must be performed with equipment approved and calibrated for the range and resolution applicable. For example, pen chlorimeters typically do not accurately measure the concentration of chlorine in the high strength solution. High Strength Testing Strips are preferred. Any field testing equipment must be approved by OWNER's local Water Quality personnel.

PART 3 EXECUTION

3.1 PREPARATION

All pipelines shall be pressure and leak tested, flushed, and cleaned of debris and dirt prior to application of the disinfectant. Flushing shall continue until the volume in the newly installed main has turned over at least one time unless the OWNER or ENGINEER determines that conditions do not permit the required volume to be safely discharged to waste.

3.2 APPLICATION OF DISINFECTANT

Methods to be used for disinfection are those detailed in ANSI/AWWA C651 Disinfecting Water Mains.

3.3 WATER MAINS

Two (2) methods of chlorination are described below. Information in the forward of AWWA Standard C651 will be helpful in determining the best method to be used. The tablet method cited in the AWWA standard is not approved for use. The CONTRACTOR shall coordinate with the OWNER on the preferred method.

A. Continuous Feed Method

1. Set up. The continuous feed method consists of completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and then refilling the main with chlorinated potable water. The potable water shall be chlorinated, so that after a 24-hour holding period in the main, there will be a free chlorine residual of not less than 10 mg/L in collected samples.

   Chlorine can be applied in advance of preliminary flushing by swabbing joints with bleach or placing hypochlorite granules in the pipe in areas where contamination is suspected. In any such case, the CONTRACTOR shall make sure and take appropriate action to make sure that the flushed water is dechlorinated.

2. Preliminary flushing. Prior to being chlorinated, fill the main to eliminate air pockets and flush to remove particulates. The flushing velocity in the main shall be not less than 3 fps unless the ENGINEER determines that conditions do not permit the required flow to be discharged to waste. **Table 1** shows the rates of flow required to produce a velocity of 3 fps in pipes of various sizes. In mains of 24-inches or larger diameter, an acceptable alternative to flushing is to broom-sweep the main, carefully removing all sweepings prior to chlorinating the main. WARNING: OSHA requirements for confined space need to be addressed before entering a pipeline.

   NOTE: Flushing is no substitute for preventive measures during construction. Certain contaminants such as caked deposits resist flushing at any feasible velocity.

Table 1
Required Flow and Openings to Flush Pipelines at 3 fps
(40 psi Residual Pressure in Water Main)*

Pipe Diameter (in.)	Flow Required to Produce 3 fps Velocity in Main (gpm)	Size of Tap Used (in.) Number of Taps Required on Pipe** 1	1-1/2	2	Number of 2-1/2 in. Hydrant Outlets to Use
4	120	1			1
6	260		1		1
8	470		2		1
10	730		3	2	1
12	1060			3	2
16	1880			5	2

*With a 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2½-inch hydrant outlet will discharge approximately 1,000 gpm and a 4½-inch hydrant outlet will discharge approximately 2,500 gpm.

**Number of taps on pipe based on discharging through 5 feet of galvanized iron pipe with one 90-degree elbow.

3. Chlorinating the Main.

   a. Potable water may be supplied from a temporary backflow-protected connection to the existing distribution system or other approved source. The flow shall be at a constant, measured rate into the newly installed water main. In the absence of a meter, approximate the rate by placing a pitot gauge in the discharge or measuring the time to fill a container of known volume.

   b. At a point not more than 10 feet downstream from the beginning of the new main, dose the water entering the new main with chlorine fed at a constant rate such that the water will have not less than 25 mg/L free chlorine. Measure the chlorine concentration at regular intervals to ensure that this concentration is provided. Measure chlorine in accordance with the procedures described in the current edition of the AWWA Manual M12 or of *Standard Methods for the Examination of Water and Wastewater.*

   c. **Table 2** gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of 1 percent chlorine may be prepared with calcium hypochlorite. The solution requires 1 pound of calcium hypochlorite in 8 gallons of water.

Table 2
Chlorine Required to Produce 25 mg/L
Concentration in 100 feet of Pipe by Diameter

Pipe Diameter (in.)	100% Chlorine (lb.)	1% Chlorine (gal.)
4	0.013	0.16
6	0.030	0.36
8	0.054	0.65
10	0.085	1.02
12	0.120	1.44
16	0.217	2.6

   d. During the application of chlorine, position valves so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Do not stop the chlorine application until the entire main is filled with heavily chlorinated water. Keep the chlorinated water in the main for at least 24 hours. During this time, operate all valves and hydrants in the section treated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.

e. Hypochlorite solution may be applied to the water main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to safely withstand the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. Check all connections for tightness before the solution is applied to the main. The main should undergo hydrostatic testing prior to disinfection.

f. If gaseous chlorine in solution is permitted by the OWNER or ENGINEER and proposed by the CONTRACTOR, the preferred equipment for the gas application employs a feed vacuum-operated chlorinator to mix the chlorine gas, in combination with a booster pump for injecting the chlorine gas solution water into the main to be disinfected. Direct feed chlorinators cannot be used. (A direct feed chlorinator is one which operates solely from the pressure in the chlorine cylinder.)

B. Slug Method

1. Set up. The slug method consists of placing calcium hypochlorite granules in the main during construction; completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing a slug of water containing 100 mg/L of free chlorine through the main so that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hours.

2. Preliminary flushing. Same as 3.3.A.2 in this Specification Section

3. Chlorinating the Main.

a. Potable water may be supplied from a temporary backflow-protected connection to the existing distribution system or other approved source. The flow shall be at a constant, measured rate into the newly installed water main. In the absence of a meter, approximate the rate by placing a pitot gauge in the discharge or measuring the time to fill a container of known volume. The main should undergo hydrostatic testing prior to disinfection.

b. At a point not more than 10 feet downstream from the beginning of the new main, dose the water entering the new main with chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. Measure the chlorine concentration at regular intervals to ensure that this concentration is provided. Measure chlorine in accordance with the procedures described in the current edition of the AWWA Manual M12 or of *Standard Methods for the Examination of Water and Wastewater*. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hours.

c. The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L, stop the flow, relocate the chlorination equipment to the head of the slug, and as flow is resumed, apply chlorine to restore the free chlorine in the slug to not less than 100 mg/L.
d. As the chlorinated water flows past fittings and valves, operate related valves and hydrants to disinfect appurtenances and pipe branches.

C. Alternative Methods

1. Alternative methods for disinfection may be considered with the approval of the ENGINEER and OWNER's Water Quality personnel.

3.4 FINAL FLUSHING AND DISPOSAL OF HEAVILY CHLORINATED WATER

A. Do not keep heavily chlorinated water in contact with pipe for more than 48 hours after the applicable retention period. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, flush the heavily chlorinated water from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use. Take all steps necessary to dechlorinate water where required per section 3.04B and 3.04C below. Contact the local sewer department to arrange for disposal of the heavily chlorinated water to the sanitary sewer if applicable.

B. Neutralize the chlorine residual of the water being disposed of by treating with one of the chemicals listed in **Table 3**. Select an alternative disposal site if a sanitary sewer system is unavailable for disposal of the chlorinated water.

C. The proposed alternative disposal site shall be inspected and approved of by the OWNER or ENGINEER. Apply a reducing agent to the chlorinated water to be wasted to completely neutralize the chlorine residual remaining in the water. (See **Table 3** for neutralizing chemicals. Do not overdose neutralizing chemicals as this may result in adverse environmental impacts. Only dose the amount required to neutralize the amount of chlorine present). Contact Federal, State and Local regulatory agencies, where necessary, to determine special provisions for the disposal of heavily chlorinated water.

Table 3
Pounds of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water.

Residual Chlorine Concentration (mg/L)	Sulfur Dioxide (SO_2)	Sodium Bisulfite ($NaHSO_3$)	Sodium Sulfite (Na_2SO_3)	Sodium Thiosulfate ($Na_2S_2O_3 \cdot 5H_2O$)	Ascorbic Acid ($C_6O_8H_6$)
1	0.8	1.2	1.4	1.2	2.1
2	1.7	2.5	2.9	2.4	4.2
10	8.3	12.5	14.6	12.0	20.9
50	41.7	62.6	73.0	60.0	104.0

D. Test for chlorine residual throughout the disposal process to be sure that the chlorine is neutralized.

E. Submit a plan of disposal of flushed water to the OWNER or ENGINEER for approval.

3.5 BACTERIOLOGICAL TESTING

A. After final flushing and before the water main is placed in service, samples must be collected and tested.

B. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch greater than one pipe length.

C. Samples shall be collected by the OWNER, or other qualified person approved by the ENGINEER. Coordinate with OWNER and submit samples to the OWNER for testing of bacteriological (chemical and physical) quality. Testing will be in accordance with *Standard Methods of the Examination of Water and Wastewater*. Samples shall show the absence of coliform organisms; and the presence of a chlorine residual. Samples shall also be tested for turbidity, pH, and standard heterotrophic plate count (HPC). HPC levels must be consistent with levels normally found in the distribution system to which the new main is connected.

D. Bacteriological tests must show complete absence of coliforms and acceptable HPCs. If tests show the presence of coliform or unacceptable HPCs, perform additional flushing and disinfection of the pipeline until acceptable tests are obtained, all at no cost to the OWNER. The CONTRACTOR will not be charged for the additional testing performed by the OWNER.

3.6 RETESTING AND TESTING SOURCE WATER

A. At the time of initial flushing the main to remove material and test for air pockets, CONTRACTOR may request the OWNER to continue flushing until the desired chlorine residual is met at the discharge point. Notification must be provided in advance and the CONTRACTOR shall be prepared to test for chlorine at intervals of no more than five minutes as the water clears. This will provide the CONTRACTOR with some assurance that the source water is chlorinated.

B. If the subsequent tests for bacteriological contamination conducted by the CONTRACTOR fail, the CONTRACTOR may request the OWNER to continue flush from the source water into the new pipe system until a chlorine residual is found at the discharge point. Notification must be provided in advance and the CONTRACTOR shall be prepared to test for chlorine at intervals of no more than five minutes as the water clears. The operation of all existing system valves shall be by the OWNER at the CONTRACTOR expense and the discharge point must be opened prior to opening existing valves to avoid contamination. This will provide the CONTRACTOR with some assurance that the source water is chlorinated for subsequent tests.

3.7 BASIS OF PAYMENT

The items described in this Specification Section are considered incidental to the installation of the water main.

–END OF SECTION 15020–

SECTION 15025

CLEANING PIPELINES

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing necessary labor, material, tools, transportation, and other equipment for cleaning the required pipeline when it is determined that normal flushing will not sufficiently remove dirt and debris introduced during construction. The cleaning shall use foam pigs, swabs or "go-devils" as described herein.

1.2 GENERAL

After the installation of water mains normal flushing often proves inadequate to remove all the entrapped air, loose debris and other objects that may have been left in the main during installation. Therefore, after the installation of water mains it may be necessary to use polyurethane foam pigs and/or polyurethane hard foam swabs to remove all foreign matter from the pipeline (i.e. "pig" the pipeline).

Cleaning per the requirements of this section shall be performed prior to testing and disinfection of the main.

1.3 RELATED WORK

A. Specification Section 15000-3.2-Construction Methods to Avoid Contamination.

B. Specification Section 15020-3.1-Preparation (prior to disinfecting pipelines).

1.4 SUBMITTALS

A. Submit a cleaning plan.

B. Submit in accordance with Section 01300.

1.5 PROTECTION DURING FLUSHING AND CLEANING

A. Coordinate with ENGINEER and OWNER before flushing to ensure that an adequate amount of flushing water is available, at sufficiently high pressure. Determine if the water can be disposed of safely. Notify the OWNER, ENGINEER, and the following prior to flushing or cleaning:

1. Fire Department

2. Other utilities, such as gas, electric and telephone companies, who may have underground facilities in the area.

3. Customers who may be inconvenienced by reduced pressure or dirty water.

B. Operation of Water System – The operation of main valves and fire hydrants on the water system in service often results in disturbance of the natural sediments and mineral deposits in mains, causing problems for Illinois-American's customers. Illinois-American has a responsibility to provide its customers the highest level of service possible. Therefore Illinois-American has adopted a strict policy that no one, other than an employee of Illinois-American, unless expressly authorized, is to operate any valve, fire hydrant, or other appurtenance of water system that is in service or which will affect the system that is in service. This operation is to be performed by an employee of Illinois-American or under Illinois-American direct supervision.

C. Coordinate with the OWNER to isolate the section to be flushed from the operating distribution system. Provide a minimum notice of two (2) working days to schedule Illinois American staff to report to site.

D. Protect the work staff and the public during flushing and cleaning operation. Keep children away from the flow of flushing water. Where practical employ energy dissipators to help avoid damage to property and the flooding of streets. See General Conditions Article 6.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

As the cleaning described in this section pertains to new water mains, the use of pipe cleaning plugs which utilize bristles, wire brushes, carbide abrasives, steel studs or any other type of abrasive is not permitted unless specifically approved by the ENGINEER. Consult a manufacturer of pipe cleaning plugs, such as Knapp Polly Pig (Houston, Texas), to determine the type and size of cleaning plug best suited for the application. Two types of plugs shall be considered and are described as follows:

A. Swabs used for cleaning mains shall be made of polyurethane foam. This foam has a density of 1 to 2 pounds per cubic foot. Swabs shall be purchased from commercial manufacturers of swabs for pipes. Both soft and hard grade foam swabs are available. New mains are typically cleaned with hard foam swabs.
Use swabs cut into cubes and cylinders slightly larger than the size of the pipe to be cleaned. Cubes one inch larger in dimension than the nominal diameter of the pipe being cleaned have worked well for cleaning pipes up to 12-inches in diameter.
For mains greater than 12-inches in diameter, the swab diameter must be considered individually for each operation. For new mains, swabs three inches larger than the pipe diameter have worked well. Swabs for the larger mains are usually 1-1/2 times the diameter in length.

B. Pigs, if used, shall be commercially manufactured for the specific purpose of cleaning pipes. They shall be made of polyurethane foam weighing 2 to 15 pounds per cubic foot. Pigs are bullet shaped and come in various grades of flexibility and roughness. Pigs are typically 1/4 -inch to 1/2-inch larger in diameter than the pipe to be cleaned.

PART 3 EXECUTION

3.1 PLUG INSTALLATION AND REMOVAL

A. Satisfactorily expose cleaning wyes, or other entry or exit points. Remove cleaning wye covers, etc., as required by the ENGINEER to insert the plugs into the mains.

B. If approved by the ENGINEER, stripped fire hydrants, air valves and blow-offs may serve as entry and exit points for smaller sized mains. The ENGINEER will examine these appurtenances and the connecting laterals to ensure that adequate openings exist through which a plug may be launched. If these appurtenances are used, a special launcher to ease the insertion and launching of the plug is required. If available a pressurized water source such as a fire hydrant can be used to launch the plug. If water from the system is not available nearby, use a water truck with pump.

C. If hydrants are used as entry and exit points, remove the internal mechanisms and plug the drains. Insert the plug and replace the cap with a special flange with a 2-1/2-inch fitting. Connect the 2-1/2-inch fitting with a pressure gauge and valve to a pressurized water source. After the last valve isolating the section to be cleaned is closed, open the hydrant supply valve. Propel the swab or pig into the main by opening the exit valve.

D. In mains greater than 8-inches, wyes shall be used at the entry and exit points. Fabricate the wye section one size larger than the main to ease the insertion and extraction of the plug. The use of wyes, as with the previously mentioned appurtenances, requires an outside source of pressurized water for launching. Cap the wye with a flange with a 2 to 6 inch fitting for connecting with the pressurized water source.

E. Many pigs, since they are less flexible than swabs, are harder to insert into a pipe. Other methods acceptable to insert pigs include:

1. winching with a double sling,

2. winching with a rope attached to the pig,

3. compression with a banding machine prior to insertion, and

4. the use of a specially designed tapered steel pipe which is removed after use.

F. During swab or pig installation, leave as much water as possible in the main to be cleaned. The water suspends the material being removed from the pipe and minimizes the chance of the material forming a solid plug. Water in the pipe also keeps the swab or pig from traveling through the pipe at excessive rates. If swabs or pigs travel too fast they will remove less material. The swab or pig will also wear more rapidly in such a case.

G. At the exit point or blow-off, install a wye long enough to house the swab or pig. Attach temporary piping to the end cap to allow the drainage of the water.

H. Take precautions to prevent backflow of purged water into the main when the cleaning plug exits through a dead end main. This can be accomplished by installing mechanical joint bends and pipe joints to provide a riser out of the trench. Additional excavation of the trench may serve the same purpose.

3.2 PRE-CLEANING PROCEDURES

A. Prepare a written cleaning plan for the ENGINEER's review.

B. Suggested pre-cleaning procedures include the following:

1. Identify mains to be cleaned on a map. Mark the location of the entry, water supply and exit points, any blow-offs to be used, valves to be closed, and the path of the swab or pig.

2. Under the ENGINEER's supervision and with OWNER staff as required, inspect and operate all valves and hydrants to be used in the cleaning operation. Ensure that all operate correctly and that a tight shutdown is possible.

3. Check location and type of hydrants, launch and exit location, and blow-offs to be used. Make blow-off tap connections if necessary.

4. The OWNER will notify customers served by the main to be cleaned that their water will be off for a specified period on the day of the cleaning.

5. The OWNER will identify customers who may require temporary services during the main cleaning operation. The CONTRACTOR shall provide the temporary connections.

6. Determine the number and size of plugs to be used.

3.3 CLEANING PROCEDURE

Clean the pipeline using the following procedures and the CONTRACTOR’s cleaning plan, as approved by the ENGINEER.

A. Swab Cleaning Procedures

1. Open the water supply upstream of the swab. Throttle the flow in the main at the discharge (plug exit) point so that the swab passes through the main at a speed of 2 to 4 fps. At this velocity, swabs will effectively clean pipes for distances of up to 4000 feet before disintegrating to a size smaller than the main. Use pitot gauges at the exist hydrant or blow-off to estimate the flowrate in the main.

2. Note the time of entry of the swab into the main and estimate its time or arrival at the exit point. If the swab does not reach the exit point in the estimated time plus ten minutes, then a blockage has probably occurred. Reverse the flow in the main and note the time required for the swab to reach the original entry point. From the return travel time, approximate the location of the blockage. The

ENGINEER may require a swab to which a transmitter has been attached to be used to accurately locate a blockage.

3. Swab repeatedly as needed. Stop swabbing when the water behind the swabs emerging at the exit clears up within one minute. Account for all swabs inserted into the main.

4. After the last swab has been recovered, flush the main to remove swab particles. This may require up to an hour or flushing.

B. Pig Cleaning Procedures

1. Remove all air valves along the line. This will provide pressure relief should the pig suddenly stop and assure that no air is trapped in the main.

2. If the pig is inserted directly into the main, set it in motion by opening the upstream gate valve and a downstream fire hydrant or blow-off valve (usually the valve on the capped end at the exit point). If the pig is launched from a wye, fire hydrant, or other appurtenance, use an external pressurized water source to inject the pig into the main as described in Section 3.01.

3. Once the pig is in motion in the main, control its speed by throttling the discharge at a downstream fire hydrant or blow-off. Operate pigs typically at 1 fps. This slow speed will help prevent pressure surges when the pig passes through undersized valves, enters smaller pipes, or turns through tees or crosses. Speeds of up to 2 fps can be used on straight runs with no restrictions or sharp turns.

4. Make sufficient passes of the pig to obtain thorough cleaning. Two pigs may be used in tandem to save time and water. Sufficient cleaning is established when the water discharging after the pig becomes clear within one minute.

3.4 POST CLEANING PROCEDURE

After successful completion of cleaning the main shall be tested, flushed and disinfected in accordance with applicable sections of these Specifications.

3.5 BASIS OF PAYMENT

The items described in this Specification Section are considered incidental to the installation of the water main.

–END OF SECTION 15025–

SECTION 15030

PRESSURE AND LEAKAGE TESTS

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing necessary labor, tools, material, and equipment for testing all pipelines installed under this Contract. Testing shall be performed concurrent with installation.

1.2 RELATED WORK

A. Specification Section 15000 – Piping – General Provisions

1.3 REFERENCES

Refer to current standards:

A. AWWA C600

1.4 SUBMITTALS

A. Submit schedules and procedures to the OWNER for testing of all parts of the water main installed.

B. Submit the schedule at least seven days prior to any testing.

C. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 EQUIPMENT

Furnish the pump, pipe connections, and all necessary apparatus for the pressure and leakage tests including gauges and metering devices. The OWNER reserves the option to furnish the gauges and metering devices for the tests. Excavate, backfill, and furnish all necessary assistance for conducting the tests.

PART 3 EXECUTION

3.1 GENERAL

A. Perform hydrostatic pressure and leak tests in accordance with AWWA C600, Section 4 - Hydrostatic Testing after the pipe or section of pipe has been laid, thrust blocking cured (min. 5 days), and the trench is completely or partially backfilled. Where practical, testing shall be performed fully isolated from the active distribution system.

B. The CONTRACTOR may completely backfill the trench or partially backfill the trench over the center portion of each pipe section to be tested. However, the OWNER may direct the CONTRACTOR to completely backfill the trench if local traffic or safety conditions require.

C. For system operating pressures of 200 psi or less, perform the hydrostatic test at a pressure of no less than 100 psi above the normal operating pressure without exceeding the rating of the pipe and appurtenances, or a minimum of 150 psi. For system operating pressures in excess of 200 psi, perform the hydrostatic test at a pressure that is 1.5 times the normal operating pressure, but no more than the design rating of the pipe and appurtenances.

D. Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. A test pressure greater than the rated valve working pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests exceeding the rated valve working pressure, the test setup should include a provision, independent of the valve, to reduce the line pressure to the rated valve working pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or the valve can be fully opened if desired.

E. The test pressure shall not exceed the rated working pressure or differential pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

F. Attach a tapping sleeve and valve assembly to the main. Pressure test the assembly prior to making the tap. The required test pressure shall be determined in the same manner as for pipe. The test is acceptable if there is no pressure drop in 15 minutes at test pressure.

3.2 FILLING AND TESTING

A. Slowly fill each segregated section of pipeline with water ensuring that all air is expelled. Extreme care must be taken to ensure that all air is expelled during the filling of pipe. The line shall stand full of water for at least twenty-four hours prior to testing to allow all air to escape. If necessary, tap the main at points of highest elevation to expel air as the pipe is filled. Remove the corporation stops and plug the taps after successfully filling the pipeline and expelling all air as approved by the OWNER.

B. Apply the specified test pressure, measured at the point of lowest elevation, using a pump connected to the pipe in a manner satisfactory to the OWNER. If the elevation of the high point of the pipeline being tested is such that the pressure during testing will be below 85% of the required test pressure, the OWNER will require a separate test to be performed on this section of pipeline. In lieu of a separate test, the test pressure measured at the lowest elevation may be increased, within the pressure rating of the pipeline material, such that the resulting pressure at the highest point exceeds 85% of the required test pressure. The test will be conducted for at least two hours at the required test pressure ± 5 psi.

C. Conduct a leakage test concurrently with the pressure test. Leakage is defined as the volume of the water that must be supplied into the newly laid pipeline to maintain pressure within 5 psi of the test pressure after it is filled and purged of air. Measure the volume of water using a calibrated container or meter.

D. No pipeline installation will be accepted by the OWNER if the leakage is greater than that shown in the following table:

Allowable Leakage per 1000 ft. of Pipeline*---gph

Avg. Test Pressure	Nominal Pipe Diameter—*in.*													
psi	4	6	8	10	12	14	16	18	20	24	30	36	42	48
450	0.57	0.86	1.15	1.43	1.72	2.01	2.29	2.58	2.87	3.44	4.30	5.16	6.02	6.88
400	0.54	0.81	1.08	1.35	1.62	1.89	2.16	2.43	2.70	3.24	4.05	4.86	5.68	6.49
350	0.51	0.76	1.01	1.26	1.52	1.77	2.02	2.28	2.53	3.03	3.79	4.55	5.31	6.07
300	0.47	0.70	0.94	1.17	1.40	1.64	1.87	2.11	2.34	2.81	3.51	4.21	4.92	5.62
275	0.45	0.67	0.90	1.12	1.34	1.57	1.79	2.02	2.24	2.69	3.36	4.03	4.71	5.38
250	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85	4.49	5.13
225	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65	4.26	4.86
200	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44	4.01	4.59
175	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22	3.75	4.29
150	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98	3.48	3.97
125	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72	3.17	3.63
100	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43	2.84	3.24

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size. The table has been generated from the formula:
$L = \frac{S*D*P^{1/2}}{}$ where L is the allowable leakage in gallons per hour, S is the length of 148,000 pipe in feet, D is the nominal pipe diameter in inches, and P is the test pressure in psig.

E. Should any test disclose damaged or defective materials or leakage greater than that permitted, the CONTRACTOR shall, at CONTRACTOR's expense, locate and repair and/or replace the damaged or defective materials. Materials used for repair must be approved by the OWNER and meet the Specifications. Repeat the tests until the leakage is within the permitted allowance and is satisfactory to the OWNER.

3.3 BASIS OF PAYMENT

The items described in this Specification Section are considered incidental to the installation of the water main.

–END OF SECTION 15030–

SECTION 15105

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing ductile iron pipe and fittings as shown on the Drawings and Standard Details. The OWNER reserves the right to provide ductile iron pipe. A list of additional materials to be provided by the OWNER, if applicable, is shown in Specification Section 01000.

1.2 RELATED WORK

A. Specification Section 01000 – Summary of Work

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 02210 – Trenching, Backfilling, and Compacting

D. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

Refer to current Standards:

A. AWWA C104 – American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

B. AWWA C105 – American National Standard for Polyethylene Encasement for Ductile- Iron Pipe Systems

C. AWWA C110 – American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids

D. AWWA C111 – American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

E. AWWA C115 – American National Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

F. AWWA C116 – American National Standard for Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service

G. AWWA C150 – American National Standard for the Thickness Design of Ductile-Iron Pipe

H. AWWA C151 – American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water

I. AWWA C153 – American National Standard for Ductile-Iron Compact Fittings, 3-inch through 24-inch and 54-inch through 64-inch, for Water Service

J. AWWA C600 -- AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances

K. ISO 8179-1 – Ductile Iron Pipes-External Zinc-based coating-Part1: Metallic Zinc with Finishing Layer

1.4 SUBMITTALS

A. Submit shop drawings and manufacturer's literature for all CONTRACTOR supplied materials.

B. Submit in accordance with Section 01300.

PART 2 – PRODUCTS

Research has documented that certain elastomers (such as those used in gasket material) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied under this Specification Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation the CONTRACTOR identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify the OWNER immediately. Stop installing piping in the area of suspected contamination until direction is provided by the OWNER.

2.1 PIPE MATERIALS

A. General

Ductile iron pipe shall conform to the latest specifications as adopted by the American National Standards Institute, Inc., (ANSI) and the American Water Works Association (AWWA). Specifically, ductile iron pipe shall conform to AWWA Standard C151.

The exterior of ductile iron pipe shall be coated with a layer of arcsprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The coating system shall conform in every respect to ISO 8179-1 “Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004- 06-01.”

The pipe or fitting exterior shall be topcoated with a bituminous coating in accordance with AWWA Standard C151. The pipe or fitting interior shall be cement mortar lined and seal coated in compliance with the latest revision of AWWA Standard C104.

B. Quality

Pipe and fittings shall meet the minimum quality requirements by conforming to the following:

1. AWWA C105 / ANSI A21.5 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water Polyethylene Encasement for Ductile-Iron Pipe Systems

2. AWWA C110 / ANSI A21.10 Ductile Iron and Gray Iron Fittings, 3 NPS through 48 NPS for Water AWWA C111 / ANSI A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

3. AWWA C115 / ANSI A21.15 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

4. AWWA C116 / ANSI A21.16 Protective Fusion-Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service

5. AWWA C150 / ANSI A21.50 Thickness Design of Ductile-Iron Pipe

6. AWWA C151 / ANSI A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water

7. AWWA C153 / ANSI A21.53 Ductile-Iron Compact Fittings, 3 NPS through 24 NPS and 54 NPS through 64 NPS, for Water Service

   Ductile iron water pipe and fittings will be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification for iron fittings shall list a fitting description, quantity, bare fitting weight and source, (AWWA Standard C110, C153 or Manufacturer, if fitting is not listed in either standard). The certification shall accompany the material delivered to the project site. The OWNER reserves the right to sample and test this material subsequent to delivery at the project site. If foreign manufactured fittings are provided, then the CONTRACTOR is obligated to notify the ENGINEER with a submittal and provide the necessary documentation to satisfy the ENGINEER and the OWNER that the materials provided meet the specified AWWA standards and, among other documentation that may be required, provide certificates of compliance on the component supplied.

C. Pipe Class

The pressure and thickness class of pipe to be furnished shall be in accordance with **Table 1** and the notes listed below.

Table 1
MINIMUM Rated Working Pressure
For Ductile Iron Pipe Manufactured In Accordance With AWWA Standard C151

Pipe Size (Inch)	Pressure Class	Thickness Class
6	350	52
8	350	52
12	350	54
16	300	54
20	300	54
24	250	54

NOTES:

1. Larger pipe sizes up to 54-inch can be installed as pressure Class 200 with cover up to nine (9) feet and an operating pressure of 200 psi, where approved by the ENGINEER. When trench depths exceed fifteen (15) feet for pipe sizes of 16-inch or larger, the ENGINEER shall direct the CONTRACTOR on the proper class pipe to use.

2. The noted pressure class is adequate to support 3/4 and 1-inch corporation stops. Use a full saddle for larger taps (e.g.., air relief valves or larger corporations) due to limited wall thickness.

3. There are special conditions where a larger wall thickness is required. The ENGINEER shall direct the CONTRACTOR on the proper pressure class pipe to use in specific instances; e.g. at treatment plant or booster station sites where frequent excavation can be anticipated in the vicinity of pipe, where the pipeline is laid on a river channel bottom to prevent external damage to the pipe and minimize the potential for costly pipe replacement, etc.

D. Testing
Perform a hydrostatic test of all pipe and appurtenances as required by AWWA Standard C151 and Specification Section 15030.

E. Joints

1. Mechanical and Push-On joints including accessories shall conform to AWWA Standard C111.

2. Flanged joints shall conform to AWWA Standard C110 or ANSI B16.1 for fittings and AWWA Standard C115 for pipe. Do not use flanged joints in underground installations except within structures.

Furnish all flanged joints with 1/8-inch thick, red rubber or styrene butadiene rubber gaskets. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in American Standard for Wrench Head Bolts and Nuts and Wrench Openings (ANSI B18.2). For bolts of 1-3/4-inches in diameter and larger, bolt studs with a nut on each end are recommended. The high-strength, low-alloy steel for bolts and nuts shall havethe characteristics listed in Table 6 of AWWA Standard C111. Exposed bolts and nuts in aggressive soils shall feature a baked-on, ceramic filled fluorocarbon resin such asXylan or FluoroKote #1. Preferred Manufacturer for bolts is Cor-Blue, or equal.

3. Restrained Joint for pipes shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Restrained push-on joints allowed for pipe only shall have accessories conforming to AWWA Standard C111. Restrained system shall be suitable for the following minimum working pressures:

Pipe Size (Inch)	Pressure (psi)
Less than 20	350
20	300
24	250
30 - 64	200

F. Acceptable Suppliers are listed in the most current version of the Supplemental Technical Specifications.

2.2 FITTINGS

A. Ductile Iron Fittings

Standard fittings shall be ductile iron conforming to AWWA Standard C110. Compact ductile iron fittings shall meet the requirements of AWWA Standard C153.

1. Working Pressures - Fittings shall be suitable for the following working pressures unless otherwise noted in AWWA Standard C110 or C153:

Size (inch)	Compact Fittings Working Pressure (psi)	Standard Fitting Working Pressure (psi)
3 - 24	350	250 (350 with special gaskets)
30 - 48	250	250
54 - 64	150	N/A

The use of standard ductile iron fittings having a 250 psi pressure rating with ductile iron pipe (having a rating of 350 psi) is not permitted except by the expressed written approval by the ENGINEER.

2. Coating and Lining – The exterior of ductile iron pipe fittings shall be coated with a layer of arcsprayed zinc per ISO 8179 or coated with a zinc rich paint per ISO 8179-2. The mass of the zinc applied shall be 200 g/m2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The coating system shall conform in every respect to ISO 8179-1 “Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01” Or ISO 8179-2 “Ductile iron pipes, fittings, accessories and their joints – External zinc-based coating – Part 2: Zinc-rich paint.” The fittings shall be topcoated on the outside with a petroleum asphaltic coating in accordance with AWWA Standard C110 or fusion coated epoxy in accordance with AWWA Standard C116 and lined inside with cement-mortar and seal coated in accordance with AWWA Standard C104 or fusion coated epoxy in accordance with AWWA Standard C116.

B. Acceptable Suppliers are listed in the most current version of the Supplemental Technical Specifications.

C. Joints

1. Mechanical and Push – On joints including accessories shall conform to AWWA Standard C111. Anti-Rotational T-Bolts shall be used on mechanical joints and shall be of domestic origin, high strength, low alloy steel, meeting the current provisions of ANSI/AWWA C111/A21.1-90 for rubber gasket joints for cast iron or ductile iron pipe and fittings. Bolt manufacturer’s certification of compliance must accompany each shipment. T-bolts shall feature a baked-on, ceramic-filled fluorocarbon resin such as Xylan or FluoroKote #1, (corrosion resistant) to handle corrosive conditions on any buried bolts. Standard T-Bolts may be allowed by the OWNER but must adhere to the above characteristics.

2. Flanged joints shall meet the requirements of AWWA Standard C115 or ANSI B16.1. Do not use flanged joints in underground installations except within structures. Furnish all flanged joints with a minimum 1/8-inch thick red rubber or styrene butadiene rubber gasket. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. Xylan or FluoroKote #1 Coated Hex Bolts (corrosion resistant) to handle corrosive conditions shall be used on any buried flanged bolts. Flange gaskets shall be rubber in composition; paper gaskets are not permitted.

   Bolts and nuts shall be threaded in accordance with ASME/ANSI B1.1, Unified Inch Screw Threads (UN and UNR Thread Form) class 2A external and class 2B internal. For bolts of 1-3/4-inches in diameter and larger, bolt studs with a nut on each end are recommended. Material for bolts and nuts shall conform to ASTM A307, 60,000 psi Tensile Strength, Grade B, unless otherwise specified. Bolt manufacturer’s certification of compliance must accompany each shipment.

3. Restrained joints for valves and fittings shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Field Lok gaskets are not permitted on valves or fittings. Restrained push-on joints allowed for pipe only shall have accessories conforming to AWWA Standard C111. Restrained system shall be suitable for the following minimum working pressures:

Pipe Size (Inch)	Pressure psi)
Less than 20	350
20	300
24	250
30 - 64	200

Where adjacent fittings are to be placed (as in a mechanical joint hydrant tee and a mechanical joint hydrant valve), the use of a suitably sized Foster adaptor is permitted to facilitate restraint between the fittings.

PART 3 EXECUTION

3.1 INSTALLATION

Follow the provisions of Specification Section 15000 and 02210 in addition to the following requirements:

A. Push-On Joints - Clean the surfaces that the gasket will contact thoroughly, just prior to assembly using a bacteria free solution (bleach, potable water or NSF approved material). Insert the gasket into the groove in the bell. Apply a liberal coating of special lubricant to the gasket and the spigot end of the pipe before assembling the joint. Center the spigot end in the bell and push home the spigot end.

B. Mechanical Joints - Clean the surfaces that the gasket will contact thoroughly, just prior to assembly using a bacteria free solution (bleach, potable water or NSF approved material). Apply a liberal coating of special lubricant to all the surfaces that the gasket will contact. Slip the follower gland and gasket over the pipe plain end making sure that the small side of the gasket and lip of the gland face the bell socket. Insert the plain end into socket. Push the gasket into position with fingers. Seat gasket evenly. Slide gland into position, insert bolts, and tighten nuts by hand. Tighten bolts alternately (across from one another) to the recommended manufacturing rating or if not provided, to the following normal torques:

Bolt Size (inch)	Range of Torque (foot-pounds)
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1-1/4	90 - 120

C. Restrained Joints

1. Ball and Socket. Assemble and install the ball and socket joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint. Check the retainer ring fastener.

2. Push-On. Assemble and install the push-on joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint. Check the retainer ring fastener.

   Protect pipe from damage from the jacking device (backhoe bucket, pipe jack, etc.) when “pushing home” any pipe by using wood or other suitable (non-metallic) material.

3. Mechanical Joint. Assemble and install the mechanical joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint. Use approved restrained joint device on fittings and valves where required and approved for use by OWNER.

D. Pipe Protection

Protect pipe from damage from the jacking device (backhoe bucket, pipe jack, etc.) when “pushing home” any pipe. Wood or other suitable material (non-metallic) shall be used to push home the pipe.

E. Gaskets

Gaskets shall be as provided or recommended by the manufacturer and satisfy AWWA standard C111 in all respects. As noted in the products section of this specification, some gasket materials are prone to permeation of certain hydrocarbons which may exist in the soil (see part 2). Under these conditions and at the OWNER’s discretion provide FKM (Viton, Flourel) gasket material in areas of concern.

3.2 BASIS OF PAYMENT

The installation of water main, or restrained joint water main, will be paid at the Contract Unit Price per linear foot measured without deducting for length of fittings and valves for various sizes of water main installation. The installation of fittings will be paid at the Contract Unit Price for each type and size of fitting installed. The unit price includes furnishing labor, material (except when provided by OWNER), and equipment to install water main. Items specified in other Specification Sections that are considered incidental to water main installation shall be included in this Contract Unit Price including, but not limited to, excavation, backfill, shoring, polywrap, tracer wire, location tape, testing, disinfection, thrust restraint, and temporary blow-off outlets.

Note: Fire hydrant piping is not included in this item.

–END OF SECTION 15105–

SECTION 15120

POLYVINYL CHLORIDE (PVC) PIPE

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing PVC pressure pipe and fittings. Under special conditions 2-inch PVC may be specified in which case it shall meet NSF 61 and satisfy a 200 psi pressure rating. The OWNER reserves the right to provide certain material. A list of materials to be provided by the OWNER, if applicable, is shown in Specification Section 01000.

1.2 RELATED WORK

A. Specification Section 01000 – Summary of Work

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 02210 – Trenching, Backfilling, and Compacting

D. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

Refer to current Standards:

A. ASTM A536 – Standard Specification for Ductile Iron Castings

B. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

C. ASTM D2855 – Standard Practice for Making Solvent Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

D. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

E. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution

F. AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution

G. AWWA Manual M23 – PVC Pipe - Design and Installation

H. NSF Standard No. 61

1.4 SUBMITTALS

A. Submit shop drawings and manufacturer's literature for all CONTRACTOR supplied materials.

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

Research has documented that certain pipe materials (such as polyvinyl chloride, polyethylene, and polybutylene) and certain elastomers (such as those used in gasket material) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied under this section have been selected based on the non-expectation of encountering petroleum products or organic solvents. If during the course of pipeline installation the CONTRACTOR identifies, or suspects, the presence of petroleum products or any unknown chemical substance the OWNER is to be notified immediately. Installation of any further piping in the area of suspected contamination shall be stopped until direction is provided by the OWNER.

2.1 PIPE MATERIALS

PVC pipe shall conform to the latest edition of American Water Works Association (AWWA) Standard C900/C905 with elastomeric gasket couplings in accordance with this Standard. The use of solvent cement connections shall not be allowed unless approved by the ENGINEER. Pipe shall be furnished with cast iron pipe equivalent outside diameter and the Dimension Ratio shall be 14, with a Pressure Class of 200 psi. The PVC compounds shall be treated or certified suitable for potable water products by the National Sanitation Foundation (NSF) Testing Laboratory (NSF Standard No. 61). Restrained Joint PVC pipe shall be supplied where called for on the Drawings.

Acceptable Suppliers are listed in the most current version of the Supplemental Technical Specifications.

PART 3 EXECUTION

3.1 INSTALLATION

Follow the provisions of Specification Section 15000 and 02210 in addition to the following requirements:

A. Pipe Joint Assembly

1. The assembly of joints should be performed as recommended by the pipe manufacturer, except that **neither deflection of PVC pipe joints nor bending of PVC pipe lengths are permitted**. The elastomeric gaskets may be supplied separately in cartons or positioned in the bell joint or coupling at the factory. When gaskets are color coded, be sure to consult the pipe manufacturer or literature for the significance. In all cases, clean the gasket, the bell or coupling

interior, especially the groove area (except when gasket is permanently installed) and the spigot area with a rag, brush or paper towel to remove any dirt or foreign material before the assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation. When gaskets are separate, use only gaskets which are designed for and supplied with the pipe. Insert them as recommended by the manufacturer.

2. Lubricant should be applied as specified by the pipe manufacturer. Bacterial growth, damage to the gaskets or the pipe, may be promoted by use of non-approved lubricants. Use only lubricant supplied by the pipe manufacturer.

3. After lubrication, the pipe is ready to be joined. Good alignment of the pipe is essential for ease of assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint; that is, do not suspend the pipe and swing it into the bell. The spigot end of the pipe is marked by the manufacturer to indicate the proper depth of insertion.

4. Solvent cemented joints will not be allowed.

5. To join field-cut pipe, it is necessary to first prepare the pipe end. A square cut is essential for proper assembly. The pipe shall be marked around its entire circumference prior to cutting to assure a square cut. Use a factory-finished beveled end as a guide for proper bevel angle, and depth of bevel plus the distance to the insertion reference mark. The end shall be beveled using a pipe beveling tool or a wood rasp which will cut the correct taper. A portable sander or abrasive disc may also be used to bevel the pipe end. Round off any sharp edges on the leading edge of the bevel with a pocket knife or a file.

3.2 BASIS OF PAYMENT

The Work included in this Section will be paid at the Contract Unit Price per linear foot measured without deducting for length of fittings and valves for various sizes of water main installation. The unit price includes furnishing labor, material (except when provided by OWNER), and equipment to install water main. Items specified in other Specification Sections that are considered incidental to water main installation shall be included in this Contract Unit Price including, but not limited to, excavation, backfill, shoring, tracer wire, location tape, testing, and disinfection, thrust restraint, and temporary blow-off outlets.

Note: Fire hydrant piping is not included in this item.

–END OF SECTION 15120–

SECTION 15122

FUSIBLE PVC PIPE

PART 1 – GENERAL

1.1 SUMMARY

This section includes furnishing and installing fusible polyvinyl chloride (PVC) pipe as shown on the Drawings. The OWNER reserves the right to provide certain material. A list of materials to be provided by the OWNER, if applicable, is shown in Specification Section 01000.

1.2 RELATED WORK

A. Specification Section 01000 – Summary of Work

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 02100 – Trenching and Backfilling

D. Specification Section 15120 – Polyvinyl Chloride (PVC) Pipe

E. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

Refer to current Standards:

A. AWWA C110 – American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids

B. AWWA C111 – American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

C. AWWA C153 – American National Standard for Ductile-Iron Compact Fittings, 3-inch through 24-inch and 54-inch through 64-inch, for Water Service

D. ASTM D1784 – Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

E. ASTM D1785 – Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

F. ASTM D2152 – Test Method for Degree of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion

G. ASTM D2241 – Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)

H. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe

I. ASTM F1057 – Standard Practice for Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique

J. UNI-PUB-08 – Tapping Guide for PVC Pressure Pipe

K. NSF-14 – Plastics Piping System Components and Related Materials

L. PPI TR-2 – PVC Range Composition Listing of Qualified Ingredients

1.4 SUBMITTALS

A. PRE-CONSTRUCTION SUBMITTALS

The following PRODUCT DATA is required from the pipe supplier and/or fusion provider:

1. Pipe Size
2. Dimensionality
3. Pressure Class per applicable standard
4. Color
5. Recommended Minimum Bending Radius
6. Recommended Maximum Safe Pull Force
7. Fusion technician qualification indicating conformance with this specification

B. POST-CONSTRUCTION SUBMITTALS

The following AS-RECORDED DATA is required from the CONTRACTOR and/or fusion provider to the OWNER or pipe supplier upon request:

1. Approved datalogger device reports
2. Fusion joint documentation containing the following information:
3. Pipe Size and Thickness
4. Machine Size
5. Fusion Technician Identification
6. Job Identification
7. Fusion Joint Number
8. Fusion, Heating, and Drag Pressure Settings
9. Heat Plate Temperature
10. Time Stamp
11. Heating and Cool Down Time of Fusion
12. Ambient Temperature

C. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 FUSIBLE POLYVINYLCHLORIDE PRESSURE PIPE FOR POTABLE WATER

A. Pipe shall conform to the following dimensionality and general characteristics table:

Pipe Description	Nominal Diameter (in.)	DR	Color	Pressure Class (psi)
Fusible PVC® Pipe	4”-36”	18	Blue or Green	235
Fusible PVC® Pipe	4”-36”	25	Blue or Green	165
Fusible PVC® Pipe	14”-36”	21	Blue or Green	200

B. All piping shall be made from PVC compound conforming to cell classification 12454 per ASTM D1784.

C. Fusible polyvinylchloride pipe shall conform to AWWA C900, AWWA C905, ASTM D2241 or ASTM D1785 for standard dimensions, as applicable. Testing shall be in accordance with the referenced AWWA standards for all pipe types.

D. Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

E. Fusible polyvinylchloride pipe shall be manufactured in a standard 40’ nominal length, or custom lengths as specified.

F. Fusible polyvinylchloride pipe shall be blue in color for potable water use.

G. Pipe shall be marked as follows:

1. Nominal pipe size
2. PVC
3. Dimension Ratio, Standard Dimension Ratio, or Schedule
4. AWWA pressure class, or standard pressure rating for non-AWWA pipe, as applicable
5. AWWA standard designation number, or pipe type for non-AWWA pipe, as applicable
6. NSF-61 mark verifying suitability for potable water service
7. Extrusion production-record code
8. Trademark or trade name
9. Cell Classification 12454 and/or PVC material code 1120 may also be included

H. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

2.2 FUSION JOINTS

A. Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. The CONTRACTOR shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed as described in this specification.

2.3 CONNECTIONS AND FITTINGS FOR PRESSURE APPLICATIONS

A. Connections shall be defined in conjunction with the coupling of project piping, as well as the tie-ins to other piping systems.

B. DUCTILE IRON MECHANICAL AND FLANGED FITTINGS

Acceptable fittings for use with fusible polyvinylchloride pipe shall include standard ductile iron fittings conforming to AWWA/ANSI C110/A21.10, or AWWA/ANSI C153/A21.53 and AWWA/ANSI C111/A21.11.

1. Connections to fusible polyvinylchloride pipe may be made using a restrained or non-restrained retainer gland product for PVC pipe, as well as for MJ or flanged fittings.

2. Bends, tees and other ductile iron fittings shall be restrained with the use of thrust blocking or other means as indicated in the construction documents.

3. Ductile iron fittings and glands must be installed per the manufacturer's guidelines.

4. If required, linings for Ductile Iron fittings shall meet the following requirements:

    a) Liquid Epoxy shall be 100% solids liquid epoxy, Tnemec Epoxyline Series FC22.
    b) Polyurethane shall be DuraShield 210-61 or 310-61.

5. If required, coatings for Ductile Iron fittings shall meet the following requirements for buried and/or immersion service duty:

    a) Polyurethane shall be DuraShield 210 or 310.
    b) Liquid Epoxy shall be 100% solids liquid epoxy, Tnemec Epoxyline Series FC22.
    c) Coal tar epoxy shall be Sherwin Williams Targuard.

C. PVC GASKETED, PUSH-ON FITTINGS

Acceptable fittings for use with fusible polyvinylchloride pipe shall include standard PVC pressure fittings conforming to AWWA C900 or AWWA C905.

1. Acceptable fittings for use joining fusible polyvinylchloride pipe other sections of fusible polyvinylchloride pipe or other sections of PVC pipe shall include gasketed PVC, push-on type couplings and fittings, including bends, tees, and couplings as shown in the drawings.

2. Bends, tees and other PVC fittings shall be restrained with the use of thrust blocking or other restraint products as indicated in the construction documents.

3. PVC gasketed, push-on fittings and mechanical restraints, if used, must be installed per the manufacturer's guidelines.

D. FUSIBLE POLYVINYL CHLORIDE SWEEPS OR BENDS

1. Fusible polyvinyl chloride sweeps or bends shall conform to the same sizing convention, diameter, dimensional tolerances and pressure class of the pipe being joined using the sweep or bend.

2. Fusible polyvinyl chloride sweeps or bends shall be manufactured from the same fusible polyvinyl chloride pipe being used for the installation, and shall have at least 2 feet of straight section on either end of the sweep or bend to allow for fusion of the sweep to the pipe installation. There shall be no gasketed connections utilized with a fusible polyvinyl chloride sweep.

3. Standard fusible polyvinyl chloride sweep or bend angles shall not be greater than 22.5 degrees, and shall be used in nominal diameters ranging from 4 inch through 16 inch.

E. SLEEVE-TYPE COUPLINGS

1. Sleeve-type mechanical couplings shall be manufactured for use with PVC pressure pipe and may be restrained or unrestrained as indicated in the construction documents.

2. Sleeve-type couplings shall be rated at the same or greater pressure carrying capacity as the pipe itself.

F. EXPANSION AND FLEXIBLE COUPLINGS

1. Expansion-type mechanical couplings shall be manufactured for use with PVC pipe and may be restrained or unrestrained as indicated in the construction documents.

2. Expansion-type mechanical couplings shall be rated at the same or greater pressure carrying capacity as the pipe itself.

G. CONNECTION HARDWARE

Bolts and nuts for buried service shall be made of non-corrosive, high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21.11, regardless of any other protective coating.

H. APPROVED MANUFACTURERS

Acceptable Suppliers are listed in the most current version of the Supplemental Technical Specifications.

PART 3 EXECUTION

3.1 DELIVERY AND OFF-LOADING

A. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the OWNER or ENGINEER.

B. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify OWNER or ENGINEER immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color, and type.

C. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23, and all pipe supplier guidelines shall be followed.

D. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.

E. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.

F. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to ensure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from trucks.

3.2 HANDLING AND STORAGE

A. Any length of pipe showing a crack, or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the OWNER or ENGINEER.

B. Any scratch or gouge greater than 10% of the wall thickness will be considered significant and can be rejected unless determined acceptable by the OWNER or ENGINEER.

C. Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.

E. If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.

F. Pipe shall be stored and stacked per the pipe supplier's guidelines.

3.3 FUSION PROCESS

A. GENERAL

1. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.

2. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.

3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.

4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:

a) HEAT PLATE – Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.

b) CARRIAGE – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
c) GENERAL MACHINE – Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
d) DATA LOGGING DEVICE – An approved datalogging device with the current version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

5. Other equipment specifically required for the fusion process shall include the following:
   a) Pipe rollers shall be used for support of pipe to either side of the machine
   b) A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's recommendations.
   c) An infrared (IR) pyrometer for checking pipe and heat plate temperatures.
   d) Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
   e) Facing blades specifically designed for cutting fusible polyvinylchloride pipe shall be used.

B. JOINT RECORDING

Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible polyvinyl chloride pipe. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

3.4 FUSION TECHNICIAN REQUIREMENTS

A. Fusion Technician shall be fully qualified by the pipe supplier to install fusible polyvinylchloride pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

3.5 GENERAL INSTALLATION

A. Installation guidelines from the pipe supplier shall be followed for all installations.

B. The fusible polyvinylchloride pipe will be installed in a manner so as not to exceed the recommended bending radius.

C. Where fusible polyvinylchloride pipe is installed by pulling in tension, the recommended Safe Pulling Force established by the pipe supplier shall not be exceeded.

3.6 PREPARATION PRIOR TO MAKING CONNECTIONS INTO EXISTING PIPING SYSTEMS

A. Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the CONTRACTOR shall:

1. Field verify location, size, piping material, and piping system of the existing pipe.

2. Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.

3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.

B. Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

3.7 PIPE SYSTEM CONNECTIONS

A. Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines and as indicated in the construction documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines.

3.8 TAPPING FOR POTABLE AND NON-POTABLE WATER APPLICATIONS

A. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for Saddle Tapping per Uni-Pub-8.

B. All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings.

C. Equipment used for tapping shall be made specifically for tapping PVC pipe:

1. Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited.

2. Manually operated or power operated drilling machines may be used.

D. Taps may be performed while the pipeline is filled with water and under pressure (‘wet’ tap,) or when the pipeline is not filled with water and not under pressure (‘dry’ tap).

3.9 TESTING

A. See Specification 15030

3.10 BASIS OF PAYMENT

The installation of water main will be paid at the Contract Unit Price per linear foot measured without deducting for length of fittings and valves for various sizes of water main installation. The unit price includes furnishing labor, material (except when provided by OWNER), and equipment to install water main. Items specified in other Specification Sections that are considered incidental to water main installation shall be included in this Contract Unit Price including, but not limited to, excavation, backfill, shoring, tracer wire, location tape, testing, disinfection, thrust restraint, and temporary blow-off outlets.

Note: Fire hydrant piping is not included in this item.

–END OF SECTION 15122–

SECTION 15125

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing 4-inch through 63-inch high density polyethylene (HDPE) pipe and fittings as shown on the Drawings. The OWNER reserves the right to provide certain material. A list of materials to be provided by the OWNER, if applicable, is shown in Specification Section 01000.

1.2 RELATED WORK

A. Specification Section 01000 – Summary of Work

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 02100 – Trenching and Backfilling

D. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

A. AWWA Standard C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) though 63 In. (1,575 mm), for Water Distribution and Transmission.

B. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

C. ASTM D2683 – Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

D. ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

E. ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

F. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

1.4 SUBMITTALS

A. Submit shop drawings and manufacturer's literature for all CONTRACTOR supplied materials.

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

Research has documented that certain pipe materials (such as polyethylene, polybutylene, polyvinyl chloride, and asbestos cement) and elastomers, such as used in jointing gaskets and packing glands, may be subject to permeation by lower molecular weight organic solvents or petroleum products. Products supplied under this Specification Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation, the CONTRACTOR identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify the OWNER immediately. Stop installing piping in the area of suspected contamination until direction is provided by the OWNER.

2.1 MATERIALS

A. Pipe and fittings shall be made from the same resin meeting the requirements of the Plastic Pipe Institute (PPI) material designation PE 4710 with an ATSM D3350 minimum cell classification of PE 345464C.

B. The material shall have a minimum Hydrostatic Design Basis (HDB) of 1,600 psi at 73 degrees F.

C. All materials which come in contact with water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.

2.2 PIPE

A. All pipe and fittings shall be manufactured in ductile iron pipe sizes (DIPS) only in accordance with AWWA Standard C906. Iron Pipe Sizes (IPS) may be allowed by approval of the OWNER and as shown on the Drawings.

B. The pipe shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.

C. Permanent identification of water piping service shall be provided by co-extruding longitudinal blue stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed or painted on the outside surface shall not be acceptable.

D. The nominal pipe diameter is specified on the Drawings. The DR (dimension ratio) and the pressure rating of the pipe shall be as noted on the Drawings.

E. The minimum pressure rating will be 200 psi, or as shown on the Drawings.

F. HDPE may be deflected subject to approval by the OWNER. The following table shows maximum deflection based upon the allowable strain of the pipe wall. Potential flow restrictions, surge and other non- trench stability and pipe strain issues may reduce the values shown here per the ENGINEER's recommendations. The

bend radius multiplier determines the minimum radius of the pipe curvature and is calculated by multiplying the outside diameter of the pipe by the multiplier from the appropriate DR used. Bending radius allowed by the manufacturer can vary. Verify the multiplier with the manufacturer. In no case shall the radius be less than 125% of the manufacturer's permitted multiplier.

PE pipe Dimension Ratio (DR)	Allowable deflection (percent)	Bend Radius Multiplier
32.5	8.1	50
26.0	6.5	45
21.0	5.2	40
19.0	4.7	37.5
17.0	4.2	32.5
15.5	3.9	30
13.5	3.4	27.5
11.0	2.7	25

2.3 FITTINGS

A. Plain end butt fused fittings and electrofusion couplings shall be used when joining polyethylene materials. Mechanical (compression) fittings shall be used only when joining polyethylene materials to different piping materials and approved by the OWNER.

B. The fittings shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added. The fittings shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.

C. Butt fusion fittings shall comply with ASTM D3261.

D. Electrofusion fittings shall comply with ASTM F1055.

E. Mechanical (compression) fittings used with polyethylene pipe shall be specifically designed for, or tested and found to be acceptable for, use with polyethylene pipe.

2.4 ACCEPTABLE MANUFACTURERS are listed in the most current version of the Supplemental Technical Specifications

PART 3 EXECUTION

3.1 PACKAGING, HANDLING, AND STORAGE

A. The manufacturer shall ensure that the interior of all pipe is clean and install plastic cleanliness plugs in all pipes to keep the pipe interiors clean. The manufacturer shall package the pipe in a manner designed to ensure that it arrives at the project neat, clean, intact, and without physical damage. The transportation carrier shall use

appropriate methods and intermittent checks to assure that the pipe is properly supported, stacked, and restrained during transport such that the pipe is not nicked, gouged, or physically damaged.

B. Inspect pipe and appurtenances for defects prior to installation in the trench. Set aside defective, damaged, or unsound material and hold material for inspection by the OWNER.

C. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The pipe shall be handled in such a manner that it is not pulled over sharp objects or cut by chokers or lifting equipment.

D. Sections of pipe having been discovered with cuts or gouges more than 10% of the pipe wall thickness shall be cut out and removed. The undamaged portions of the pipe shall be rejoined by butt fusing or the use of electrofusion fittings.

3.2 PIPE INSTALLATION

A. Refer to Specifications 15000 and the Drawings that are part of these Contract Documents. Trenching shall be performed in accordance with ASTM D2774 and embedment materials shall be in accordance with ASTM D2321.

B. Remove all dirt and foreign matter from pipe before lowering into the trench. Do not place debris, hand tools, clothing or other materials in the pipe. Keep pipe clean during and after laying.

C. Maximum pipe bending radius shall be in conformance with the manufacturer's recommendation for the specific diameter and dimension ratio (DR) of the pipe. Whenever possible, changes in direction shall be accomplished by bending the pipe in lieu of installing a fitting, except as approved by the OWNER.

D. Place location wire immediately above the initial backfill material, directly over the pipe. The wire shall be as required in Specification 15130-2.8.

E. Prevent flotation of sealed pipe during work stoppages.

F. HDPE pipe will not be employed with directional drilling through rock and other abrasive conditions unless it is encased.

3.3 PIPE AND FITTING JOINING

A. Butt fusion and electrofusion procedures shall be in accordance with the manufacturer's recommendations. Surfaces must be clean and dry before joining. The fusion equipment operator shall be fully trained in the use of the respective equipment. The wall thicknesses of the adjoining pipes shall have the same DR at the point of fusion.

B. Butt fusion equipment shall be equipped with a Datalogger. Records of each weld (including, as a minimum, heater temperature, fusion pressure, and a graph of the fusion cycle) shall be appropriately identified and provided to the ENGINEER.

C. Electrofusion reports of each weld shall be appropriately identified and provided to the ENGINEER. The reports shall include, as a minimum, the fusion date, time, ambient temperature, fitting type and size, user ID, and the manufacturer of the part.

D. Mechanical (compression) joining of pipe and fittings is only permissible when joining polyethylene pipe to unlike materials. HDPE stiffeners shall be utilized with all mechanical (compression) fittings. Blocking must be provided at changes in direction for any mechanical fittings. Use of positive restrained joints fittings (non-friction type) is permissible when approved by the OWNER.

3.4 SERVICE CONNECTIONS

A. Sidewall fused polyethylene hot-tapping tees shall be used for 3/4 inch and 1 inch service lines off mains 3 inches to 12 inches in diameter. For larger sized mains, polyethylene service saddles may be used, sidewall fused, and then tapped with a tapping tool or machine.

B. For large mains (>12 inch), mechanical clamps or tapping saddles may be used provided they are designed for HDPE pipe and acceptable to the manufacturer of the pipe.

3.5 TESTING AND DISINFECTION

A. Pressure testing shall be conducted in accordance with the Manufacturer's recommended procedure or as recommended by the ENGINEER. Pressure testing shall use water as the test media. Pneumatic (air) testing is prohibited. Air must be completely removed before pressure testing. Under no circumstances shall HDPE pipe be pressure tested when the temperature of the pipe is above 80 degrees F.

3.6 BASIS OF PAYMENT

The Work included in this Section will be paid at the Contract Unit Price per linear foot measured without deducting for length of fittings and valves for various sizes of water main installation. The unit price includes furnishing labor, material (except when provided by OWNER), and equipment to install water main. Items specified in other Specification Sections that are considered incidental to water main installation shall be included in this Contract Unit Price including, but not limited to, excavation, backfill, shoring, tracer wire, location tape, testing, and disinfection, thrust restraint, and temporary blow-off outlets.

Note: Fire hydrant piping is not included in this item.

–END OF SECTION 15125–

SECTION 15130

PIPING SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing miscellaneous piping specialties as shown on the Drawings. Piping specialties include polyethylene encasement (polywrap); valve boxes; rods, bolts, lugs, and brackets; retaining glands; test/tracer wire boxes; and marking posts.

1.2 RELATED WORK

A. Specification Section 02100 – Trenching, Backfilling, and Compacting

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 15105 – Ductile Iron Pipe and Fittings

1.3 REFERENCES

Refer to current Standards:

A. AWWA C105 – American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems

B. AWWA C217 – Petrolatum and Petroleum Wax Tape Coatings

C. AWWA C600 – Installation of Ductile Iron Water Mains and Their Appurtenances

D. DIPRA Field Polyethylene Installation Guide

PART 2 PRODUCTS

2.1 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall conform to AWWA Standard C105 and shall be enhanced with V-Bio. The polyethylene encasement shall be 8 mils thick (12 mils thick in corrosive soil). The polyethylene film shall be translucent and blue in color and distinctly marked (at minimum 2-foot intervals) with the following information:

1. manufacturer’s name (or trademark),
2. year manufactured,
3. minimum film thickness and material type (LLDPE or HDCLPE),
4. range of nominal pipe diameter size
5. ANSI/AWWA C105/A21.5 (compliance)
6. A warning “WARNING–CORROSION PROTECTION-REPAIR ANY DAMAGE” labeled “WATER”

B. Tape shall be polyethylene compatible adhesive and a minimum of 1.5 inches wide. Acceptable suppliers are listed in the most current version of the Supplemental Technical Specifications.

C. Store all polyethylene encasement out of the sunlight. Exposure of wrapped pipe should be kept to a minimum.

D. Acceptable Suppliers of polyethylene encasement are listed in the most current version of the Supplemental Technical Specifications.

2.2 VALVE BOXES

A. All valves shall be provided with valve boxes. Valve boxes shall be of the standard, adjustable, cast-iron extension type, multiple piece, 5-1/4-inch shaft, screw type, and of such length as necessary to extend from the valve to finished grade. Cast iron valve boxes shall be hot coated inside and out with an asphaltic compound.

B. Valve boxes shall be positioned with a Box Alignment Tool or Box Aligner ("top hats").

C. Valve box bases shall conform to the following:

Valve Size (inch)	**Base**
4 and smaller	Round, 8-inch high, 10-7/8-inch diameter at bottom.
6 and 8	Round, 11-inch high, 14-3/8-inch diameter at bottom
10 and larger	Oval, 11-inch high, 15-inch by 11-1/8-inch at bottom

D. Acceptable Manufacturers are listed in the Supplemental Technical Specifications.

2.3 RODS, BOLTS, LUGS AND BRACKETS

A. All steel rods, bolts, lugs, and brackets, shall be ASTM A36 or A307 carbon steel with xylan coating as a minimum requirement. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. Xylan or FluoroKote #1 coated T-Bolts, corrosion resistant to handle corrosive conditions shall be used on any buried flanged bolts.

B. After field installation, all steel surfaces shall receive a petrolatum wax tape coating in accordance with Specification Section 15000 and AWWA Standard C217. Subject to approval by the OWNER, an alternative corrosion protection for exposed buried metal is an aerosol applied rubberized coating per Specification Section 15000.

C. Acceptable manufacturers are listed in the most current version of the supplemental Technical Specifications.

2.4 RETAINING GLANDS

A. All retaining glands shall be ductile iron with ductile iron set screws. Pressure ratings for use with ductile iron pipe shall be a minimum of 250 psi. Retainer Glands shall be coated with electrostatically applied baked-on polyurethane coating or approved equal. Locking wedges, bolts, and set screws shall be coated with Xylan or FluoroKote #1.

B. Acceptable Manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.5 TEST /TRACER BOXES

A. All test/tracer boxes shall be 18-inch plastic box flared and squared at base and have a 4-inch I.D. with a 1 ½-inch cast iron flange. Lid shall be a one-piece locking lid with “Test Station” marked on lid and shall contain 5 screw-type brass terminals on a non-conductive terminal board.

B. Acceptable Manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.6 MARKING POSTS

A. All marking posts shall be Rhino FiberCurveTM with PolyTechCoating or equivalent fiber-composite marking posts. The color shall be standard blue for water and the length shall be a minimum 66-inches. The decals shall be UV stable, all-weather type with a no dig symbol in white and contrasting white and blue vertical lettering: Butterfly and Gate Valves decals (Rhino GD-5226K) Blow-Offs decals (Rhino GD-5411K) Pipeline decals (Rhino GD-1333K).

B. Acceptable Manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.7 IDENTIFICATION TAPE

A. Identification tape shall be manufactured of polyethylene with a minimum thickness of 4-mils. The tape shall be highly resistant to alkalis, acid and other destructive agents found in soil. Tape width shall be a minimum of 3 inches and a maximum of 6 inches and shall have a blue background color, imprinted with black letters. Imprint shall be “CAUTION – WATER LINE BURIED BELOW” and shall repeat itself a minimum of once every 2 feet for entire length of the tape.

B. Acceptable manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.8 LOCATION WIRE

A. Location wire shall be used at all pipe installations. Location wire shall be a direct burial #12 AWG (0.0808-inch diameter) fully annealed; high strength solid copper clad steel conductor (HS-CCS); insulated with a 30-mil high molecular weight, high

density blue polyethylene jacket complying with ASTM D1248; and rated for direct burial use at 30 volts. HS-CCS conductor must be at 21% conductivity with 452-pound average tensile break load for open cut and 1150-pound average tensile break load for boring. Location wire may only be spliced with approved connectors.

B. Acceptable manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.9 RESTRAINED JOINT MARKING TAPE

A. Restrained Joint Marking Tape shall be used when restrained joint pipe or fittings are installed. Joint restraint tape is specifically to warn Water Company workers/contractors that the water main joint is restrained. It is not to be used in place of regular marking tape.

B. Restrained Joint Marking Tape shall be polyethylene 4-mil thick and 2 ½-inches wide with blue lettering on white background color and imprinted with the words “RESTRAINED JOINT” at 2-foot intervals. The tape shall have an adhesive backer. The tape shall be highly resistant to alkalis, acid and other destructive agents found in soil.

C. Acceptable manufacturers are listed in the most current version of the Supplemental Technical Specifications.

PART 3 EXECUTION

3.1 INSTALLATION

Install “piping specialties” in accordance with the general provisions provided in Specification Section 15000 and the following:

A. Polyethylene Encasement

1. Encase piping in polyethylene as required to prevent contact with surrounding backfill and bedding material in all areas shown on the Drawings or designated by the ENGINEER.

2. Install the polyethylene wrap in accordance with DIPRA V-Bio Enhanced Polyethylene Encasement brochure found at: https://www.dipra.org/component/phocadownload/category/15-ductile-iron-pipe-research-association-brochures?download=56:v-bio-enhanced-polyethylene-encasement-brochure

B. Valve Boxes

Valve boxes shall be supported so that no load can be transmitted from the valve box to the valve. See Standard Details. Using the Box Alignment Tool/Box Aligner according to the manufacturer’s instructions, make sure that the bottom of the box is centered over the operating nut and runs perpendicular to the horizontal prior to backfilling.

C. Test/Tracer Wire Boxes

Boxes shall be placed at areas designated in the Drawings and shall be flush with existing grade unless otherwise noted.

D. Marker Posts

Install Marker Posts per manufacturer guidelines and place at locations noted in the Drawings or as approved by ENGINEER.

3.2 IDENTIFICATION TAPE, LOCATION WIRE, AND RESTRAINED JOINT MARKING TAPE

1. Install in accordance with manufacturer's installation instructions and as specified in the Contract Documents.

2. Install identification tape one foot above the top of the pipe.

3. Install location wire directly on top of the buried pipe.

4. Loop the location wire up the outside of valve box to one foot from the surface. Insert the wires into the valve box at that depth for connection to a locating device. The wire shall be one continuous piece from valve box to valve box up to 1250 feet maximum. When distance between valve boxes exceeds 1250 feet, or when shown on the Drawings, install tracer boxes near the mid-point of such lengths that no continuous piece of location wire exceeds 1250 feet.

5. Install the joint marking tape by adhering directly to the pipe as it is installed. The marking tape shall be installed along the entire length of pipe, including around the circumference of the bells of all fittings and valves. The pipe must be free of any foreign matter along the surface of the pipe for the marking tape installation. If clear polywrap is used, the restrained joint tape can be applied on the top of the pipe so long as it is visible. Otherwise, the joint marking tape shall be applied on top of the polywrap and secured so the tape is not shifted by backfilling.

6. The tape does not adhere in wet or cold conditions. The tape should be stored in temperatures above 50 degrees F until the time of application. The pipe must be free of frost and moisture along the surface of the pipe receiving the tape.

7. CONTRACTOR and/or OWNER shall test the performance of the location wire prior to conducting pavement or landscape restoration.

3.3 BASIS OF PAYMENT

The Work included in this Section is considered incidental to the installation of pipe, valves, and fittings.

–END OF SECTION 15130–

SECTION 15150

GATE VALVES

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing gate valves as shown on the Drawings. Insertion valves may be approved for use on certain projects. If insertion valves are shown on the Drawings, see Supplemental Technical Specifications.

1.2 RELATED WORK

A. Specification Section 02210 – Trenching, Backfilling and Compacting

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

Refer to current standards:

A. AWWA C509 OR C515, C111, C550, C500

1.4 SUBMITTALS

A. Submit shop drawings and manufacturer's data

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 SMALL GATE VALVES

A. All gate valves, 3 inches through 12 inches NPS, shall be iron body, resilient-seated, nut-operated, non-rising stem gate valves suitable for buried service. The valve interior and exterior shall be epoxy coated at the factory by the valve manufacturer in accordance with AWWA Standard C550 (6-8 mil average, 4 mil minimum). The valves shall be designed for a minimum differential pressure of 250 psi and a minimum internal test pressure of 500 psi unless otherwise noted on the Drawings. Valves shall be designed to operate in the vertical position.

B. Valves shall comply fully with AWWA Standard C509 OR C515. Valve ends shall be push on joint or MJ (when restrained), or as shown on the Drawings or approved in writing in accordance with AWWA Standard C111. Stems shall be made of a low zinc alloy in accordance with AWWA C509 OR C515. Stem seals shall be double O-ring

stem seals. Square operating nuts conforming to AWWA Standard C509 OR C515 shall be used. Valves shall open (left or right) in accordance with **Table 1 of the Supplemental Technical Specifications**. All valve materials shall meet the requirements of NSF 61.

C. Test valves (Operation Test and Hydrostatic Tests) at the manufacturer's plant in accordance with AWWA Standard C509 OR C515. If requested, provide the OWNER with certified copies of all tests prior to shipment. The OWNER reserves the right to observe all tests.

D. Acceptable Manufacturers are listed in the Supplemental Technical Specifications.

2.2 LARGE GATE VALVES

A. Gate valves larger than 12-inches NPS shall be iron body, double disc (metal to metal seat), parallel seats, bronze mounted, rubber O-ring packing seals, epoxy coated interior and exterior meeting the requirements of AWWA Standard C550, and conforming to AWWA Standard C500. Stems shall be made of a low zinc alloy in accordance with AWWA C500 4.2.2.4.3. All valves shall have openings through the body of the same circular area as that of the pipe to which they are attached. All valves furnished shall open (left or right) in accordance with **Table 1 of the Supplemental Technical Specifications**. All valve materials shall meet the requirements of NSF 61.

B. Test valves (Operation Test and Hydrostatic Tests) at the manufacturer's plant in accordance with AWWA Standard C515. If requested, provide the OWNER with certified copies of all tests prior to shipment. The OWNER reserves the right to observe all tests.

C. Valves shall have mechanical joint ends unless otherwise designated on the Drawings or approved by the OWNER.

D. The valves shall be designed for a minimum differential pressure of 150 psi and a minimum internal test pressure of 300 psi, unless otherwise noted on the Drawings. Make all valves tight under their working pressures after they have been placed and before the main is placed in operation. Any defective parts shall be replaced at the CONTRACTOR's expense.

E. Acceptable Manufacturers are listed in the Supplemental Technical Specifications.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the valves in strict accordance with the requirements contained in Specification Section 15000, Drawings, and Standard Details.

B. Install valve box in accordance with Specification Section 15130.

3.2 PROTECTION

After installation of the valve all external bolts shall be protected as described in Technical Specification 15130-2.03 before backfilled in accordance with Specification Section 15000. If polyethylene is applied to the pipe, the entire valve shall be encased in the polyethylene encasement prior to backfill. The polyethylene encasement shall be installed up to the operating nut leaving the operating nut exposed and free to be operated.

3.3 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price for each new valve, by type and size, complete in place. The Contract Unit Price shall include all labor, material, and equipment for the valve installation including excavation and backfilling, valve box installation, protection, location tape, tracer wire, rough grading, removal of excess excavated material, and any other ancillary Work related to valve installation.

Note: This item does not include hydrant valves.

–END OF SECTION 15150–

SECTION 15155

BUTTERFLY VALVES

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing butterfly valves as shown on the Drawings.

1.2 RELATED WORK

A. Specification Section 02210 – Trenching, Backfilling and Compacting

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

Refer to current standards:

A. AWWA C504, C111, C550

1.4 SUBMITTALS

A. Submit shop drawings and manufacturer's data

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 BUTTERFLY VALVES

A. Valves shall be rubber-seated butterfly valves and shall conform to AWWA Standard C504. Valves shall conform to Class 150B of AWWA C504 when the working pressure is less than 150 psi. Valves shall conform to Class 250B of AWWA C504 when the working pressure is greater than 150 psi.

B. Valve bodies shall be ductile iron with mechanical joint ends. Mechanical joint ends shall conform to AWWA Standard C111. All valve materials shall meet the requirements of NSF 61. Valves shall open (left or right) in accordance with **Table 1 of the Supplemental Technical Specifications**.

C. Valve shafts shall consist of one-piece units extending through the discs of 18-8 stainless steel Type 303 or 304. Shaft diameter shall be in accordance with Table 3 of AWWA Standard C504.

1. Valve discs shall be Ni-Resist, Type 1, or cast iron with stainless steel edges.

2. Valve seats shall be hycar or natural rubber mounted in the valve body.

3. Valve bearings shall be nylon or Teflon.

D. The valve interior and exterior shall be epoxy coated at the factory by the valve manufacturer in accordance with AWWA Standard C550 (6-8 mil average, 4 mil minimum).

E. All elastomers used in the butterfly valves must be suitable for service in the following water conditions:

1. Chlorine concentration up to 12 mg/L.

2. Chloramine concentrations up to 6 mg/L.

3. Ozone concentrations up to 2.0 mg/L (AWWA Standard says 0.5 ppm)

4. pH range of 4-11.

F. Manual buried operators, if provided, shall be either worm gear or traveling nut type and shall be furnished with 2-inch AWWA nuts and extension shafts. Input required at nuts to produce specified output torque shall be less than 150 foot-pounds. Operators shall be designed to withstand an input at the nut of 300 foot-pounds without damage to any operator components.

G. Test valves (Operation Test and Hydrostatic Tests) at the manufacturer's plant in accordance with AWWA Standard C504. If requested, provide the OWNER with certified copies of all tests prior to shipment. The OWNER reserves the right to observe all tests.

H. Acceptable Manufacturers are listed in the most current version of the Supplemental Technical Specifications.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the valves in strict accordance with the requirements contained in Specification Section 15000, Drawings, and Standard Details.

B. Install valve box in accordance with Specification Section 15130.

3.2 PROTECTION

After installation of the valve all external bolts shall be protected as described in Technical Specification 15130-2.03 before backfilled in accordance with Specification Section 15000. If polyethylene is applied to the pipe, the entire valve shall be encased in the polyethylene encasement prior to backfill. The polyethylene encasement shall be

installed up to the operating nut leaving the operating nut exposed and free to be operated.

3.3 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price for each new valve, by size, complete in place. The Contract Unit Price shall include all labor, material, and equipment for the valve installation including excavation and backfilling, valve box installation, protection, location tape, tracer wire, rough grading, removal of excess excavated material, and any other ancillary Work related to valve installation.

–END OF SECTION 15155–

SECTION 15170

TAPPING SLEEVES, SADDLES AND VALVES

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing tapping sleeves, tapping valves, and tapping saddles as shown on the Drawings.

1.2 RELATED WORK

A. Specification Section 02210 – Trenching, Backfilling and Compacting

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

Refer to current standards:

A. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service

B. AWWA C550 – Protective Interior Coatings for Valves and Hydrants

C. AWWA C207 – Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)

D. AWWA C223 – Fabricated Steel and Stainless-Steel Tapping Sleeves

E. Manufacturer's Standardization Society (MSS) Standard Practice 60 – Connecting Flange Joints Between Tapping Sleeves and Tapping Valves

F. Manufacturer's Standardization Society (MSS) Standard Practice 124 – Fabricated Tapping Sleeves

1.4 SUBMITTALS

A. Submit shop drawings and manufacturer's data.

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 GENERAL

A. All tapping sleeves, saddles and valves shall be designed for a working pressure of at least 250 psi for 12-inch and smaller. The valves shall be designed for a minimum differential pressure of 250 psi and a minimum internal test pressure of 500 psi unless otherwise noted on the Drawings.

B. Verify the type of existing pipe and the outside diameter of the pipe on which the tapping sleeve is to be installed.

2.2 TAPPING VALVES

A. The horizontal tapping valves, 3-inch through 12-inch, shall conform to the applicable requirements of AWWA Standard C509. The tapping valves, 3-inch through 12-inch, shall be ductile iron body, resilient-seated, nut-operated, non-rising stem gate valves suitable for buried service. The valve interior and exterior shall be epoxy coated at the factory by the valve manufacturer in accordance with AWWA Standard C550 (6-8 mil average, 4 mil minimum). The tapping valves shall have mechanical joint inlets with mechanical joint outlets, enclosed bevel gears, bypass valve, rollers, tracks and scrapers. All valves furnished shall open (left or right) in accordance with the **Table 1 of the Supplemental Technical Specifications**.

B. Test valves (Operation Test and Hydrostatic Tests) at the manufacturer's plant in accordance with AWWA Standard C509. If requested, provide the OWNER with certified copies of all tests prior to shipment. The OWNER reserves the right to observe all tests.

C. Acceptable Manufacturers are listed in the most current version of the Supplemental Technical Specification.

2.3 STAINLESS STEEL TAPPING SLEEVES

Stainless steel tapping sleeves shall meet the requirements of MSS SP-124 and AWWA C223 and be suitable for use with the tapping valves listed in this Specification. Tapping sleeves shall provide a reinforced outlet gasket made of ASTM D 2000 rubber, include a ¾" NPT test plug, have a mechanical joint outlet, and be compatible with multiple pipe materials including, but not limited to, ductile iron, steel, cast iron, asbestos cement, and PVC. When tapping cast iron or asbestos cement mains, and the outlet is 12" or less, a full circumferential seal or gasket shall be used in place of the outlet gasket.

A. Acceptable Manufacturers are listed in the Supplemental Technical Specifications.

2.4 CONCRETE PIPE TAPPING SLEEVES

Concrete pipe tapping sleeves shall meet the requirements of MSS SP-124, AWWA C223 and AWWA M-9 Manual and be suitable for use with the tapping valves listed in this Specification. Tapping sleeves shall provide a reinforced outlet gasket made of ASTM D 2000 rubber.

A. Acceptable Manufacturers are listed in the Supplemental Technical Specifications.

2.5 TAPPING SADDLES

Unless otherwise specified by the Drawings, tapping saddles shall conform to the requirements of AWWA Standard C800 for the High-Pressure class tapping saddles. Tapping saddles shall have a brass or bronze body and consist of ductile iron outlet castings, attached to the pipeline with high strength stainless steel straps. Castings shall be sealed to pipeline with O-ring seals. Saddles shall have ANSI A21.10 flanged outlets counterbored for use with tapping valves and tapping equipment.

A. Acceptable Manufacturers are listed in Supplemental Technical Specifications.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the tapping sleeves, saddles, and valves in strict accordance with the requirements contained in Specification Section 15000 and Drawings.

B. Install the tapping sleeves, tapping saddles, and tapping valves in accordance with the manufacturer’s instructions. The tapping procedure is to be in accordance with the tapping machine manufacturer's instructions.

C. Install valve box in accordance with Specification Section 15130.

3.2 PROTECTION

After installation of the tapping sleeve, tapping saddle, and tapping valve all external bolts except the operating nut shall be protected as described in Technical Specification 15130-2.03 before backfilled in accordance with Specification Section 15000. If polyethylene is applied to the pipe, the entire valve shall be encased in the polyethylene encasement prior to backfill. The polyethylene encasement shall be installed up to the operating nut leaving the operating nut exposed and free to be operated.

3.3 PRELIMINARY TESTING

Perform a hydrostatic test of the tapping sleeve and valve assembly in accordance with Specification Section 15030 after installation of the tapping sleeve and valve, but prior to making the tap. The test shall be made with the valve open using a tapped mechanical joint cap. No leakage is acceptable. The test pressure shall be maintained for a minimum of 15 minutes. Close the valve, remove the cap and observe for leakage at the valve seal. No leakage is acceptable.

Perform hydrostatic test of tapping saddles in accordance with AWWA Standard C800.

3.4 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price for each new tapping sleeve and valve, by size, complete in place. The Contract Unit Price shall include all labor, material, and equipment for the tapping sleeve and valve installation including excavation and backfilling, thrust restraint, valve box installation, protection, location tape, tracer wire, rough grading, removal of excess excavated material, and any other ancillary Work related to tapping sleeve and valve installation.

Note: This item does not include service line taps.

–END OF SECTION 15170–

SECTION 15175

LINE STOPS

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing Line Stops as shown on the Drawings.

1.2 RELATED WORK

A. Specification Section 02210 – Trenching, Backfilling and Compacting

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 15170 – Tapping Sleeves, Saddles, and Valves

1.3 SUBMITTALS

A. Action Submittals: Submit the following:

1. Product Data:

a. Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of proposed pipe and pipe fitting. For all existing pipes to be tapped or line-stopped, submit piping schedule showing field- verified pipe location, depth, material, size, exact outside diameter, condition, and all other information pertinent to performing line stopping services.

PART 2 PRODUCTS

2.1 LINE STOP FITTINGS AND TEMPORARY VALVES

A. The permanent carbon steel or cast-iron line stop fittings such as the mechanical tapping sleeves, blind flanges and completion plugs shall be shop primed and finish coated in the field with an Illinois EPA approved for potable water liquid epoxy coating. The interior and exterior surfaces shall be coated. The coatings shall be applied in accordance with the coating manufacturer's recommendations and AWWA Standard C-210-92. All bolts, nuts, washers or connection devices used on the permanent line stop fittings shall be corrosion resistant 316 stainless steel.

1. Line stop fitting:

a. Two-part saddle weldment fabricated from ASTM A285, Grade C steel.

b. Outlet shall be sealed with blind flanges.

c. Minimum saddle wall thickness shall be 3/8 inch.

d. All mild steel parts shall be stressed relieved after welding and coated with a fusion-bonded epoxy.

1) Nozzle flanges shall be machined from 150 lb forged steel flanges, ASTM A181 or A105.
2) The design of the nozzle flange shall be such that it will receive, securely retain, and pressure seal a completion plug installed under pressure through the Line Stop Valve.
3) After welding and stress relief, the nozzle and flange shall be bored to provide a pressure-tight seal with the O-Ring contained in a groove in the completion plug.
4) A single ¾" NPT pipe coupling shall be welded to each nozzle for pressure test purposes.

2. The upper saddle plate shall be sealed to the outside of the force main by means of a resilient gasket cemented inside a groove in the nozzle half of the fitting. The gasket shall be located adjacent to and concentric with the bore of the nozzle. It will be molded with one or more concentric lips that will seal more tightly against the main with an increase in fluid pressure.

3. The fitting halves shall be drawn together by twelve ¾" diameter Type 304 stainless steel bolts, nuts, and washers.

4. The design of the completion plug shall be such that it will carry an O-Ring to pressure seal against the interior of the nozzle and be mechanically held in place in the nozzle flange. The plug shall be capable of later removal, under pressure, in the event that a Line Stop may have to be reinstalled. The plug shall be made from ductile iron.

5. A suitable blind flange shall be fabricated from ASTM A-36 mild steel plate and coated with fusion-bonded epoxy. Type 304 stainless bolts and nuts shall be provided to secure the blind flange to the nozzle flange after the completion plug has been installed.

B. Blow Down/Equalization Fittings:

1. Pressure taps shall be provided downstream from line stop on the water main. This pressure connection will allow quick determination of shutdown adequacy and allow draining.

2. In order to remove a line stop-plugging head, water pressure must be equalized across that head. The equalization tap provides access to the depressurized main for purposes of refilling and final pressure equalization.

3. Outlets shall be sealed with screwed pipe caps or blind flanges at option of OWNER.

C. Sleeve, Concrete Thrust Blocking, and Appurtenances:

1. Line Stop CONTRACTOR is responsible for furnishing and installing sleeve, concrete thrust blocking, and all necessary appurtenances for completion of each line stop.

2. After construction is completed on the water main, Line Stop CONTRACTOR is responsible for removal of all equipment and any appurtenances not left in place permanently.

D. Installed line stopping fittings shall be leak tested before any pipe cutting is initiated. The leak test pressure shall be determined by the line stopping equipment installation subcontractor. Any leaks shall be repaired before tapping the pressurized pipe.

PART 3 EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall power wire brush and grind the exterior of the main to remove any debris, corrosion deposits, or other surface irregularities that might interfere with proper seating and sealing of each line stop fitting against each main.

B. Any structural defects in main, service connections, appurtenances or adjacent utilities that could interfere with the line stop installation shall be immediately reported by the CONTRACTOR to the OWNER.

C. CONTRACTOR shall fit saddle assemblies to main, thoroughly checking for proper fit to main.

D. Under no circumstances shall CONTRACTOR attempt to force, reshape, or bend saddle plates by excessive tightening of saddle studs while line stop fitting is assembled around the main.
   a. Any retrofitting shall be accomplished with the fitting removed from the main.
   b. Any damage to fitting, accessories or main shall be repaired at CONTRACTOR's expense to the approval of the OWNER.

E. The CONTRACTOR will excavate, dewater (if necessary), and expose the water main.

F. The CONTRACTOR shall clean the exterior of the main at location of each line stop. If main is heavily corroded; or if utilities will interfere with fittings, support/reaction blocking, or equipment; move location up or downstream to structurally sound pipe.

1. The CONTRACTOR shall verify pipe size and condition.

2. The CONTRACTOR shall place approved concrete thrust restraints and supports.

3. Backfill and restoration by the OWNER.

G. The CONTRACTOR shall:

1. Assemble line stop fitting around the main.

2. Pressure test all fittings and saddles per ENGINEER's specifications. Pressure tap blow down and equalization fitting.

3. Pour concrete support and reaction blocking at the line stop. Allow to cure per ENGINEER's instructions.

4. Install temporary line stop tapping valve and tapping machine. Pressure tap line stop. Remove tapping machine.

5. Mount line stop machine.

6. Test for flow at equalization fitting. Use pitot-type instrument, if necessary.

7. When flow ceases, insert Line Stop into pipe. Test for good shut down at equalization and blow down fittings. If a complete shutdown is not achieved, the stop head shall be withdrawn, and the sealing element changed in order to achieve a better stop. This procedure shall be repeated as many times as necessary to achieve the best possible shutdown

8. Install the blow down and equalization fittings.

9. Drain the depressurized pipe.

10. Cut pipe; perform required work on depressurized pipe.

11. Refill downstream piping through blow down tap. If necessary, bleed air at equalization tap.

12. Equalize pressure across line stop plugging head. Retract plugging head. Close temporary valve. Remove line stop machine.

13. Install completion machine; open Line Stop valve. Insert completion plug into flange of line stop fitting.

14. Remove completion machine and temporary valve. Install blind flange.

15. Repeat completion operations at blow down and equalization fittings.

3.2 CLEANING, FLUSHING, INSPECTING

A. Tapping and line stopping assemblies: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

1. Inspect pressure piping in accordance with procedures of ASME B31.

3.3 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price for each new line stop, complete in place. The Contract Unit Price shall include all labor, material, and equipment and incidentals for the line stop installation This work includes but is not limited to:

A. Furnishing and installation and removal of all temporary piping, valves, couplings, bolts, gaskets, supports, thrust blocks, and concrete encasement required to complete the line stopping activities associated with this project.

B. Hydrostatic pressure testing and disinfection of all lines and fittings associated with the temporary bypass piping and line stopping.

–END OF SECTION 15175–

SECTION 15180

FIRE HYDRANTS

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing fire hydrant assemblies at locations shown on the Drawings and in accordance with Standard Details and local regulations. The fire hydrant assembly includes the connection to the water main, hydrant valve and valve box, anchor couplings, hydrant lateral, hydrant extensions, and the fire hydrant (including base and hydrant barrel). The OWNER reserves the right to provide the fire hydrant (including base and hydrant barrel). A list of additional materials to be provided by the OWNER, if applicable, is shown in Specification Section 01000.

1.2 RELATED WORK

A. Specification Section 01000 – Summary of Work

B. Specification Section 02210 – Trenching, Backfilling and Compacting

C. Specification Section 15105 – Ductile Iron Pipe and Fittings

D. Specification Section 15000 – Piping – General Provisions

E. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

Refer to current standards:

A. AWWA C502 – Dry Barrel Fire Hydrants

B. AWWA C550 – Protective Interior Coatings for Valves and Hydrants

1.4 SUBMITTALS

A. Submit shop drawings and manufacturer’s data

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 MATERIAL

A. All fire hydrants shall be ductile iron and conform to the requirements of AWWA C502, traffic-model break-away type fire hydrants.

B. Contact the local water district and obtain written fire hydrant mechanical details for the water district prior to ordering any fire hydrants for the Work. All fire hydrants shall open left or right as required and be clearly marked on the top of the hydrant with a 1-1/2-inch pentagon top nut and have not less than two (2) O- ring stem seals. The number and sizes of hose nozzle outlets is dependent on the local regulation. (Most Districts use two (2) bronze male threaded 2-1/2-inch hose outlet nozzles and one (1) bronze male threaded 4-1/2-inch pumper outlet nozzle with American National Fire Hose Connection Screw Threads (NH).) The hydrant shall be break-away traffic flange, 5-1/4-inch valve opening, 6-inch mechanical joint pipe connection. The hydrant interior and exterior shall be epoxy coated at the factory by the hydrant manufacturer in accordance with AWWA Standard C550 (6-8 mil average, 4 mil minimum).

C. All hydrant materials shall meet the requirements of NSF 61.

D. Acceptable manufacturers and model numbers are listed in the Supplemental Technical Specifications.

PART 3 EXECUTION

3.1 INSPECTION PRIOR TO INSTALLATION

A. Contractor shall inspect all fire hydrants upon receipt. Cycle each hydrant to full open and full closed positions to ensure that no internal damage or breakage has occurred during shipment and handling. Check all external bolts for proper tightness.

B. After inspection, close the hydrant valves and replace the outlet nozzle caps to prevent the entry of foreign matter. Protect stored hydrants from the weather/elements with the inlets facing downward.

3.2 INSTALLATION

A. The location shall provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. When placed behind the curb, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than eighteen to twenty-four inches, depending on local requirements, from the gutter face of the curb. All hydrants shall stand plumb with the pumper nozzle facing the curb. Set hydrants with nozzles at least eighteen inches above the finished grade as shown on the Standard Details. Set the break flange at least two but no more than six inches above finished grade, or as directed by the ENGINEER. Connect each hydrant to the main with a six-inch branch connection controlled by an independent six inch gate valve, unless otherwise shown on the Drawings. All hydrant assemblies must be restrained from the hydrant to the main.

B. The OWNER may authorize hydrant protection using steel pipe bollards when hydrant installations have a greater than normal exposure to vehicular damage (e.g., parking lot installations, unusual driving situation, etc.). Install all such protection designated by the ENGINEER. Locate bollards as necessary adjacent to

the hydrant and in such a manner as to not interfere with the ability to connect hoses or operate the hydrant as shown in the Drawings. Additionally, locate the bottom of the bollard and encasement above the hydrant supply piping and valve to prevent the possibility of damage to the piping should the bollard be displaced when hit.

C. Unless otherwise directed by the OWNER, excavate a drainage pit two feet in diameter and two feet deep below but not beyond each hydrant. Fill the pit with compacted Coarse Aggregate, as described in Specification Section 02210, under and around the base of the hydrant to a level 12 inches above the hydrant drain opening. No hydrant drainage pit shall be connected to a sewer.

D. Cover the drainage area with geotextile fabric. The fabric shall completely isolate the gravel or stone so that no fill material or adjacent earth comes in contact with pit material.

E. Notify the ENGINEER of situations where the ground water table is above the drain opening of dry barrel hydrants. If directed by ENGINEER, plug the drain opening using a method acceptable to the hydrant manufacturer. No drainage pit is required when the hydrant drain is plugged. Mark the hydrant, in a manner acceptable to the OWNER, to indicate that the drain opening has been plugged. Operation of a hydrant with plugged drain leaves the hydrant barrel full of water. Pump the hydrant barrel dry after each use.

F. Install connection to water main and hydrant lateral in accordance with Specification Sections 15000, 15130, 15150, and Standard Details.

G. Install hydrant valve and valve box in accordance with Specification Sections 15000, 15130, and 15150.

H. If thrust blocks are called for by the Drawings or the ENGINEER, reaction or thrust blocking at the base of each hydrant must not obstruct the drainage outlet of the hydrant. The size and shape of concrete thrust blocking and the number and size of tie rods, when required, shall be approved by the ENGINEER. Use the thrust blocking material specified in Specification Section 03300. See Specification Section 15000 for tie rod requirements.

I. Paint all hydrants above the bury line in accordance with the local operations standards listed in the Supplemental Technical Specifications. Touch up paint shall be applied upon completion of installation as needed. Take extreme care to avoid getting any paint on the “O” ring under the top operating nut or on the hydrant nozzles. Should paint be found on the “O” ring, the Contractor shall remove the paint and replace the “O” ring at no additional cost to the OWNER. Any paint on the hydrant nozzles shall be removed at the Contractor’s expense.

3.3 TESTING

After installation and before backfilling (and after pressure testing the water main) test the hydrant as follows:

A. Pressure Test

1. Open the hydrant fully and fill with water; close all outlets.
2. To prevent caps from being blow off dry-barrel hydrants and to prevent other possible damage, vent air from the hydrant by leaving one of the caps slightly loose as the hydrant is being filled. After all air has escaped, tighten the cap before proceeding.
3. Apply line pressure.
4. Check for leakage at flanges, nozzles and operating stem.
5. If leakage is noted, repair or replace components or complete hydrant until no leaks are evident.

B. Drainage Test for Dry Barrel Hydrants

1. Following the pressure test, close hydrant.
2. Remove one nozzle cap and place pylon or hand over nozzle opening.
3. Drainage rate should be sufficiently rapid to create a noticeable suction.
4. After backfilling, operate the hydrant to flush out any foreign material.
5. Tighten nozzle caps, then back them off slightly so that they will not be excessively tight; leave tight enough to prevent removal by hand.

3.4 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price for each new fire hydrant assembly complete in place. The Contract Unit Price shall include all labor, material (unless provided by the OWNER), and equipment for the hydrant assembly installation including excavation and backfilling, valve box installation, protection, thrust restraint, location tape, tracer wire, rough grading, removal of excess excavated material, painting, and any other ancillary Work related to fire hydrant assembly installation.

–END OF SECTION 15180–

SECTION 15190

AIR RELEASE, BLOW-OFF OUTLETS AND RELATED COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing air release and blow-off outlets at the locations shown on the Drawings and in accordance with Standard Details.

1.2 RELATED WORK

A. Specification Section 02210 – Trenching, Backfilling and Compacting

B. Specification Section 15000 – Piping – General Provisions

C. Specification Section 15200 – Service Lines

D. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

Refer to current standards:

A. AWWA C512

1.4 SUBMITTALS

A. Submit shop drawings and manufacturer's data

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

2.1 COMBINATION AIR/VACUUM RELEASE VALVES

A. Combination valves shall be double acting to prevent accumulation of air in the pressurized main and to permit air to enter the pipe when pressure seriously drops. Bodies shall be cast iron with stainless steel floats. Not for use in flood prone areas.

B. Acceptable Manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.2 BLOW-OFF FLUSHING HYDRANT ASSEMBLY

A. Blow off assembly for underground applications shall be designed to fit within a standard valve box. In areas prone to cold weather, they shall be self-draining and non-freezing. All working parts shall be serviceable from above with no digging required. They shall be operated such that the device goes from full open to full close in a ¼ clockwise turn.

B. Acceptable Manufacturers are listed in the most current version of the Supplemental Technical Specifications.

2.3 RELATED COMPONENTS

See Specification Section 15200 for copper pipe, corporation stops, curb stops, curb boxes and miscellaneous service line fittings.

PART 3 EXECUTION

3.1 INSTALLATION

A. See Specification Section 15000 for piping general provisions. See Specification Section 15200 for information about selected components (copper pipe, corporation stops, curb stops, curb boxes) common to service lines. See Standard Details showing installation of manual air release, air/vacuum release valve assemblies and blow-off flushing hydrant assemblies.

B. Excavate, backfill, and restore the surface in accordance with Division 2 of these Specifications.

C. Install copper pipe between the corporation stop and the curb stop or air release valve location making only gradual changes in grade or alignment, as required. Do not make bends greater than 15 degrees in any direction. Install curb stops with the operating nut in the vertical position

D. Open the corporation stop slowly to fill the service line. When the line is full and all air has been removed, completely open the corporation. Perform a visual leak inspection of all piping, fittings, and taps prior to backfilling. Zero leakage is allowed in 10 minutes.

E. Provide polyethylene encasement, or other protective wrap approved by the OWNER, on all service lines (valves, stops, etc.) unless they are not subject to aggressive soils. Polyethylene encasement shall extend along the service line for its entire length.

F. Install the curb box centered over the nut. Install and adjust the curb boxes to be flush with finished grade. Install and lock the lids on the curb boxes.

3.2 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price for each new air/vacuum release valve and each permanent blow-off/flushing hydrant assembly complete in place. The Contract Unit Price shall include all labor, material, and equipment for the installation including excavation and backfilling, valve box/curb box/ meter box installation, connection to the water main, thrust restraint, rough grading, removal of excess excavated material, and any other ancillary Work related to the installation. **Temporary blow-off outlets are considered incidental to the installation of the water main.**

–END OF SECTION 15190–

SECTION 15195

WATER MAIN ABANDONMENT

PART 1 GENERAL

1.1 SUMMARY

This section includes abandoning existing water mains, cutting & capping existing water mains, and removing associated items as shown on the Drawings and Standard Details. When shown on the Drawings or required by local agencies place flowable fill in water mains to be abandoned.

1.2 RELATED WORK

A. Specification Section 02210 – Trenching, Backfilling, and Compacting

B. Specification Section 03300 – Cast-In-Place Concrete

C. Specification Section 15000 – Piping-General Provisions

D. Specification Section 15150 – Ductile Iron Pipe & Fittings

1.3 SUBMITTALS

A. CONTRACTOR's plan for filling abandoned pipe completely with flowable fill, if required.

B. Submit in accordance with Section 01300

PART 2 PRODUCTS

2.1 FLOWABLE FILL

A. Flowable fill for abandoned water mains shall meet the requirements of flowable fill for trench backfill in accordance with Specification Section 02210, or as approved by OWNER.

PART 3 EXECUTION

All work shall be coordinated with OWNER and ENGINEER. Provide a minimum of 72 hours' notice prior to beginning abandonment Work. The Work described in this section shall not proceed until the ENGINEER has determined that all hydrants and customer service lines are transferred to the new main and placed in service.

3.1 ABANDONING WATER MAIN

A. CONTRACTOR shall have all labor, equipment, and material on site for all reasonable water main abandonment possibilities. Excavate at water main and locate the connection to the water main to be abandoned or point of abandonment. ENGINEER shall determine type of abandonment to be performed and its exact location for each water main abandonment. OWNER will be responsible for operating valves necessary for isolating the abandonment.

B. Water main to be abandoned shall be physically separated from the rest of the system at the points determined by the ENGINEER. Cut and remove a sufficient length of the pipe to provide access for installing cap and thrust restraint on the portion of the main to remain in service and, if required, placing flowable fill in the portion of water main to be abandoned. The abandoned water main shall be drained and the water safely discharged. Install the type of abandonment determined by the ENGINEER and install thrust restraint.

C. Remove valve boxes on all valves located on abandoned water main.

D. When shown on the Drawings or required by local agencies, the abandoned main shall be filled with flowable fill. The main shall be completely filled, leaving no voids.

E. Backfill excavations in accordance with Specification Section 02210.

3.2 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price for each abandonment by size. The Contract Unit Price shall include all labor, material, and equipment for the abandonment of water main including excavation, backfill, rough grading, removal of pipe and valve boxes, and any other ancillary Work related to abandoning water main. Any required line stops will be considered a separate pay item.

–END OF SECTION 15195–

SECTION 15200

SERVICE LINES

PART 1 GENERAL

1.1 SUMMARY

This section includes furnishing and installing the water service line and ancillary items originating at the water main and terminating at the property line (typically at a curb stop/meter box) at locations shown on the Drawings or described in the Supplemental Technical Specifications. This section also includes furnishing and installing required items for Service Renewals as determined by the OWNER/ENGINEER. This Specification Section does not include service lines or meter installation beyond the property line. Refer to Standard Details for typical service line installation(s).

1.2 RELATED WORK

A. Specification Section 01000 – Summary of Work

B. Specification Section 02210 – Trenching, Backfilling and Compacting

C. Specification Section 15130 – Piping Specialties

1.3 REFERENCES

Refer to current standards:

A. AWWA C800 – Underground Service Line Valves and Fittings

B. Illinois State Plumbing Code

1.4 SUBMITTALS

A. Product Data – Submit manufacturer's data on the following:

1. Service line material
2. Corporation stops
3. Curb stops
4. Curb boxes
5. Meter boxes
6. Meter box frame and lid
7. Meter setter

B. Submit in accordance with Section 01300.

PART 2 PRODUCTS

All Products described below shall meet the requirements of NSF 61.

Research has documented that certain pipe materials (such as polyethylene) and certain elastomers (such as those used in gasket material and packing glands) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied under this Specification Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation, the CONTRACTOR identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify the OWNER immediately. Stop installing piping in the area of suspected contamination until direction is provided by the OWNER.

2.1 COPPER SERVICE LINE MATERIAL

Copper pipe shall be Type L or Type K, as specified on the Drawings or Supplemental Technical Specifications, meeting the requirements of ASTM Standard B88. The pipe size (¾", 1", 1-½", or 2") and type are to be determined by the ENGINEER. Type K is normally required in corrosive environments where polyethylene is not allowed.

Acceptable manufacturers are listed in the Supplemental Technical Specifications.

2.2 POLYETHYLENE SERVICE LINE MATERIAL

Polyethylene service line material shall be Class 160 (minimum), ultra-high molecular weight, as specified on the drawings or Supplemental Technical Specifications, conforming to AWWA Standard C901. Pipe sizes (¾", 1", 1-½" and 2", copper tube size (CTS) or iron pipe size (IPS)) to be determined by the ENGINEER. PE service lines will typically not be allowed in systems with surface water sources due to temperature fluctuations. PE service lines will typically not be allowed in high pressure systems.

Acceptable manufacturers are listed in the Supplemental Technical Specifications.

2.3 CORPORATION STOPS

Corporation stops shall be of the brass, ball valve type manufactured in accordance with AWWA Standard C800. The inlet connection shall have standard AWWA tapered threads unless otherwise required by the OWNER/ENGINEER. The outlet connection shall be copper or brass compression connection end or pack joint for polyethylene pipe, as required. Dielectric unions shall be used to prevent transfer of any electrical stray currents from metallic service lines to metallic water main. The sizes shall range from ½" to 2" and shall match the size of specified service line material.

Acceptable manufacturers are listed in the Supplemental Technical Specifications.

2.4 CURB STOPS

Curb stops shall be bronze body construction, ball valves, with Double O-ring stem seals. Curb stops shall conform to AWWA Standard C800. End connections shall be

suitable for copper or brass compression connection or pack joint for polyethylene pipe, as required. Sizes shall be from ¾" to 2" and shall match the service line size.

Acceptable manufacturers are listed in the Supplemental Technical Specifications.

2.5 CURB BOXES

Curb boxes shall be standard cast iron, sliding or screw type, 1" or 2-½" as required, complete with lid and head bolt. Boxes shall be adjustable from 18-inches to 66-inches. The box size will be determined by the OWNER/ENGINEER.

Acceptable manufacturers are listed in the Supplemental Technical Specifications.

2.6 METER BOX/METER PIT

Meter boxes shall be a high quality, heavy duty, crush resistant plastic pipe. They must have a dual-wall construction with a smooth, white interior, a ribbed/corrugated exterior, and shall be notched on the bottom sides of the pit.

Acceptable manufacturers are listed in the Supplemental Technical Specifications.

2.7 METER BOX FRAME AND LID

Meter box frames and lids shall be cast iron and have a non-recessed lid opening. The meter box frames must be compatible with the meter box.

Acceptable manufacturers are listed in the Supplemental Technical Specifications.

2.8 METER SETTER/METER YOKE

Meter Setters shall be manufactured and tested in accordance with applicable section of AWWA C800 and maintain electrical ground continuity (Bonded).

Acceptable manufacturers are listed in the Supplemental Technical Specifications.

2.9 MISCELLANEOUS SERVICE LINE FITTINGS

Miscellaneous service line fittings such as couplings, adapters, saddles, bends, plugs, service line electrical insulators, etc. shall conform to AWWA Standard C800.

Acceptable manufacturers are listed in the Supplemental Technical Specifications.

PART 3 EXECUTION

3.1 POTHOLE INVESTIGATION

A. CONTRACTOR shall pothole all existing services 2 feet on the owner side of the water meter and a minimum of 4 feet on the customer side of the meter to determine material.

B. Work includes hydro-vac excavation, rough grading, and removal of excess excavation materials per OWNER specifications, replacement of driveway, roadway, or gravel to existing condition, and any other ancillary work related to potholing to replace the work area to existing conditions.

C. Water will be supplied by the OWNER.

D. Service line size and material shall be documented by both CONTRACTOR and ENGINEER and delivered to OWNER upon request.

E. If, at any time, lead services are encountered, CONTRACTOR shall immediately coordinate with the OWNER and refer to Specification 15205. CONTRACTOR shall take care to not disturb or agitate lead service line.

3.2 INSTALLATION OF CORPORATION STOPS

A. Use experienced craftsmen familiar with installation of water service lines when tapping water mains. Make all taps with a suitable tapping machine (Mueller, Ford, Hays or Dresser type) using the proper combined drill and tap. Handheld drilling equipment is not acceptable.

B. Before making the tap, inspect corporation stops for cleanliness, damaged threads, and proper operation of the ball valve prior to installation. Do not install corporation stops that fail this inspection.

C. The main may be tapped along the top half of the pipe as directed by the ENGINEER or as shown on Standard Details. Use a tapping saddle when the water main wall thickness or material (plastic, concrete or asbestos cement pipeline material) make it unsuitable for direct tapping. Taps should be a minimum of 18” away from pipe bells.

D. In the case of multiple services of small diameter (less than 2” diameter), corporation stops shall be at least 12 inches apart and at least 22-½ degrees above or below the location of any adjacent tap(s). Curb stops and boxes and/or meter boxes shall be at least one foot apart. In the case of large diameter multiple services, tap at least 24 inches apart and at least 22-½ degrees above or below the location of any adjacent tap(s).

E. Install all corporation stops so that between 2 and 3 threads extend beyond the inside wall of the main. If necessary, make a test tap with the boring bar marked to the proper depth. The corporation stop, when properly installed, will not be shouldered with the main. Do not use lubricants of any type when installing the corporation stop.

F. Use the procedures outlined in AWWA Standard C600 or the DIPRA Field Polyethylene Installation Guide for installing taps on grey iron or ductile iron mains encased in polyethylene.

3.3 INSTALLATION OF SERVICE LINES AND FITTINGS

A. Excavate the service line trench in accordance with Division 2 of these Specifications. Where augering, directional drilling, or moling is permitted follow guidelines provided by the equipment manufacturer including making a proper size hole to launch and receive the unit. If moling, directional drilling, or augering is employed, take appropriate precautions to avoid damaging other utilities and disturbing the unexcavated surface. CONTRACTOR is responsible for locating, identifying, and utilizing appropriate precautionary measures to protect existing utilities in accordance with State and Local requirements.

B. Install all services straight and at right angles to the main. If this cannot be accomplished, consult OWNER.

C. All trench services shall be installed with identification tape in accordance with Specification Section 02210.

D. All PE services shall be installed with tracer wire in accordance with Specification Section 02210.

E. All plastic service line connections shall use insert stiffeners of the appropriate length and size.

F. Coupling new utility side service line to existing service lines are not permitted under paved surfaces or within 10 feet of the meter or curb stop, unless authorized by the OWNER.

G. All service line size and material, on both sides of the meter, shall be verified and recorded.

3.4 INSTALLATION OF CURB STOPS

A. Install curb stops with the operating nut in the vertical position and the curb box centered over the nut. Install curb boxes plum and adjusted to be flush with finished grade. Install and lock curb boxes immediately after installation.

B. After completion of service line installation, but prior to backfilling, open the corporation stop slowly to fill the line. When the line is full and all air has been removed, completely open the corporation and close the curb stop. Visually inspect all piping, fittings, and taps for leaks. Backfill and restore the surface the service line trench in accordance with Division 2 of these Specifications.

3.5 INSTALLATION OF METER SETTER

A. Always verify an electrically safe environment before continuing work. Please contact owner for recommended procedures.

B. Install meter setter with the shut-off valve in the vertical position and the meter box centered over the valve. Install meter boxes plum and adjusted to be flush with finished grade.

C. After completion of service line installation, but prior to backfilling, open the corporation stop slowly to fill the line. When the line is full and all air has been removed, completely open the corporation, and close the curb stop or inlet valve in meter box. Visually inspect all piping, fittings, and taps for leaks. Backfill and restore the surface of the service line trench in accordance with Division 2 of these Specifications.

3.6 BASIS OF PAYMENT

Payment for “Potholes” will be on a Contract Unit Price basis and contract will be adjusted to actual number of potholes completed. Potholes performed in pavement will be considered a separate unit price.

Payment will be made at the Contract Unit Price for each “Long Service Transfer” and each “Short Service Transfer”. A Long Service Transfer is defined as a tap and new service line when the new water main is located on the opposite side of the street of the unit being re-connected. A Short Service Transfer is defined as a tap and new service line when the new water main is located on the same side of the street of the unit being re-connected. Payment will be made at the Contract Unit Price for each “Service Renewal – Meter Setter”, “Service Renewal – Meter Box”, and “Service Renewal – Meter Box Frame and Lid” as determined by the OWNER/ENGINEER. The Contract Unit Price shall include all labor, material (unless provided by the OWNER), and equipment for the water service line installation including excavation and backfilling, connection to the water main, installation of water service line and fittings, installation of curb stop, installation of meter setter and meter box, protection, location tape, tracer wire, rough grading, removal of excess excavated material, and any other ancillary Work related to water service line installation.

Where an installation is made that a single tap and service line is then split to serve multiple units, the tap and service line will be considered its respective “Service Transfer.” Any improvements to the Meters will be paid by the respective Contract Unit Price. A “Multiple Service Transfer” will be paid for each instance for the pipe and fittings from the service line split to the respective meters or curb stops.

–END OF SECTION 15200–

SECTION 15205

LEAD SERVICE LINE REPLACEMENT

PART 1 GENERAL

1.1 SUMMARY

This section includes additional requirements for replacing lead services lines. Any work described in this section is supplemental to Specification 15200.

1.2 RELATED WORK

A. Specification Section 01000 – Summary of Work

B. Specification Section 02210 – Trenching back Backfilling

C. Specification Section 15130 – Piping Specialties

D. Specification Section 15200 – Service Lines

1.3 REFERENCES

Refer to current standards:

A. AWWA C800 – Underground Service Line Valves and Fittings

B. Illinois State Plumbing Code

1.4 SUBMITTALS

A. Submit data as required in Specification 15200

PART 2 PRODUCTS

All Products described below shall meet the requirements of Specification 15200.

PART 3 EXECUTION

3.1 PRE-REPLACEMENT COORDINATION

A. Prior to commencing replacement of the lead service line, delivery of communication materials must have been completed. Additionally, if replacing the customer side service line, an executed Lead Service Line Agreement must be obtained.

3.2 OWNER-SIDE SERVICE TRANSFER

A. All work shall be in accordance with Specification 15200.

B. The replacement of a lead corporation stop shall be installed a minimum of 18" laterally away from the previous location.

3.3 CUSTOMER-SIDE SERVICE TRANSFER

A. Install new service line from meter pit into, or reasonable distance per ENGINEER's approval, the CUSTOMER's building per Specification 15200. Service line shall be replaced through the foundation and extend not more than 5 feet into the building. Route of new service line shall be coordinated with OWNER, CUSTOMER, and ENGINEER.

B. Connect or reconnect CUSTOMER's service line to meter pit.

C. Connect or reconnect CUSTOMER's service line into existing plumbing.

3.4 FLUSHING PROCEDURES (FOR CONTRACTOR INFORMATION ONLY)

A. Following all Lead Service Line Replacements Flushing and Sampling procedures must be followed:

1. A 30-minute flush of the hose bibb followed by a 30-minute flush of all the cold water taps inside the home. A sample is collected and delivered by the Inspector to the Illinois American Water Engineering Office.

2. If the property owner does not agree to a Full In-Home flush, inspector is to flush at the hose bibb for 60 minutes and collect a sample, both of which are required to be delivered by the inspector to the Illinois American Water Engineering Office.

3. A second property owner elected sample, which must be collected within 72 hours of the first by the CUSTOMER and after 6 hours of no water use in the house, is to be picked up and delivered by the Inspector to the appropriate Illinois American Water Engineering office.

4. Coordination and scheduling with the customer.

B. Upon notification of passing samples, the service transfer will be considered complete.

3.5 BASIS OF PAYMENT

Payment will be made at the Contract Unit Price for each "Long Service Transfer", each "Short Service Transfer", and each "Lead Service Line Replacement – Customer". "Long Service Transfer" and "Short Service Transfer" is paid as described in Specification 15200. A "Lead Service Line Replacement – Customer" is defined as a complete service line replacement from the water meter to the existing shut-off valve inside the building.

The Contract Unit Price for “Lead Service Line Replacement – Customer” shall include all labor, material, and equipment for the water service line installation including excavation and backfilling, connection to the water meter, installation of water service line and fittings, foundation penetration, waterproofing, connection to the shut-off valve, protection, rough grading, removal of excess excavated material, final grading, seeding, pavement restoration, landscaping, and any other ancillary Work related to water service line installation.

Coordination with OWNER and/or CUSTOMER is incidental to these Unit Prices.

–END OF SECTION 15205–

SECTION 17000

PIPING – GENERAL PROVISIONS

PART 1 GENERAL

1.1 DRAWINGS

Dimensions shown on Drawings are approximate only. Verify all piping geometry in the field and to ensure proper alignment and fit of all piping consistent with the intent of the Drawings. Submit field layout drawings as required for approval.

PART 2 PRODUCTS

2.1 CONTRACTOR'S RESPONSIBILITY FOR MATERIAL

A. Examine all material carefully for defects. Do not install material which is known, or thought to be, defective.

B. The CONTRACTOR is responsible to inspect all material. The OWNER reserves the right to inspect all material and to reject all defective material shipped to the job site or stored on the site. Failure of OWNER to detect damaged material shall not relieve the CONTRACTOR from their responsibility for the completed work if it leaks or breaks after installation.

C. OWNER will determine if corrective repairs may be made, or if the material is rejected. OWNER /ENGINEER shall determine the extent of the repairs.

D. Classify defective pipes prior to the OWNER's inspection as follows:

1. Damage to interior and/or exterior paint seal coatings.
2. Damage to interior cement-mortar or epoxy lining.
3. Insufficient interior cement-mortar lining or epoxy thickness.
4. Excessive pitting of pipe.
5. Poor quality exterior paint seal coat.
6. Pipe out of round.
7. Pipe barrel area damaged to a point where pipe class thickness is reduced (all pipe).
8. Denting or gouges in plain end of pipe (all pipe).
9. Excessive slag on pipe affecting gasket seal (DIP).
10. Any visible cracks, holes.
11. Embedded foreign materials.
12. Non-uniform color, density and other physical properties along the length of the pipe.

E. The CONTRACTOR shall be responsible for all material, equipment, fixtures, and devices furnished. These materials, equipment, fixtures, and devices shall comply with the requirements and standards of all Federal, State, and local laws, ordinances, codes, rules, and regulations governing safety and health.

F. The CONTRACTOR shall take full responsibility for the storage and handling of all material furnished until the material is incorporated in the completed project and accepted by OWNER. CONTRACTOR shall be solely responsible for the safe storage of all material furnished to or by him until incorporated in the completed project and accepted by OWNER.

G. Load and unload pipe, fittings, valves, and accessories by lifting with hoists or skidding to avoid shock or damage. Do not drop these materials. Pipe handled on skidways shall not be skidded or rolled against other pipe. Handle this material in accordance with AWWA C600, C605 or C906 whichever is applicable.

H. Drain and store fittings and valves prior to installation in such a manner as to protect them from damage due to freezing of trapped water.

2.2 RUBBERIZED-BITUMEN BASED SPRAY-ON UNDERCOATING

Subject to approval by OWNER, an alternative corrosion protection for exposed buried metal is an aerosol applied rubberized coating. The material shall be rapid dry and specifically designed for corrosion protection. 3M Rubberized Underseal Undercoating 08883 or any equivalent rubberized-bitumen based spray-on undercoating may be used. Follow manufacturer's recommendations for storage and application.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL REQUIREMENTS

A. Lay and maintain all pipe to the required lines and depths on the plans. Provide 42 inches of cover from the top of the pipe barrel to the top of the finished grade unless otherwise authorized by OWNER. Install fittings and valves in strict accordance with the Specifications at the required locations with joints centered, spigots home, and all valve stems plumb. Do not deviate from the required alignment, depth, or grade without the written consent of OWNER.

B. Lay all pipe to the invert elevation specified. The minimum pipe cover shall be as shown on the Drawings or as specified in the Specifications.

C. Do not lay pipe in a wet trench, on subgrade containing frost, or when trench conditions are unsuitable for such work. If all efforts fail to obtain a stable dry trench bottom and OWNER determines that the trench bottom is unsuitable for such work, OWNER will order the kind of stabilization to be constructed, in writing. In all cases, water levels must be at least 6" below the bottom of the pipe.

D. Thoroughly clean the pipes and fittings before they are installed. Keep these materials clean until the acceptance of the completed Work. Lay pipe with the

bell ends facing in the direction of laying, unless otherwise shown on the Drawings, or directed by OWNER. Exercise care to ensure that each length abuts the next in such a manner that no shoulder or unevenness of any kind occurs in the pipeline.

E. Do not wedge or block the pipe during laying unless by written order of OWNER.

F. Before joints are made, bed each section of pipe the full length of the barrel, at the required grade, and at the invert matching the previously laid pipe. Dig bell holes sufficiently large to permit proper joint making. Do not bring succeeding pipe into position until the preceding length is embedded and secure in place.

G. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying. Take up such in-place pipe sections found to be defective and replace them with new pipe. Take up, relaying, and replacement will be at the CONTRACTOR's expense.

H. Place enough backfill over the center sections of the pipe to prevent floating. Take all other necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench, or the collapse of the pipeline from any cause. Should floating or collapse occur, restoration will be at the CONTRACTOR's expense.

I. CONTRACTOR shall install tracer wire along all pipelines. Tracer wire may be installed in trench below both the pipe and pipe bedding to prevent the tracer wire from being disturbed during repairs. Tracer wire shall be affixed to the pipe using tape or other acceptable method every 50-ft.

J. Bedding materials and concrete work for the pipe bedding and thrust restraint shall be as specified by design.

K. Prevent foreign material from entering the pipe while it is being placed. Do not place debris, tools, clothing, or other materials in the pipe during laying operations. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's work, or for other reasons such as rest breaks or meal periods.

L. Only cut pipe with equipment specifically designed for cutting pipe such as an abrasive wheel, a rotary wheel cutter, a guillotine pipe saw, or a milling wheel saw. Do not use chisels or hand saws. Grind cut ends and rough edges smooth. Bevel the cut end slightly for push-on connections as per manufacturer recommendations.

M. In distributing material at the site of the Work, unload each piece opposite or near the place where it is to be laid in the trench. If the pipe is to be strung out, do so in a straight line or in a line conforming to the curvature of the street. Block each length of pipe adequately to prevent movement. Block stockpiled pipe adequately to prevent movement. Do not place pipe, material, or any other object on private property, obstructing walkways or driveways, or in any manner that interferes with the normal flow of traffic.

N. Exercise special care to avoid damage to the bells, spigots or flanged ends of pipe during handling, temporary storage, and construction. Replace damaged pipe that cannot be repaired to OWNER's satisfaction, at the CONTRACTOR's expense.

O. Remove all existing pipe, fittings, valves, pipe supports, blocking, and all other items necessary to provide space for making connections to existing pipe and installing all piping required under this Contract.

P. Maintain the minimum required distance between water and sewer lines and other utility lines in strict accordance with all Federal, State, and local requirements and all right-of-way limitations.

Q. Marking tape to be provided along all mains and service lines installed. Marking tape to be installed. Marking tape shall be placed within four feet of pipe unless pipe depth dictates otherwise. Foil backing is not required on marking tape. Tape shall be colored green for sewer. Marking tape along pressurized force mains shall be labeled "Pressurized Wastewater".

–END OF SECTION 17000–

SECTION 17010

PRESSURE AND LEAKAGE TESTS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Test all piping, valves, manholes and appurtenances installed under this Contract. Testing shall be performed concurrent with installation. Do not install more than 1,000 feet of pipe without being tested, unless approved by OWNER.

1.2 SUBMITTALS

A. Prepare and submit schedules and procedures to OWNER for testing of all parts of the sewer main installed in accordance with this Contract. Submit the schedule at least seven days prior to any testing.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Furnish the pump, pipe connections, and all necessary apparatus for the pressure and leakage tests including gauges and metering devices. OWNER reserves the option to furnish the gauges and metering devices for the tests. Excavate, backfill, and furnish all necessary assistance for conducting the tests.

PART 3 EXECUTION

3.1 GENERAL

A. LEAKAGE: All sewers shall be tested for excessive leakage. This may include appropriate water or low-pressure air testing

1. Hydrostatic Testing

a. Test to be conducted in conformance with the procedures described in ASTM C969-17

b. The leakage outward or inward (exfiltration or infiltration) shall not exceed fifty (50) gallons per inch of pipe diameter per mile per day for any section of the system. An exfiltration or infiltration test shall be performed with a minimum positive head of 2 feet and shall be ran for no less than two (2) hours after stabilization of temperature.

2. The air test, if used, shall be conducted in accordance with one of the following Standards:

    a. ASTM C1103-14 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

    b. ASTM F1417, “Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.” For plastic, composite, and ductile Iron Pipe.

    c. UNI-B-6, “Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.” Published by the Uni-Bell PVC Pipe Association. The testing method selected shall properly consider the existing groundwater elevations during the test. If the test section fails the test for excessive leakage, the CONTRACTOR shall repair or replace all defective materials and/or workmanship at no additional cost to the OWNER and re-test.

B. DEFLECTION: Not less than 30 days after completion of the backfill, a deflection test shall be performed for all flexible and semi-rigid pipes. If any section fails the test for excessive deflection, the CONTRACTOR shall repair or replace all defective materials and/or workmanship at no additional cost to the OWNER and re-test. Deflection tests shall be conducted using a go/no-go mandrel of at least nine (9) or more odd number fins. The mandrels outside dimension shall be sized to permit no more than 5 percent deflection. The percent deflection shall be established from the base inside diameter of the pipe. The mandrel shall be approved by the OWNER prior to use. Lines that permit safe entry may allow other deflection test options, such as direct measurements with extension rulers.

    1. Should any test disclose damaged or defective materials or leakage greater than that permitted, the CONTRACTOR shall, at the CONTRACTOR’s expense, locate and repair and/or replace the damaged or defective materials. Materials used for repair must be approved by OWNER and meet the relevant specifications. Repeat the tests until the leakage is within the permitted allowance and is satisfactory to MAWC.

C. MANHOLES: CONTRACTOR shall furnish all labor and materials for the testing of all manholes and structures.

    1. All manholes shall be tested after backfilling to at least the level of the bottom adjustment ring.

    2. The vacuum test shall include testing of the seal between the cast iron frame and the concrete cone, slab, or top adjustment ring.

    3. All pipes entering the manhole shall be plugged at least eight (8) inches into the sewer pipe. The plug must be inflated at a location beyond the manhole/pipe gasket and shall be adequately braced to prevent the plug of pipe from being dislodged and pulled into the manhole

4. A vacuum of at least 10.5 inches of mercury shall be drawn on the manhole. Shut the valve on the vacuum line to the manhole and disconnect the vacuum line. Open the vacuum line valve and adjust the vacuum to ten (10) inches of mercury.

5. A liquid filled pressure gage shall be used with a reading from zero (0) to thirty (30) inches of mercury.

6. The time for the vacuum reading to drop from ten (10) inches of mercury to nine (9) inches of mercury must be equal to or greater than the following values for the manhole to be considered as passing the test.

Manhole Depth	Time (minutes)
10 feet or less	2
10.1 to 15 feet	2.5
15.1 to 25 feet	3

7. If a manhole fails the vacuum test, the manhole shall be uncovered, and the leak repaired by patching the exterior of the manhole. The manhole shall then be backfilled and re-tested.

8. The vacuum testing of the manholes shall be done prior to air testing the sewer lines that enter of exit the manhole.

–END OF SECTION 17010–

SECTION 17020

PUMPING AND BYPASSING

PART 1 GENERAL

1.1 SCOPE

A. CONTRACTOR is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for the purpose of diverting the existing flow around the work area for the duration of the Project.

B. The design, installation, and operation of the temporary bypass pumping system shall be the CONTRACTOR's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

C. When directed by OWNER, the CONTRACTOR shall put the affected sanitary sewer line back into service at the end of each working day.

D. All unmanned bypass pumping operations shall be fitted with an auto-dialer feature to monitor the operation of the pump and notify the CONTRACTOR in the event of a pump failure or overflow situation.

1.2 SUBMITTALS

A. Conform to the requirements of Section 1300 – Submittal Procedures

B. The following additional items shall be submitted for approval in accordance with Section 1300:

1. Detailed Bypass Pumping Plan – CONTRACTOR shall submit to OWNER detailed design plans and descriptions outlining all provisions and precautions to be taken by the CONTRACTOR regarding the handling of existing wastewater flows. The pumping system must be designed to provide adequate capacity for peak flows.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric, or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to account for the cyclical nature of effluent flows or be equipped with floats or other level sensing devices to automatically start and stop the pumps.

B. CONTRACTOR shall provide the necessary stop/start controls for each pump.

C. Discharge and suction piping sizing shall be determined according to flow calculations and system operating calculations.

D. High Density Polyethylene (HDPE) – Piping shall be homogenous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, or other deleterious faults. Pipe shall be assembled and joined on site using couplings, flanges or butt-fusion method to provide leak proof joint. Thread or solvent joints are not acceptable. Pipe fusion shall be carried out by personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment. Butt-fusion joints shall be true alignment and uniform roll- back beads resulting from use of proper temperature and pressure.

E. Flexible Hoses and Associated Couplings and Connectors – Flexible hose and couplings shall be abrasive resistant and suitable for the intended services (i.e., fire hoses are not permitted). Couplings shall be wiring to ensure the device connection is secure. They shall be rated for external and internal loads anticipated including test pressure. External load design shall incorporate anticipated traffic loadings, including traffic impact loading where applicable. When subjected to traffic loading, the system shall be composed of traffic ramps and covers maintaining an H-20 loading requirement while in use or as directed by OWNER.

F. All rigid or hard piping shall be constructed with positive restrained joints.

G. Under no circumstance will aluminum irrigation type piping or glued PVC pipe be allowed.

2.2 DESIGN REQUIREMENTS

A. Bypass pumping systems shall have sufficient capacity to pump the peak flow required. The CONTRACTOR shall provide all pipeline plugs, pumps of adequate size to handle peak flow, and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired. Bypass pumping system may be required to be operated 24- hours a day. CONTRACTOR shall provide all necessary monitoring devices to notify the CONTRACTOR of any pump failure.

B. The CONTRACTOR shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each pump size utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.

C. Bypass pumping system shall be capable of bypassing flow around the Work area and of releasing any amount of flow up to the full available flow into the work area as necessary for satisfactory performance of the Work.

D. The CONTRACTOR shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. The system must overcome any existing force main pressure on discharge.

2.3 PERFORMANCE REQUIREMENTS

A. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the CONTRACTOR shall provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with work, carry it past the work area, and return it to the existing sewer downstream of the work area.

B. The design, installation, and operation of the temporary pumping system shall be the CONTRACTOR's responsibility. The bypass system shall meet the requirements of all local, State, and Federal codes and regulations.

C. CONTRACTOR shall provide all necessary means to safely convey the sewage past the work area. The CONTRACTOR will not be permitted to stop or impede the main flows under any circumstances.

D. The CONTRACTOR shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers, and that will protect public and private property from damage and flooding.

E. The CONTRACTOR shall protect water resources, wetlands, and other natural resources.

F. All bypass systems shall have redundant systems with automatic switch-over or shall have 24-hour surveillance through the bypass operation.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL AND MAINTENANCE

A. Test – CONTRACTOR shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. The OWNER will be given 24-hour notice prior to testing.

B. Inspection – CONTRACTOR shall inspect bypass pumping system every two hours to ensure that the system is working properly.

C. Maintenance Service – CONTRACTOR shall insure that the temporary pumping system is properly maintained, and a responsible operator shall be available to responds to all situations before any bypass occurs.

D. Extra Materials:

1. Spare parts for pumps and piping shall be kept on site as required.

2. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

3.2 REPARATION

A. Precautions

1. CONTRACTOR is responsible for locating any existing utilities in the area the CONTRACTOR selects to locate the bypass pipelines. The CONTRACTOR shall locate the bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from OWNER. All costs associated with relocating utilities and obtaining approvals shall be the responsibility of the CONTRACTOR.

2. During all bypass pumping operation, the CONTRACTOR shall protect the pumping station and main and all local sewer lines from damage inflicted by any equipment. The CONTRACTOR shall be responsible for any physical damage to the pump station and main and all local sewer lines caused by human or mechanical failure.

3.3 INSTALLATION AND REMOVAL

A. CONTRACTOR shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at the access location indicated on the Drawings and as may be required to provide suction conduit.

B. Plugging or blocking of sewage flows shall incorporate primary and if possible secondary plugging devices. When plugging or blocking is no longer needed for performance and acceptance of Work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging, or causing other major disturbances downstream.

C. When working inside a manhole or force main, the CONTRACTOR shall exercise caution and comply with OSHA requirements for working in confined spaces and the presence of sewer gases, combustible oxygen-deficient atmospheres.

D. The installation of bypass pipelines is prohibited in all saltmarsh/wetland areas.

E. The pipeline must be protected from and not impede vehicular or pedestrian traffic. When the bypass pipeline crosses local streets and private driveways, where roadway ramps cannot be used, the CONTRACTOR must place the bypass line in trenches and cover with temporary pavement or plates.

F. Upon completion of the bypass pumping operations, and after the receipt of written permission from the OWNER, the CONTRACTOR shall remove all piping, restore all property to pre-construction condition, and restore all pavement and roadways. The CONTRACTOR is responsible for obtaining any approvals for placement of temporary pipelines from local agencies.

–END OF SECTION 17020–

SECTION 17030

HYDROSTATIC TESTING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Test all piping, valves, manholes and appurtenances installed under this Contract. Testing shall be performed concurrent with installation. Do not install more than 1,000 feet of pipe without being tested, unless approved by OWNER.

1.2 SUBMITTALS

A. Prepare and submit schedules and procedures to OWNER for testing of all parts of the sewer main installed in accordance with this Contract. Submit the schedule at least seven days prior to any testing.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Furnish the pump, pipe connections, and all necessary apparatus for the pressure and leakage tests including gauges and metering devices. OWNER reserves the option to furnish the gauges and metering devices for the tests. Excavate, backfill, and furnish all necessary assistance for conducting the tests.

PART 3 EXECUTION

3.1 GENERAL

A. LEAKAGE: All sewers shall be tested for excessive leakage.

1 Hydrostatic Testing for Gravity Systems

a. Test to be conducted in conformance with the procedures described in ASTM C969-17

b. The leakage outward or inward (exfiltration or infiltration) shall not exceed fifty (50) gallons per inch of pipe diameter per mile per day for any section of the system. An exfiltration or infiltration test shall be performed with a minimum positive head of 2 feet and shall be ran for no less than two (2) hours after stabilization of temperature.

2 Hydrostatic Tests for Pressure Systems

a. Conformance Procedure: Perform hydrostatic pressure and leakage tests.

Conform to AWWA C 600 procedures as modified herein. Tests shall apply to all pressure sewers.

b. Sectionalizing: Test in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs. CONTRACTOR shall furnish and install test plugs at no additional cost to the OWNER, including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs. CONTRACTOR shall be responsible for any damage to public or private property caused by failure of plugs. Limit fill rate of line to available venting capacity.

c. Pressure Test: Conduct at 1.5 times maximum operating pressure determined by the following formula:

Ppt = (1.5) (.433) (OP-GE), in which
Ppt = test pressure in psi at gauge elevation
OP = operating pressure in feet as indicated for highest elevation of the hydraulic gradient on each section of the line
GE = elevation in feet at center line of gauge.

Perform pressure tests satisfactorily prior to determining leakage.

d. Leakage Test: Conduct at the maximum operating pressure as determined by the following formula:

Plt = 0.433 (OP-GE), in which
Plt = test pressure in psi at gauge elevation
OP and GE – as defined from pressure test formula (see above) All joints shall be watertight and free from leaks

B. DEFLECTION: Not less than 30 days after completion of the backfill, a deflection test shall be performed for all flexible and semi-rigid pipes. If any section fails the test for excessive deflection, the CONTRACTOR shall repair or replace all defective materials and/or workmanship at no additional cost to the OWNER and re-test. Deflection tests shall be conducted using a go/no-go mandrel of at least nine (9) or more odd number fins. The mandrels outside dimension shall be sized to permit no more than 5 percent deflection. The percent deflection shall be established from the base inside diameter of the pipe. The mandrel shall be approved by the OWNER prior to use. Lines that permit safe entry may allow other deflection test options, such as direct measurements with extension rulers.

C. Should any test disclose damaged or defective materials or leakage greater than that permitted, the CONTRACTOR shall, at the CONTRACTOR's expense, locate and repair and/or replace the damaged or defective materials. Materials used for repair must be approved by OWNER and meet the relevant specifications. Repeat the tests until the leakage is within the permitted allowance and is satisfactory to the OWNER.

–END OF SECTION 17030–

SECTION 17040

INFILTRATION AND EXFILTRATION TESTING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Test all piping, valves, manholes and appurtenances installed under this Contract. Testing shall be performed concurrent with installation. Do not install more than 1,000 feet of pipe without being tested, unless approved by OWNER.

1.2 SUBMITTALS

A. Prepare and submit schedules and procedures to OWNER for testing of all parts of the sewer main installed in accordance with this Contract. Submit the schedule at least seven days prior to any testing.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Furnish the pump, pipe connections, regulator to avoid over pressurization, and all necessary apparatus for the pressure and leakage tests including gauges and metering devices. OWNER reserves the option to furnish the gauges and metering devices for the tests. Excavate, backfill, and furnish all necessary assistance for conducting the tests.

PART 3 EXECUTION

3.1 GENERAL

A. Air Testing of Gravity Systems: All sewers shall be tested for excessive leakage.

1. CONTRACTOR may perform air tests for all pipe (except concrete and fiberglass) for all sizes.

2. The air test, if used, shall be conducted in accordance with one of the following Standards:

   a. ASTM C1103-14 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

   b. ASTM F1417, “Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.” For plastic, composite and ductile Iron Pipe.

c. UNI-B-6, “Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.” Published by the Uni-Bell PVC Pipe Association. The testing method selected shall properly consider the existing groundwater elevations during the test. If the test section fails the test for excessive leakage, the CONTRACTOR shall repair or replace all defective materials and/or workmanship at no additional cost to the OWNER and re-test

3. The pipe plug for introducing air to the sewer line shall be equipped with two taps. One tap will be used to introduce air into the line being tested through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valves and fittings to accept a pressure test gauge indicating internal pressure in the sewer pipe. Additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.

4. The pressure test gauge shall meet the following minimum specifications:

Size (diameter)	4.5 inches
Pressure Range	0 -15 psi
Figure Intervals	1 psi increments
Minor Subdivisions	0.05 psi
Pressure Tube	Bourdon Tube or diaphragm
Accuracy	± 0.25% of maximum scale reading
Dial	White coated aluminum with black lettering, 270^0 arc and mirror edge
Pipe Connection	Low male 1/2-inch N.P.T.

Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the OWNER whenever air tests are performed.

Gravity sewer pipe shall be air-tested in accordance with the requirements of ASTM F 1417.

5. Plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressure is allowed to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If the time in seconds for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the table below, the pipe shall be presumed free of defects.

Pipe Diameter	Minimum	Length	Time for Longer Length (sec)
4	3:46	597	0.380 * L
6	5:40	398	0.854 * L
8	7:34	298	1.520 * L
10	9:26	239	2.374 * L
12	11:20	199	3.418 * L
15	14:10	159	5.342 * L
18	17:00	133	7.692 * L
21	19:50	114	10.470 * L
24	22:40	99	13.674 * L
27	25:30	88	17.306 * L
30	28:20	80	21.366 * L
33	31:10	72	25.852 * L
36	34:00	66	30.768 * L
42	39:48	57	41.883 * L
48	45:34	50	54.705 * L

If air test fails to meet above requirements, repeat test as necessary after all leaks and defects have been repaired and backfilled. Prior to acceptance, all constructed sewer lines shall satisfactorily pass the low-pressure air test.

6. If the maintenance of existing flow in a pipe is necessary and air pressure testing is not possible, the CONTRACTOR shall perform closed circuit television inspection of the pipe at the CONTRACTOR's expense.

B. DEFLECTION: Not less than 30 days after completion of the backfill, a deflection test shall be performed for all flexible and semi-rigid pipes. If any section fails the test for excessive deflection, the CONTRACTOR shall repair or replace all defective materials and/or workmanship at no additional cost to the OWNER and re-test. Deflection tests shall be conducted using a go/no-go mandrel of at least nine (9) or more odd number fins. The mandrels outside dimension shall be sized to permit no more than 5 percent deflection. The percent deflection shall be established from the base inside diameter of the pipe. The mandrel shall be approved by the OWNER prior to use. Lines that permit safe entry may allow other deflection test options, such as direct measurements with extension rulers.

C. Should any test disclose damaged or defective materials or leakage greater than that permitted, the CONTRACTOR shall, at the CONTRACTOR's expense, locate and repair and/or replace the damaged or defective materials. Materials used for repair must be approved by OWNER and meet the relevant specifications. Repeat the tests until the leakage is within the permitted allowance and is satisfactory to the OWNER.

D. MANHOLES – CONTRACTOR shall furnish all labor and materials for the testing of all manholes and structures.

1. All manholes shall be tested after backfilling to at least the level of the bottom adjustment ring.

2. The vacuum test shall include testing of the seal between the cast iron frame and the concrete cone, slab or top adjustment ring

3. All pipes entering the manhole shall be plugged at least eight (8) inches into the sewer pipe. The plug must be inflated at a location beyond the manhole/pipe gasket and shall be adequately braced to prevent the plug of pipe from being dislodged and pulled into the manhole

4. A vacuum of at least 10.5 inches of mercury shall be drawn on the manhole. Shut the valve on the vacuum line to the manhole and disconnect the vacuum line. Open the vacuum line valve and adjust the vacuum to ten (10) inches of mercury.

5. A liquid filled pressure gage shall be used with a reading from zero (0) to thirty (30) inches of mercury

6. The time for the vacuum reading to drop from ten (10) inches of mercury to nine (9) inches of mercury must be equal to or greater than the following values for he manhole to be considered as passing the test.

Manhole Depth	Time (minutes)
10 feet or less	2
10.1 to 15 feet	2.5
15.1 to 25 feet	3

7. If a manhole fails the vacuum test, the manhole shall be uncovered, and the leak repaired by patching the exterior of the manhole. The manhole shall then be backfilled and re-tested

8. The vacuum testing of the manholes shall be done prior to air testing the sewer lines that enter of exit the manhole.

–END OF SECTION 17040–

SECTION 17100

CASING PIPING FOR UTILITY JACKING

PART 1 GENERAL

1.1. GENERAL REQUIREMENTS

The installation of casing pipe shall conform to these Specifications and any Federal, State, or local Highway requirements or any applicable Railroad requirements whichever may be more restrictive.

1.2. SUBMITTALS

Submit details of proposed jacking or boring pits to the OWNER showing locations, dimensions, and details of sheeting and shoring required, if requested.

1.3. RELATED WORK

Excavation, backfilling and compaction for jacking and receiving pits and for open cut installation shall conform to the requirements set forth in Specification Section 02100 Trenching and Backfilling.

PART 2 PRODUCTS

2.1 MATERIAL

Casing pipe shall be bare wall steel pipe with a minimum yield strength of 35,000 psi and a minimum wall thickness as listed below:

Casing Outside Diameter Inches	Highway Crossings Casing Wall Thickness Inches	Railroad Crossings Casing Wall Thickness Inches
24	0.312	0.406
30	0.375	0.469
36	0.500	0.532
42	0.500	0.563
48	0.625	0.625
54	0.625	0.688
60	0.625	0.750
66	0.625	0.813
72	0.750	0.875

Smooth wall steel plates with a nominal diameter of over 54 inches shall not be permitted.

The inside diameter of the casing pipe shall be at least four (4) inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe less than six (6) inches in diameter; and at least six (6) inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe six (6) inches and greater in diameter.

PART 3 EXECUTION

3.1 ALIGNMENT AND GRADE

Locate pipelines to cross roadways or tracks at approximately right angles where practicable, but preferably at not less than 45 degrees. Do not place pipelines in culverts or under bridges where there is likelihood of their restricting the area required for the purposes for which the bridges or culverts were built, or of endangering the foundations. Install the casing pipe on an even grade for its entire length and sloped to one end or as noted in a profile plan if provided. Satisfy a maximum tolerance of 1.5% (18” in one hundred feet) with the desired location of the casing or as otherwise required by regulation or specified on the plans, whichever is more restrictive.

3.2 WELDING

Connect steel casing sections by welding. Welding shall conform to AWWA Standard C206.

3.3 PROTECTION AT ENDS OF CASING

Block up both ends of casings in such a way as to prevent the entrance of foreign material, but to allow leakage to pass in the event of a carrier break.

3.4 DEPTH OF INSTALLATION

Unless the depth of casing pipe is specifically specified on the drawings, the casing pipe depth shall be in accordance with highway or railroad requirements.

3.5 CASING INSULATORS

The carrier pipe and casing shall be separated by an insulator. The insulator spacing shall be installed to support the weight of the pipe and contents. As a minimum, an insulator shall be placed a maximum of 3 foot from each side of a joint and evenly spaced along the carrier pipe with 3 insulators per each length of carrier pipe. Timber skids are not allowed. Casing insulators shall be sized according to the manufactures specifications for pipe sizes from the following list of approved manufactures and casing types.

3.6 INSTALLATION

Refer to Standard Detail 0201-0601-SD45 at the end of this Specification Section for a typical casing installation detail.

Install casing pipes by one of the following methods:

A. Jacking

This method shall be in accordance with the current American Railway Engineering Association Specifications, Chapter 1, Part 4, "Jacking Culvert Pipe Through Fills", except that steel pipe shall be used with welded joints. Conduct this operation

without hand mining ahead of the pipe and without the use of any type of boring, auguring or drilling equipment.

Design the bracing, backstops, and jacks so that the jacking can progress without stoppage (except for adding lengths of pipe).

B. Drilling

This method employs the use of an oil field type rock roller bit, or a plate bit made up of individual roller cutter units, welded to the pipe casing being installed. Turn the pipe for its entire length from the drilling machine to the head to give the bit the necessary cutting action against the ground being drilled. Inject high density slurry (oil field drilling mud) through a supply line to the head to act as a cutter lubricant. Inject this slurry at the rear of the cutter units to prevent any jetting action ahead of the pipe. Advance the drilling machine on a set of steel rails (thus advancing the pipe) by a set of hydraulic jacks. The method can be used to drill earth or rock.

C. Boring

This method consists of pushing the pipe into the fill with a boring auger rotating within the pipe to remove the soil. When augers or similar devices are used for pipe placement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one-half inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.

If an obstruction is encountered during installation that stops the forward action of the pipe, and if it becomes evident that it is impossible to advance the pipe, operations will cease, and the pipe shall be abandoned in place and filled completely with grout.

Bored or jacked installations shall have a bore hole essentially the same as the outside diameter of the pipe. Grout any voids that develop. Also grout around the casing pipe when the bore hole diameter is greater than the outside diameter of the pipe by more than 1 inch.

D. Directional Drilling

This process employs a drilling bit that is guided through soil to create a round cavity, which will stay intact with suitable soils and conditions for at least several days. Consequently, soil testing may be required by the Owner. Test hole and ream as required. The drill head is propelled and remains linked to the rig by adding segments of rod as the head proceeds forward. After the hole has been completed the drill bit is removed and a pulling adaptor is attached to the drilling stem and pipe is secured to the adaptor.

As the adaptor is pulled back to the rig, segments of drill rod are removed. Pipe is either a continuous fused material or segments of restrained pipe are added as the

adaptor is pulled back to the rig. The selection of pipe material and restraints, if required must be approved by the Owner. The process continues until the adaptor returns to the rig and all of the water main is in place.

This process may be employed only if approved by Owner and governing transportation and or regulating authority). The drilled opening and pipe inserted cannot be less than 3 inches in tolerance. Circulate grout in annular space completely. Alignment and grade must be maintained, and the drilled hole must be controllable using steering technology. Use radio equipment to track. Provide report of depth and location at 20-foot intervals during installation and submit as a report.

–END OF SECTION–

SECTION 17220

POLYVINYL CHLORIDE (PVC) PIPE

PART 1 GENERAL

1.1 SECTION INCLUDES

PVC pipe and fabricated fittings in nominal sizes 4-inches through 12-inches with cast iron pipe equivalent outside diameters.

1.2 SUBMITTALS

Submit manufacturer's product data, installation instructions and certification for all materials to be furnished in accordance with Specification Section 01300. Submit classification and gradation test results for embedment and pipe backfill material

PART 2 PRODUCTS

Research has documented that certain pipe materials (such as polyvinyl chloride, polyethylene, and polybutylene) and certain elastomers (such as those used in gasket material) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied under this Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation, the CONTRACTOR identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify OWNER immediately.

Stop installing piping in suspected contamination until OWNER provides direction.

PVC Schedule 40 or 80 is not permitted for conveying wastewater or potable water within distribution or collection systems. However, it may be used in other applications, such as conveying chemicals or for drainage.

2.1 GRAVITY SEWER PIPE

A. PVC gravity sanitary sewer pipe shall be green in color and in accordance with provisions in following table except where specified differently on the Drawings:

B.

Type of service	Acceptable Materials
Gravity Mains with depth of cover ≤ 10 feet	PVC SDR 26
Gravity Mains with depth of cover 10-15 feet	PVC SDR 26
Gravity Mains with depth of cover > 15 feet	PVC SDR 21, Ductile Iron Pipe, or As shown on Drawings

C. When solid wall PVC pipe 18-inches to 27-inches in diameter is required in SDR 26, provide pipe conforming to ASTM F679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.

D. For sewers crossing water lines with less than 18-inches separation provide minimum 150 psi pressure rated pipe conforming to ASTM D2241 with suitable PVC adapter couplings.

E. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D3212 and ASTM F477, or ASTM D3139 and ASTM F477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D2444.

2.2 SANITARY SEWER FORCE MAIN PIPE

A. PVC sanitary sewer force main pipe shall be green in color. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Section 17500 - Sanitary Sewerage Force Main Piping.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.

C. Fittings: Provide ductile iron fittings as per Section - Ductile Iron Pipe and Fittings, except furnish fittings with one of following approved internal linings:

1. Nominal 40 Mils (35 Mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting

2. Nominal 40 Mils (35 Mils minimum) polyurethane

3. Nominal 40 Mils (35 Mils minimum) ceramic epoxy

4. Nominal 40 Mils (35 Mils minimum) fusion bonded epoxy

D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Section 17230 – Polyethylene Wrap (Wastewater).

E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Specifications.

2.3 RECEIVING, HANDLING AND STORAGE

A. Inspect pipe and appurtenances for defects prior to installation in the trench.

B. Set aside and clearly mark defective, damaged or unsound material and hold material for inspection by CONTRACTOR.

C. Load and unload all materials in accordance with Manufacturer's recommendations and in such a manner as to prevent damage. Do not drop pipe and accessories or handle them in a rough manner.

D. Provide safe storage for all materials. Cover stored pipe that will be exposed to sunlight for periods longer than 6 months. Cover with canvas or other opaque material with provision for adequate air circulation. PVC pipe shall not be stored close to heat sources, such as heaters, boilers, steam lines, or engine exhaust.

PART 3 EXECUTION

3.1 INSTALLATION

Follow the provisions of Section 17000 – Piping – General Provisions, and Section 17500 – Sanitary Sewer Force Main Piping in addition to the following requirements:

A. Remove all dirt and foreign matter from pipe before lowering it into the trench. Do not place debris, hand tools, clothing or other materials in the pipe. Keep pipe clean during and after laying.

B. Lay pipe with the bell end pointing in the direction of work progress. Do not roll, drop or dump pipe or appurtenances into the trench.

C. Assemble push-on joints in accordance with the pipe manufacturer's recommendations. Assemble mechanical joints in accordance with the fitting Manufacturer's recommendations.

D. Cut pipe with pipe saws, circular saws, handsaws, or similar equipment. Provide a smooth end at a right angle to the longitudinal axis of the pipe. Deburr, bevel, and re-mark insertion line on spigot ends. Match factory bevel length and angle for field bevels. When connecting to certain shallow depth bells, such as those on some cast iron fittings and valves, cut off the factory bevel and prepare a deburred, square cut end with a slight outer bevel.

E. Clean the sealing surface of the spigot end, the pipe bell, the coupler or fitting, and the elastomeric gaskets immediately before assembly. Do not remove factory installed gaskets for cleaning. Keep the joint free of dirt, sand, grit, grease or any foreign material. Apply approved lubricant when assembling gasketed joints in accordance with the pipe manufacturer's requirements. The use of improper lubricants can damage gaskets. Excessive lubricant use can make disinfection more difficult and cause taste and odor problems when the line is placed in service.

F. Good pipe alignment is essential for proper joint assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint; that is, do not suspend the pipe and swing it into the bell. The spigot end of the pipe is marked by the manufacturer to indicate the proper depth of insertion. Avoid metal to plastic contact with the pushing the pipe home (use wood or other material to cushion moving the pipe.

G. Assemble pipe using the following types of joints:

H. Gasketed bell joint – Integral with the pipe or fitting

I. Gasketed coupling – A double gasketed coupling

J. Mechanical joint – Any of the several joint designs that have gaskets and bolts manufactured in accordance with AWWA standards.

K. Tracer Wire

1. Place tracer wire in accordance with Section 02600 – Existing Utilities and Structures.

2. The wire shall be contiguous except at test stations, valve boxes, and where splicing is required. All splices shall be encased with a 3M-Gel Pack Model No. 054007-09053 or approved equal.

L. All pressure and leakage testing shall be done in accordance with Specification Section 17030 – Hydrostatic Testing.

M. PVC pipe fittings shall employ ductile iron pipe fittings per Specifications 15105 - Ductile Iron Pipe and Fittings. See detail drawings for transitions between different pipe materials.

N. Gaskets – Gaskets shall be as provided or recommended by Manufacturer and satisfy AWWA standard C111 in all respects. Where ductile iron pipe and PVC pipe are directly connected, the appropriate gasket material for this purpose shall be employed. As noted in the products section of this specification, some gasket materials are prone to permeation of certain hydrocarbons which may exist in the soil (see Part 2). Under these conditions and at the discretion of OWNER, the CONTRACTOR shall be required to provide FKM (Viton, Flourel) gasket material in areas of concern.

–END OF SECTION 17220–

SECTION 17230

POLYETHYLENE WRAP (WASTEWATER)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The minimum requirements for polyethylene wrap to be used for external corrosion protection of buried ductile iron pipe, fittings, and appurtenances and for cast iron and ductile iron fittings on PVC or HDPE pipe, and for barrier valves.

1.2 SUBMITTALS

A. Conform to requirements of Section 01300 – Submittals.

B. Submit product data for proposed film and tape for approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. Polyethylene Film: Tubular or sheet form without tears, breaks, holidays, or defects; conforming with requirements of AWWA C105, 2.5 to 3 percent carbon black content, either low or high density:

1. Low-density polyethylene film shall be manufactured from virgin polyethylene material conforming to ASTM D4976.

2. High-density, cross laminated polyethylene film shall be manufactured from virgin polyethylene material conforming to ASTM D4976.

B. Polyethylene Tape: Provide minimum 2-inch-wide (3-inch typical), plastic-backed, adhesive tape.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.

B. Fit polyethylene film to contour of pipe to affect snug, but not tight fit; encase with minimum space between polyethylene and pipe. Allow sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to

polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.

C. For installations below water table or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.

3.2 INSTALLATION

A. Tubular Type (Method A):

1. Cut polyethylene tube to length approximately 2 feet longer than pipe section. Slip tube around pipe, centering tube to provide 1-foot overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears pipe ends.

2. Lower pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene tube.

3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of adjoining length of pipe, and secure in place. Then slip end of polyethylene from adjoining pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points.

4. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

B. Tubular Type (Method B):

1. Cut polyethylene tube to length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.

2. Before making up joint, slip 3 foot length of polyethylene tube over end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 3 foot length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least I foot; make each end snug and secure.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

C. Sheet Type:

1. Cut polyethylene sheet to length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.

2. Lower wrapped pipe into trench and makeup pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

D. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.

E. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.

F. Openings in Encasement: Create openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape. Service taps may also be made directly through polyethylene, with resulting damaged areas being repaired as specified.

G. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet. Secure end with circumferential turns of tape. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from cast or ductile iron pipe.

3.3 REPAIRS

A. Repair cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.

–END OF SECTION 17230–

SECTION 17300

SITE SANITARY SEWERAGE GRAVITY MAIN PIPING

PART 1 GENERAL

1.1 SCOPE

A. Installation of gravity sanitary sewers and appurtenances.

1.2 SUBMITTALS

A. Conform to requirements of Section 01300 Submittals.

B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Videos become property of Owner.

1.3 QUALITY ASSURANCE

A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Section 17030 – Hydrostatic Testing and Section 17040 Infiltration and Exfiltration Testing.

B. Regulatory Requirements.

1. Install sewer lines to meet minimum State mandated separation distance from potable water lines. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. Install new sanitary sewers no closer to water lines than 10 feet in all horizontal directions. Where water and sanitary sewer lines cross, a minimum vertical separation in accordance with State and/or local standards, but no less than 18” is required. Where separation For sewers crossing water lines with less than 18-inches separation provide minimum 150 psi pressure rated pipe conforming to ASTM D2241 with suitable PVC adapter couplings.

2. Notify Owner immediately when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.

3. Lay gravity sewer lines in straight alignment and grade.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Inspect pipe and fittings upon arrival of materials at job site.

B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.

C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

PART 2 PRODUCTS

2.1 PIPE

A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified.

B. Unlined reinforced concrete pipe is not acceptable.

2.2 PIPE MATERIAL SCHEDULE

A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in one or more of following Sections:

1. Section 15105 – Ductile-Iron Pipe and Fittings.

2. Section 17220 – Polyvinyl Chloride (PVC) Pipe.

3. Section 15125 – HDPE Pipe and Fittings

B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

2.3 APPURTENANCES

A. Laterals. Conform to requirements of Section 17400 – Site Sanitary Sewerage Gravity Service Laterals.

B. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

C. Sump pumps shall not be connected to the sanitary sewer.

2.4 BEDDING AND BACKFILL MATERIAL

A. Bedding and Backfill: Conform to requirements of Section 02100 – Trenching and Backfilling.

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of MUTCD, and/or local standards where applicable.

B. Provide barricades, flashing warning lights, and warning signs for excavations.

C. Conform to requirements MUTCD and/or local standards where applicable. Maintain barricades and warning lights where work is in progress or where traffic is affected.

D. Perform work in accordance with OSHA standards. Employ trench safety system for excavations over 5 feet deep.

E. Remove old pavements and structures including sidewalks and driveways in accordance with installation and local Department of Public Works requirements.

F. Install and operate dewatering and surface water control measures in accordance with Contract Document requirements. Section - 02110

G. Do not allow sand, debris or runoff to enter sewer system.

H. All diversion and bypass pumping shall be performed in accordance with Section 17020 – Pumping and Bypassing.

3.2 EXCAVATION

A. Earthwork. Conform to requirements of Section 02100 – Trenching and Backfilling. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by Owner. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.

C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Section 02100 - Excavation and Backfill for Utilities.

D. Pipe slopes greater than 15% will require approval from Owner and concrete anchoring at the following maximum spacing:
   - 15-35%: 36 feet on center
   - 35-50%: 24 feet on center
   - 50% and above: 16 feet on center

3.3 PIPE INSTALLATION BY OPEN CUT

A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by CONSTRUCTION INSPECTOR.

C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.

D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.

E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.

F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe

G. Keep excavations free of water during construction and until final inspection.

H. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material and ground water from entering pipe.

I. For sewers crossing water lines with less than 18-inches separation provide minimum 150 psi pressure rated pipe conforming to ASTM D2241 with suitable PVC adapter couplings.

J. Where the length of the stub is not indicated, install the stub to the right-of-way or easement line and install cleanout and stub with cap per standard detail.

3.4 PIPE INSTALLATION OTHER THAN OPEN CUT

A. For installation of pipe by directional drilling, conform to requirements of specification Sections in 02450 – Utility Directional Drilling as appropriate.

3.5 INSTALLATION OF APPURTENANCES

A. Construct manholes to conform to requirements of Section 03400 – Precast Concrete Manholes.

3.6 INSPECTION AND TESTING

A. Service Connections. Install service connections to conform to requirements of Section 17400– Site Sanitary Sewerage Gravity Service Laterals.

B. Construct manholes to conform to the requirements of Section 03400 Precast Concrete Manholes

C. Test Site Sanitary Sewerage in accordance with Section 17010 – Pressure and Leakage Tests.

3.7 BACKFILL AND SITE CLEANUP

A. Backfill and compact soil in accordance with Section 02100 - Trenching and Backfill for Utilities.

B. Backfill trench in specified lifts only after pipe installation is approved by Owner.

C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified by local regulations see Section 02610.

–END OF SECTION 17300–

SECTION 17400

SITE SANITARY SEWERAGE GRAVITY SERVICE LATERALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Installation of service laterals in sanitary sewers serving areas where sanitary sewer service did not previously exist.

B. Reconnection of existing sanitary laterals along parallel, replacement, or rehabilitated sanitary sewers.

1.2 PERFORMANCE REQUIREMENTS

A. Accurately locate in field all proposed service laterals along new sanitary sewer main.

B. Accurately locate in field existing sanitary laterals and proposed service laterals along alignment of new parallel or replacement sewer main.

1.3 SUBMITTALS

A. Conform to requirements of Section 01300 - Submittals.

B. Submit product data for each pipe product, fitting, coupling and adapter.

C. Show reconnected services on record drawings. Sanitary lateral GPS locate all sanitary lateral and include with As-Built Deliverables per section 01900.

PART 2 PRODUCTS

2.1 PVC SANITARY LATERAL

A. Use SDR 35PVC sewer pipe conforming to ASTM D1784 and ASTM D3034.

B. For depths greater than 10’, use SDR 26.

C. PVC pipe shall be gasket jointed with gasket conforming to ASTM D3212.

D. Provide sanitary lateral pipe in sizes shown on Drawings. All sanitary lateral connections shall be 6-inches. sanitary lateral sanitary lateral

E. Connect service laterals to new, parallel, or replacement sewer mains with prefabricated, full-bodied tee or wye fittings conforming to specifications for sewer main pipe material as specified in other Sections for sewers less than 10 inches in diameter.

F. Where sewers are installed using pipe augering or tunneling, or where sewer is 10 inches or greater in diameter, use a prefabricated lateral hub with rubber sleeve and stainless steel band (Insert a Tee or equal) to connect service to sewer main.

G. Break-in taps are not allowed.

2.2 PIPE SADDLES

A. Use pipe saddles only on existing sanitary sewer mains. Comply with Paragraph 2.1E for new, parallel, and replacement sanitary sewer mains.

B. Supply one-piece prefabricated saddle, either polyethylene or PVC, with neoprene gasket to accomplish complete seal. Use saddle fabricated to fit outside diameter of connecting pipe. Protruding lip of saddle must be at least 5/8- inch long with grooves or ridges to retain stainless steel band clamps.

C. Use 1/2-inch stainless steel band clamps for securing saddles to liner pipe.

2.3 COUPLINGS AND ADAPTERS

A. For connections between new PVC pipe stubouts and existing service (4-, 6-, or 8-inch diameter), use flexible adapter coupling consisting of neoprene gasket and stainless-steel shear rings with 1/2-inch stainless steel band clamps.

B. For connections between new PVC pipe stubout and new service, use rubber-gasket adapter coupling.

2.4 PLUGS AND CAPS

A. Seal upstream end of unconnected sewer service stubs with rubber gasket plugs or caps of same pipe type and size.

2.5 CLEANOUTS

A. Use SDR 35 PVC sewer pipe conforming to ASTM D1784 and ASTM D3034.

B. PVC pipe shall be gasket jointed with gasket conforming to ASTM D3212.

C. Cleanouts to be provided every 75 LF, and at all changes of direction along the sanitary sewer lateral.

D. Concrete collars to be provided on all new cleanout installations.

E. Install double cleanout on all new individual sanitary laterals in accordance with Owner standard details.

F. Solid cleanout caps shall be provided. PVC or cast-iron caps may be provided in unpaved areas. Cast iron caps shall be provided in paved areas. Cast iron caps shall be marked “Sewer”.

PART 3 EXECUTION

3.1 PERFORMANCE REQUIREMENTS

A. Provide minimum of 72 hours' notice to customers whose sanitary sewer service will potentially be interrupted.

B. Accurately field locate sanitary laterals, whether in service or not, along rehabilitated sanitary sewer main. For parallel and replacement sewers, sanitary laterals may be located as pipe laying progresses from downstream to upstream.

C. Properly disconnect existing connections from sewer and reconnect to rehabilitated liner, as described in this Section.

D. Reconnect sanitary laterals, including those that go to unoccupied or abandoned buildings unless directed otherwise by Owner. Vacant lots shall have a cleanout installed per the standard detail.

E. Complete reconnection of service lines within 4 hours after cured-in-place liner installation and within 4 hours after disconnection for parallel, or replacement sanitary sewer mains.

F. Contractor shall repair any damaged lateral lines as a result cured in place pipe lining reinstatement. Sanitary lateral sanitary lateral.

G. Reconnection shall include fittings and required pipe length to reconnect lateral.

3.2 PROTECTION

A. Provide barricades, warning lights, and signs for excavations created for sanitary laterals.

B. Do not allow sand, debris, or runoff to enter sewer system.

3.3 PREPARATION

A. Determine existing sewer locations and number of existing sanitary laterals from closed circuit television (CCTV) inspection DVDs or from field survey. Accurately field locate existing sanitary laterals, whether in service or not. Use existing service locations to connect or reconnect service lines or liner.

B. For rehabilitated sanitary sewer mains, allow liner to normalize to ambient temperature and recover from imposed stretch. For cured-in-place liners, verify that liner is completely cured.

C. For new parallel and replacement sanitary sewer mains, complete testing and acceptance of downstream sewers as applicable.

3.4 EXCAVATION AND BACKFILL

A. Excavate in accordance with Section 02100 – Trenching and Backfilling for Utilities.

B. Perform work in accordance with OSHA standards.

C. Install and operate necessary ground water and surface water control measures in accordance with requirements of the Contract Documents.

D. Determine locations where limited access, buildings or structure preclude use of mechanical excavation equipment. Obtain approval from Owner for hand excavation.

3.5 REINSTATEMENT BY EXCAVATION METHOD FOR LINED PIPE

A. Remove portion of existing sanitary sewer main or carrier pipe to expose liner pipe. Provide sufficient working space for installing prefabricated pipe saddle.

B. Cut liner pipe making hole to accept stubout protruding from underside of saddle.

C. Strap on saddle using stainless steel band on each side of saddle. Tighten bands to produce watertight seal of saddle gasket to liner pipe.

D. Remove and replace cracked, offset, or leaking service line for up to 5 feet, measured horizontally, from center of new liner.

E. Make up connection between liner and service line using PVC sewer pipe and approved fittings and couplings.

F. Encase entire sanitary lateral in cement stabilized sand as shown on Drawings.

G. Test sanitary laterals before backfilling.

3.6 REINSTATEMENT BY REMOTE METHOD FOR LINED PIPE

A. Make service reconnections using remote-operated cutting tools on non poly pipe (PVC, HDPE) for cured-in- place liners at depth greater than 6 feet.

B. Employ method and equipment that restore sanitary lateral capacity to not less than 90 percent of original capacity.

C. Immediately open missed connections and repair holes drilled in error using method approved by Owner.

3.7 RECONNECTION ON PARALLEL OR REPLACEMENT SEGMENTS

A. Install sanitary laterals on sewer main.

B. Remove and replace cracked, offset, or leaking sanitary lateral for up to 5 feet, measured horizontally, from centerline of sanitary sewer main.

C. Make connection between main and existing service line using PVC sewer pipe and approved couplings.

D. Test sanitary laterals before backfilling.

E. Embed sanitary lateral and service line as specified for sanitary sewer main as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02100 – Trenching and Backfilling.

3.8 INSTALLATION OF NEW SERVICE LATERALS

A. Install sanitary laterals on sanitary sewer main for each sanitary lateral. Provide length of lateral indicated on Drawings. Install cap on upstream end of service lateral as needed.

B. Test sanitary laterals before backfilling.

C. Embed sanitary lateral and service line as specified for sanitary sewer main, and as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02100 – Trenching and Backfilling for Utilities.

D. Install dual direction cleanouts at the point of demarcation or as otherwise shown on Drawings.

E. New service lateral slope shall not be less than 2% unless directed by OWNER/ENGINEER

3.9 TESTING

A. Test service reconnections and service laterals. Follow applicable procedures given in Section 17010 – Pressure and Leakage Tests.

B. Perform post installation CCTV inspection as specified in the Contract Documents. Cleaning and television inspection to show locations of sanitary lateral.

3.10 CLEANUP

A. Backfill excavation as specified in Section 02100 – Trenching and Backfilling for Utilities.

B. Replace pavement or sidewalks removed or damaged by excavation. In unpaved areas, bring surface to grade and slope surrounding excavation. Grades shall be sloped as such to drain away from cleanout caps. Restore all disturbed paved and lawn areas in accordance with local base and Department of Public Works regulations.

–END OF SECTION 17400–

SECTION 17500

SANITARY SEWERAGE FORCE MAIN PIPING

PART 1 GENERAL

1.1 SCOPE

A. The work covered by this section relates to sanitary sewer force mains including materials permitted, installation, and testing.

1.2 SUBMITTALS

A. Conform to requirements of Section 01300 - Submittals.

B. Submit proposed methods, equipment, materials, and sequence of operations for force main construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Force mains 12 inches in diameter and larger: Submit shop drawings and design calculations for joint restraint systems using restrained joint pipe and fittings or reinforced concrete encasement of pressure pipe and fittings.

D. Submit qualifications, proposed methods, equipment, materials, and sequence for acceptance testing of pipeline.

E. Submit test reports as specified in Part 3 of this Section.

1.3 QUALITY ASSURANCE

A. Qualifications. Install sanitary sewer force main that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Section 17010 – Pressure and Leakage Tests.

B. Regulatory Requirements.

1. Install pressurized sewer lines to meet minimum State mandated separation distance from potable water line. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. Install new sanitary sewers no closer to water lines than 10 feet in all horizontal directions. Where water and pressurized sanitary sewer lines cross, a minimum vertical separation in accordance with state and/or local standards is required when the water line passes above the sanitary sewer main. Where separation distance cannot be achieved, sanitary sewers shall be constructed of ductile iron piping or encased in reinforced concrete encasement (as detailed on the Drawings) for a minimum distance of 10 feet either side of the crossing.

PART 2 PRODUCTS

2.1 PIPE AND FITTING MATERIAL SCHEDULE

A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in one or more of the following Sections:

1. Section 17200 – Ductile-Iron Utility Pipe Water. Provide linings in accordance with this Section.

2. Section 17230 – Polyethylene Wrap (Wastewater).

3. Section 17220 – Polyvinyl Chloride (PVC) Gravity Sewer Pipe.

B. A force main must be a minimum of 4 inches in diameter, unless it is used in conjunction with a grinder pump station.

2.2 THRUST RESTRAINT

A. Unless otherwise shown on Drawings, provide concrete thrust blocking for force mains up to 12-inches in diameter, to prevent movement of buried lines under pressure at bends, tees, caps, valves and hydrants. Blocking shall be Portland cement concrete. Place concrete in accordance with details on Drawings. Place thrust blocks between undisturbed ground and fittings. Anchor fittings to thrust blocks so that pipe and fitting joints are accessible for repairs.

B. For force mains larger than 12 inches in diameter, and where indicated on Drawings, provide restrained joints conforming to requirements of force main pipe material specifications. Install restrained joints for length of pipe on both sides of each bend or fitting for full length where shown on Drawings.

C. Horizontal and vertical bends between zero degrees and the maximum allowable deflection angle will not require thrust blocks or harnessed or restrained joints.

D. Horizontal and vertical bends between the maximum allowable deflection angle and 90 degrees deflection angle shall have thrust restraint as shown on Drawings, or specified herein

E. Provide thrust restraint at tees, plugs, blowoff drains, valves, hydrants, and caps, as indicated.

F. Reinforced concrete encasement of force main pipe and fittings may be used in lieu of manufactured joint restraint systems. Alternate joint restraint systems using reinforced concrete encasement shall conform to following design requirements.

1. Design calculations shall be performed and sealed by Professional Engineer licensed in the State in which the project is being completed.

2. Base design calculations upon soil parameters quantified in geotechnical report for site where alternative thrust restraint system is to be installed. When data is not available for site, use parameters recommended by geotechnical engineer.

3. The design system pressure shall be specified test pressure.

4. The following safety factors shall be used in sizing restraint system:

    a. Apply factor of safety equal to 1.5 for passive soil resistance.
    b. Apply factor of safety equal to 2.0 for soil friction.
    5. Contain concrete encasement entirely within standard trench width and terminate on both ends at pipe bell or coupling.

6. Concrete encasement reinforcing steel shall be designed for all loads, including internal pressure and longitudinal forces. Concrete design shall be in accordance with ACI 318.

PART 3 EXECUTION

3.1 PIPE INSTALLATION BY OPEN-CUT

A. Perform excavation, bedding, and backfill in accordance with Section 02100 – Trenching and Backfilling.

B. Wrap ductile-iron pipe and fittings with polyethylene wrap in accordance with requirements of Section 17230 – Polyethylene Wrap (Wastewater) where soil conditions require installation. Do not install polyethylene wrap on ductile iron pipe protected by cathodic protection system or fusion bonded or polyurethane coated fittings.

C. Tracer wire shall be installed with pipe in accordance with the requirements of Section 02558 – Identification/Location Guide

D. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

E. Install pipe only after excavation is completed, bottom of trench is fine graded, bedding material is installed, and trench has been approved by Owner.

F. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.

G. Install pipe with spigot ends toward direction of flow. Form concentric joint with each section of adjoining pipe to prevent offsets.

H. Keep interior of pipe clean as installation progresses. Where cleaning after laying pipe is difficult because of small pipe size, use suitable swab or drag in pipe and pull it forward past each joint immediately after joint has been completed. Remove foreign material and debris from pipe.

I. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back-hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Owner.

J. Keep excavations free of water during construction and until final inspection.

K. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

L. Where sanitary sewer force main is to be installed under existing water line with separation distance of less than 2 feet, install one full joint length of pipe, minimum 18 foot length, centered on water line and maintain minimum 6-inch separation distance.

M. A force main must terminate below a manhole invert with the top of the pipe matching the water level in the manhole at design flow.

N. Any high point must include a sewage type air release valve.

3.2 PIPE INSTALLATION OTHER THAN OPEN-CUT

A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification Section 02450 – Horizontal Directional Drilling.

3.3 HYDROSTATIC TESTING

A. After pipe and appurtenance have been installed, test line and drain. Prevent damage to Work or adjacent areas. Use clean water to perform tests.

B. Owner may direct tests of relatively short sections of completed lines to minimize traffic problems or potential public hazards.

C. Test pipe in presence of Owner.

D. Test pipe at 150 psig or 1.5 times design pressure of pipe, whichever is greater.

E. Design pressure of force main shall be rated total dynamic head of lift station pump, but never exceed the ultimate design pressure of the pipe.

F. Maximum allowable leakage shall be as calculated by following formula: L = (S) (D) ($P^{0.5}$) / 133,200

Where:

L	=	Leakage in gallons per hour.
S	=	Length of pipe in feet.
P	=	Inside diameter of pipe in inches.
D	=	Pressure in pounds per square inch.

G. No leakage permitted on exposed pipes and fittings.

H. Correct defects, cracks, or leakage by replacement of defective items or by repairs as approved by the OWNER.

I. Plug openings in force main after testing and flushing. Use cast iron plugs or blind flanges to prevent debris from entering tested pipeline.

–END OF SECTION 17500–

SECTION 17600

SANITARY SEWERAGE EQUIPMENT (SMALL LIFT STATIONS)

PART 1 GENERAL

1.1 SCOPE

A. This specification section contains the requirements for a fully operational submersible sewage pump station. Small lift stations are typically limited in size to duplex pumping systems with pumps sized 7.5 hp or smaller.

1.2 SUBMITTALS

A. Conform to requirements of Section 01300 – Submittals.

B. Submit complete shop drawings and material certification(s) for wet well(s), pumps, motors, valves, hatches, electrical materials, concrete, pipe materials, and coatings.

1.3 QUALITY OF EQUIPMENT

A. Equipment and appurtenances shall be designed for and constructed of materials for the conditions of exposure and of such strength to withstand all stresses which may occur during testing, installation, and all conditions of normal operation.

B. Exposed surfaces shall be finished in appearance. All exposed welds shall be ground smooth, and the corners of structure shapes shall be rounded or chamfered for per personnel protection.

C. All machinery and equipment shall comply in all respects with the provisions of the Occupational Safety and Health Act of 1970, and other applicable Federal, State and local laws & regulations.

PART 2 PRODUCTS

2.1 SEWAGE PUMPS

A. The sewage pumps shall be vertical, recessed impeller, grinder-type submersible pumping units, complete with motor and submersible rated power and control cables. The grinder shall be capable of grinding all materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, and wooden articles into a finely ground slurry with particle dimensions no greater than ¼ inch. For serviceability and parts availability all pumps shall be standard catalog submersible pumping products.

B. Pump casings shall be completely open from suction to discharge with no wearing rings or impeller faceplates required. All internal case clearances shall be equal to the discharge diameter so that all material, which will pass through the discharge, can pass through the pump. (Maximum sphere equal to discharge diameter.)

C. The impeller shall be keyed to the motor shaft and secured by an impeller bolt.

D. Pump casings and impellers shall be constructed of ASTM A48, Class 25 or 30 grey cast iron material unless specifically indicated otherwise.

E. Pumps shall be rated for operating conditions as shown on the Drawings.

F. Energy efficient pumps that utilize premium efficiency motors shall be included within all lift stations.

2.2 MOTORS

A. All motors shall be provided with thrust and radial bearings rated for L-10 life of 17,500 hours to carry the entire load which may be imposed upon it under all operating conditions. All motors shall be of nationally known manufacture (American manufacturers are preferred), standard frame, and shall be listed by Underwriters Laboratories for operation in a Class I, Division 1, Group D hazardous location. All motors shall be mounted using manufacturers standard bolt hole pattern. No additional holes shall be made in the motor mounting. The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation and a dielectric oil filled motor, NEMA L design.

1. Motor locked rotor NEMA code shall be H or better for motors less than 15 h.p. and shall be G or better for motors 15 h.p. and above.

B. Each motor shall have two (2) tandem mounted mechanical seals, the lower one outside the motor and protecting the upper one which shall be in an oil-filled chamber. The lower, primary seal shall consist of one stationary silicon carbide or tungsten carbide ring, and one positively driven (rotating) silicon carbide or tungsten carbide ring. The upper seal between the oil and motor housing shall consist of one stationary stainless steel or tungsten carbide ring and one positively driven (rotating) carbon ring. Each interface shall be held in place by its own independent spring system.

1. Moisture detector probes in the oil-filled seal chamber shall be connected to an alarm indicating the presence of moisture in the seal chamber. Thermal overload protectors shall be imbedded in the motor windings and connected to the control to disconnect the motor in the event of overheating.

C. Each motor shall be equipped with heavily jacketed submersible cables of the length required to reach the control panel without splices or strain and allowing a minimum of 4 feet of slack. Short cables will be rejected.

D. All motors shall be sized according to the information shown on the Drawings.

2.3 PIPING

A. Piping, including fittings, shall be as shown on the Drawings and shall meet ILAW specifications.

B. HDPE piping, and galvanized steel piping are not permitted within the wet well of the lift station or the valve vault.

2.4 CHECK VALVES

A. The check valves shall be ball or swing type. The valve shall be cast iron-body or brass-body and rated for 150 psi working pressure. Construction and materials shall be such that the valve shall be suitable for raw sewage service.

1. Check valve for valve box drain shall be as shown on the Drawings.

2.5 GATE VALVES

A. Gate valves shall be resilient seat AWWA Specification valves brass body non-rising stem "O" Ring seals and 150 PSI working pressure. The valve shall be epoxy coated inside and be equipped with a stem thrust bearing.

2.6 COUPLING SYSTEM (GUIDE RAIL)

A. A guide rail system shall be furnished and installed for each pump designed to operate under the expected head and flow conditions. The system shall be designed such that the pumps can be easily removed from the wet well without entering the well or disconnecting piping.

B. The system shall consist of a 90° discharge elbow with support leg, stationary base support, slide rail pump assembly, dual stainless steel guide rails, upper, lower and intermediate stainless steel guide rail supports, and stainless-steel lifting yoke, cable/chain and eyes. The foot-mounted discharge elbow and adapter shall conform to ASTM A48 Class 25 or 30 grey iron. Guide rails shall be constructed using Type 326 stainless steel.

C. The stationary base shall be constructed of ductile iron, integrally cast. The slide face shall be constructed of Class 35 cast iron. The coupling shall incorporate a self-energizing gasket to provide positive sealing under all conditions. All bolts, nuts, screws, and miscellaneous accessories not otherwise noted shall be 316 stainless steel.

D. The guide rail system shall be a standard product of the pump manufacturer, using materials specified above.

2.7 ALUMINUM ACCESS DOORS

A. Door leaf shall be minimum ¼" aluminum pattern plate reinforced to withstand a live load of 300 pounds per square foot. Frame shall be ¼" aluminum with an anchor flange around the perimeter. Doors shall be equipped with heavy forged brass or stainless-steel hinges, stainless steel pins, and an automatic hold-open arm with release handle. Provide a staple for padlock and an aluminum lifting handle. The lifting handle shall recess into the door when not in use. Hardware shall be cadmium plated and factory finish. The frame shall be mill finish with bituminous coating applied to exterior channels where they come in contact with the frame. Doors shall be hinged as shown on the Drawings. Where opposite opening doors are indicated, safety chains shall be provided. Door assemblies shall meet OSHA requirements. On all doors with any dimension greater than 36 inches, supply compression springs to assist opening.

B. Provide safety grate option and keyed locks for all access hatches. Provide master access keys in accordance with MOAW's requirements. Two of each key shall be provided and keys shall be tagged for lock location. Safety grating shall be manufactured with 1" square molded fiberglass or steel and be capable of supporting 300 lbs/SF.

2.8 FIBERGLASS WET WELL SECTIONS AND VAULT

A. Unless otherwise indicated, the plastic terminology used in this specification shall be in accordance with the definitions given in American Society for Testing and Materials (ASTM) designations D3299. This specification is for the hand lay-up, chopped spray technique and filament wound methods for manufacturing of vertical underground fiberglass basins. Other methods of manufacturing shall not be acceptable.

B. The resin used shall be of a commercial grade and shall be evaluated as a laminate by test or determined by previous service to be acceptable for the environment. The resins used may contain the minimum amount of fillers or additives required to improve handling properties. Up to 5% by weight of thixotropic agent which will not interfere with visual inspection may be added to the resin for viscosity control. Resins may contain pigments and dyes by agreement between fabricator and Owner, recognizing that such additions may interfere with visual inspection of laminate quality.

C. The reinforcing material shall be a commercial grade of glass fiber having a coupling agent which will provide a suitable bond between the glass reinforcement and the resin.

D. The laminate shall consist of an inner surface, an interior layer, and a filament-wound structural exterior layer of laminate body.

E. The inner surface shall be free of cracks and crazing with a smooth finish and with an average of not over two pits per square foot, providing the pits are less than ⅛" in diameter with not over $^{1}/_{32}$" deep and are covered with sufficient resin to avoid exposure of inner surface fabric. Some waviness shall be permissible as

long as the surface is smooth and free of pits. Between 0.100 and 0.020 inches of resin-rich surface shall be provided.

F. A minimum of 0.100 inch of the laminate next to the inner surface shall be reinforced with 30% by weight of chopped-strand fiber having fiber lengths from 0.5 to 2.0 inches.

G. Subsequent reinforcement shall be continuous-strand roving fiberglass. The thickness of the filament-wound portion of the tank shell shall vary with the tank height to provide the aggregate strength necessary to meet the tensile and flexural requirements. If additional longitudinal strength is required, the use of other reinforcement, such as woven fabric, chopped-strand mat, or chopped strands shall be interspersed in the winding to provide additional strength. Glass content of this filament-wound structural layer shall be 50 to 80% by weight. The exterior surface shall be relatively smooth with no exposed fibers or sharp projections. Hand work finish shall be present to prevent fiber exposure.

H. The tank walls must be designed to withstand wall collapse based on the assumption of hydrostatic type loading by backfill with a density of 120 lb./cu.ft. The tank wall laminate must be constructed to withstand or exceed two times the assumed loading for any depth of basin.

I. For the tank bottoms, subsequent reinforcement shall be of 1.5 oz./sq.ft. chopped strand fiber or woven roving to a thickness to withstand applicable hydrostatic uplift pressure, with a safety factor of 2. In saturated conditions, the center deflection of any empty tank bottom shall be less than ⅜" (elastic deflection) and will not interfere with bottom pump mounting requirements nor rail system.

J. The width of the first layer of joint overlay shall be 3" minimum. Successive layers shall uniformly increase in width to form a smooth contour laminate that is centered on the joint ±½". A highly filled resin paste may be placed in the crevices between joined shall be roughened to expose glass fiber. This roughened area shall extend beyond the lay-up areas so that no reinforcement is applied to an unprepared surface. Surfaces shall be clean and dry before lay-up. The entire roughened area shall be coated with resin after joint overlay is made.

K. The finished laminate shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, air bubbles, pinhole, pimples, and delamination.

L. The surfaces shall be relatively smooth, hand finish is acceptable, with no exposed fibers or sharp projections.

M. Tanks shall be mounted on cradles if shipping is horizontal, or on a suitable skid or pallet if shipping in the vertical position. The tank shall be secured to the cradles or skid so that there can be no movement of the tank in relation to the skid or cradle under normal handling.

N. The tank bottoms shall extend past the tank walls so that the O.D. is approximately 4" larger in diameter than the O.D. of the sidewalls. This larger

diameter shall serve as an anti-flotation flange. Contractor shall place the tanks on concrete pads and secure with stainless steel clips catching the anti-flotation flange and anchored to the concrete pad. Anti-flotation flange shall not require bolt holes to secure the tank to the concrete pad.

O. Both tanks shall include NPT discharge fittings. The wet-well tank shall include a 4" caulking type bolt-on thermoplastic influent hub for mounting in the field. The hub shall be beveled approximately three degrees to accommodate gravity pipe coming in from various angles. The influent hub shall have a textured surface in order to provide better caulking adhesion. The valve vault tank shall include NPT influent fittings. Both tanks shall include appropriate NPT fitting for the valve box drain.

P. The top flange and cover O.D. shall assure a tight gasket fit and afford ease of access not possible with recessed covers. Noncorroding stainless steel helicoils shall be inserted in all bolt holes of the top flange and shall be positively locked with threads and resin to prevent stripping. A standard hole pattern shall accommodate the mounting of the cover.

Q. Covers shall be of fiberglass with an O.D. equal to the O.D. of the top flange on the basin. Cover shall be secured by stainless steel bolts. Covers shall be designed for live load of 350 lb./sq.ft.

2.9 PRESSURE TEST VALVE AND GAUGE

A. Pressure test valve shall be a brass curb stop of the oroseal or Teflon coated ball-type with a brass saddle and fitting for pressure gauge connection. Pressure gauge shall be 0-40 psi range, 4½" liquid-filled gauge with stainless steel dial and bourdon tube and ½" ANPT stainless steel connection stem.

2.10 ELECTRICAL SPLICE JUNCTION BOX

A. The electrical splice j-box shall be located in an easily accessible location adjacent to the wet well, shall provide easy access for inspection and servicing, and be of corrosion resistant materials. Junction boxes are not permitted to be located on top of the wet well. The electrical splice box shall be UL approved for wet locations.

PART 3 EXECUTION

3.1 PUMP STATION (GENERAL)

A. Construct wet well and valve pit as shown on the Drawings and specified herein. Compact clean subgrade under wet well to 100% of maximum density at optimum moisture content as determined by AASHTO T-99, Method A. Place 6" minimum of #57 crushed stone properly compacted under wet well anti-buoyancy slab. Compact clean backfill around the station in 8-inch lifts to not less than 95% of the maximum density at optimum water content as determined by AASHTO T-99, Method A. Access door units shall be flush with concrete surface and in alignment to permit unobstructed removal of pumps and valves. Complete the pump station piping and fittings in accordance with the Drawings and Specifications relating

thereto. Remove all lifting eyes etc. from precast units, rub all joints, coat interior of pump station wet wells, clean hatches to bare metal, touch up paint on electric panels, clean wet well, valve pit and drains and grade site.

3.2 INSTALLATION OF EQUIPMENT

A. The Contractor shall install equipment as required by the manufacturer's written installation instructions and approved shop drawings unless otherwise directed by the Owner.

B. The floor of the pump station shall be constructed level to a point 6 inches outside of all pump supports before installing pumps. Pump piping shall be completely made up and secured to prevent any excess movement. Provide permanent supports, and wedges as indicated to restrain movement.

C. Excess motor and control wire shall be carefully coiled and hung inside the wet well. These wires shall not be cut, and all identification tags shall be in place. Cables shall be supported with S.S. basket weave type strain reliefs hung in the wet well and be routed in a manner that will not interfere with access to any equipment or terminals in the control panels

3.3 CONTROLS INSTALLATION

A. Field Calibration: All instrumentation shall be calibrated in the presence of the Owner in accordance with the range and accuracy specified herein.

1. All equipment shall be calibrated using a standard calibration sheet which has been approved by the Owner. This calibration sheet shall be filled out identifying the instrument or item to be calibrated and signed with date and initials of the person calibrating the device.

3.4 START-UP, TESTING, AND TRAINING

A. The Contractor shall provide a factory certified technician that is fully familiar with the equipment installed to startup and completely check out the pump station. The technician shall first perform a pre-start check to include, at a minimum, proper impeller rotation, proper service voltage, and proper operation of the phase monitor. Then the technician shall perform start-up checking for, at a minimum, proper operation, including all control functions, motor operation, and measurements of vibration, current, pressures and flows to verify compliance with the Drawings and Specifications. Amp readings on each motor lead shall be recorded on the start-up report. Final technical checkout (with technician(s) present) will be made in the presence of the Owner. The Contractor shall furnish all materials, equipment, including test gauges calibrated in feet, and incidentals to conduct the tests.

B. Before the main circuit breaker is energized to allow power to the control panel, verify incoming service voltage is within normal range on all phases.

C. The factory certified technician shall also instruct the Owner in the operation of the controls, including changing all settings, and shall set all settings for proper operation of the pump station and record these initial settings on the start-up report form.

D. A written report by the factory certified technician shall be given to the Owner and this report shall include, at a minimum, the results of all tests and instructions indicated above.

–END OF SECTION 17600–

SECTION 17620
SANITARY SEWERAGE EQUIPMENT (MEDIUM LIFT STATIONS)

PART 1 GENERAL

1.1 SCOPE

A. This Section contains the requirements for a fully operational duplex submersible sewage pump station. Medium sized lift stations typically vary between 7.5 hp and 25 hp and have a maximum design flow capacity of 700 GPM.

1.2 SUBMITTALS

A. Conform to requirements of Section 01300 – Submittals.

B. Provide complete factory testing for pumps to be furnished for this project as specified by the Hydraulic Institute. Include a full performance curve from shutoff to runout.

C. Submit manufacturer's data and details of the following items for approval:

1. Shop drawings and material certification(s) for the following:

   a. Submersible pumps with piping, connections, and setting plan.

   b. Valve assemblies showing clear opening sizes, opening directions, and setting details.

   c. Base settings plans for hydraulic drive units, crane, generator, automatic transfer switch, and other equipment to be installed stand alone.

   d. Construction details, including reinforcement, jointing methods, materials, and dimensions.

   e. Wet well showing installed equipment.

   f. All proposed electrical materials.

2. Equipment manufacturer's cut sheets and specifications. Contractor shall highlight where manufacturer's specifications are different from items specified in this section.

3. Materials to be used for pipe wall penetrations.

4. Materials and procedures for corrosion-resistant liner and coatings.

5. Plugs to be used for hydrostatic testing.

6. Provide precast wet well and manhole base sections with precast fillets or benches if available. If field installation of fillets or benches is necessary, provide Manufacturer's data for pre-mix (bag) concrete used for fillets and benches.

D. Signed and sealed submittal drawings by a Professional Engineer licensed in the State where the project is being completed.

E. Complete design calculations computing discharge capacity, system head curve, wet well volumes, float and transducer elevations, and anti-floatation requirements.

F. Maintenance materials (spare parts) – Provide one complete set of the manufacturer's recommended spare parts for each pump. Provide 100% spare fuses, 100% spare alarm lights lamps, one (1) spare motor starter coil, and one (1) spare control transformer for control panel. Package each part individually or in sets of moisture proof containers or wrappings clearly labeled with part name and manufacturer's part/stock number. Provide any special tools required for equipment maintenance.

G. Provide separate control diagram with each line numbered and relay contacts indicated and written description of control sequence.

1.3 QUALITY OF EQUIPMENT

A. Equipment and appurtenances shall be designed for and constructed of materials for the conditions of exposure and of such strength to withstand all stresses which may occur during testing, installation, and all conditions of normal operation.

B. Exposed surfaces shall be finished in appearance. All exposed welds shall be ground smooth, and the corners of structure shapes shall be rounded or chamfered for personnel protection.

C. All machinery and equipment shall comply in all respects with the provisions of the Occupational Safety and Health Act of 1970, and other applicable Federal, State, and local laws & regulations.

1.4 FIELD SERVICES

A. Contractor shall provide the services of a manufacturer's representative experienced in the installation and operation of the pumping station supplied under this specification for not less than one 8-hour workday on-site for each of the following: 1) installation inspection, 2) start-up and performance testing, and 3) instructing ILAW's operating personnel.

PART 2 PRODUCTS

2.1 SEWAGE PUMPS

A. The sewage pumps shall be heavy duty submersible pumping units, complete with motor and submersible rated power and control cables. The pumps shall be field serviceable, with cast iron pump case and motor housing, integral stainless-steel motor and pump shaft, and stainless-steel fasteners. For serviceability and parts availability all pumps shall be standard catalog submersible pumping products.

B. Each phase of the motor shall contain a bimetallic temperature monitor in the upper portion of the stator windings. These thermal switches shall be connected in series and set to open at 140°C +/- 5°C. They shall be connected to the control panel, and used in conjunction with, and supplemental to, external motor overload protection.

C. Pumps shall each be supplied with Type 316 stainless steel guide rail system with integrated discharge elbow and stainless-steel lifting chain.

D. Power and control cable(s) shall be sized in accordance with NEC standards.

E. Bi-metallic temperature switches shall be provided for the upper and lower bearings, and RTD type temperature measuring devices for the motor winding and bearings.

F. Pumps shall be rated for operating conditions as shown on the Drawings.

G. Energy efficient pumps that utilize premium efficiency motors shall be provided for all lift stations.

2.2 MOTORS

A. All motors shall be provided with thrust and radial bearings rated for L-10 life of 17,500 hours to carry the entire load which may be imposed upon it under all operating conditions. All motors shall be of nationally known manufacturers (American manufacturers preferred) and manufactured with standard frames. All motors shall be mounted using manufacturer's standard bolt hole pattern. No additional holes shall be made in the motor mounting. The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation and a dielectric oil filled motor, NEMA L design.

Motor locked rotor NEMA code shall be H or better for motors less than 15 HP and shall be G or better for motors 15 HP and above.

B. Each motor shall have two (2) tandem mounted mechanical seals, the lower one outside the motor and protecting the upper one which shall be in an oil-filled chamber. The lower, primary seal shall consist of one stationary silicon carbide or tungsten carbide ring and one positively driven (rotating) silicon carbide or tungsten carbide ring. The upper seal between the oil and motor housing shall consist of one stationary stainless steel or tungsten carbide ring and one positively driven (rotating)

carbon ring. Each interface shall be held in place by its own independent spring system.

Moisture detector probes in the oil-filled seal chamber shall be connected to an alarm indicating the presence of moisture in the seal chamber. Thermal overload protectors shall be imbedded in the motor windings and connected to the control to disconnect the motor in the event of overheating.

C. Each motor shall be equipped with heavily jacketed submersible cables of the length required to reach the junction panel adjacent to the control panel without splices or strain and allowing a minimum of 4 feet of slack. Short cables will be rejected.

D. All motors shall be sized according to the information shown on the Drawings.

2.3 LIFTING CHAINS

A. Chains for attachment to below grade equipment shall be a minimum of 7/32" 316 stainless steel having a working load limit of 1200 lb. The chain weight shall be 41.1 lb/100 ft. The working load rating of the lifting system shall be a minimum of 50% greater than the pump weight. Lifting chain shall be provided with sufficient length to reach from pumps to wet well cover, with an additional 3’ of slack provided.

2.4 LIFTING DEVICE

A. Provide crane as indicated on plans. Units shall be rated at not less than 150% lifting capacity at maximum boom extension for the weight of the proposed pumps. The crane shall be capable of 360° rotation.

2.5 CHECK VALVES

A. Provide each pump with a swing check valve. Provide outside lever and weight. Valve shall provide positive control to prevent water hammer from valve closure.

2.6 GATE VALVES

A. Provide each pump with a gate valve or eccentric plug valve. Valve shall have a rising stem and flanged ends.

2.7 COUPLING SYSTEM (GUIDE RAIL)

A. A guide rail system shall be furnished and installed for each pump designed to operate under the expected head and flow conditions. The system shall be designed such that the pumps can be easily removed from the wet well without entering the well or disconnecting piping.

B. The system shall consist of a 90-degree discharge elbow with support leg, stationary base support, slide rail pump assembly, dual stainless steel guide rails, upper, lower, and intermediate stainless steel guide rail supports, and stainless-steel lifting yoke, cable, and eyes. The foot-mounted discharge elbow and adapter shall conform to ASTM A48 Class 25 or 30 grey iron.

C. The stationary base shall be constructed of ductile iron, integrally cast. The slide face shall be constructed of Class 35 cast iron. The coupling shall incorporate a self-energizing gasket to provide positive sealing under all conditions. All bolts, nuts, screws, and miscellaneous accessories not otherwise noted shall be Type 316 stainless steel.

D. The guide rail system shall be a standard product of the pump manufacturer.

2.8 ALUMINUM ACCESS DOORS

A. Door leaf shall be minimum ¼" aluminum pattern plate reinforced to withstand H-20 loading. Frame shall be ¼" aluminum with an anchor flange around the perimeter. Doors shall be equipped with heavy forged brass or stainless-steel hinges, stainless steel pins, and an automatic hold-open arm with release handle. Provide a staple for padlock and an aluminum lifting handle. The lifting handle shall recess into the door when not in use. Hardware shall be cadmium plated and factory finish. The frame shall be mill finish with bituminous coating applied to exterior channels where they come in contact with the frame. Doors shall be hinged as shown in the Drawings. Where opposite opening doors are indicated, safety chains shall be provided. Door assemblies shall meet OSHA requirements. On all door leafs with any dimension greater than 36 inches, supply compression springs to assist opening.

B. Provide safety grate option and keyed locks for all access hatches. Provide master access keys in accordance with MOAW 's requirements. Two of each key shall be provided and keys shall be tagged for lock location. Safety grating shall be manufactured with 1" square molded fiberglass or steel and be capable of supporting 300 lbs/SF.

2.9 CONCRETE WET WELL SECTIONS AND VALVE VAULT

A. Provide precast wet well sections and related components conforming to ASTM C478. Provide base riser section with fillets or benches precast into the structures unless unavailable from the precast concrete manufacturer. Mark date of manufacture and name or trademark of manufacturer on inside of barrel. Riser sections shall have dimensions and orientation of pipe cut-outs as shown on the Drawings. Flat slab top section shall have cut-outs for the access hatch frames. No ladder is permitted in the wet well.

B. Provide precast valve vault and related components conforming to ASTM C 478. The valve pit shall be provided with a flat slab top section with cut-out for the access hatch and frame. No ladder is permitted within the valve vault. Provide ventilation in the valve vault if the pit depth exceeds 5 feet. Valve vaults shall be furnished with a sump and sump pump, or approved equal, to allow for drainage.

C. In more temperate climates, MOAW permits the use of welded steel grating for top sections of valve vaults with prior approval from the Owner. Welded steel grating shall be manufactured from ASTM A-1011 carbon steel. Standard welded grating shall be manufactured with bearing bars spaced at 1- 3/16” on center and cross bars at 4” on center. Valve vaults shall be furnished with a sump and sump pump, or approved equal, to allow for drainage.

2.10 SEWAGE GRINDER

A. Furnish hardware for mounting and retrieval from the wet well, retrieval chain and basket screen for use in place of the grinder when the grinder unit is removed from the wet well. Provide hydraulic drive power pack and associated hoses and connections as required, and as recommended by the manufacturer for this application. Cutters shall be as recommended by the manufacturer for this installation.

2.11 YARD HYDRANT

A. Yard hydrant shall be bronze, self-draining, nonfreezing, self-closing compression type. Provide vacuum breaker adapter for hose connection. Size adapter on MOAW recommendation.

B. Primary interior operating parts shall be brass and removable from yard hydrant without excavation.

C. Yard hydrants shall be set in 4 cubic feet of crushed stone to allow for proper drainage. AWWA recommendations shall be followed when installing the yard hydrant.

D. Backflow prevention devices shall be installed on the yard hydrant service line in accordance with State and local regulations.

2.12 INSTRUMENTATION

A. Controls – The control logic shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump will automatically start to handle the increased flow. As the liquid level decreases, the pumps will shut off at the elevations shown on the Drawings. In the event of a malfunction or a flow that exceeds the capacity of the pumps, a high-level light and audible alarm will be activated to indicate alarm conditions. Pumps shall alternate as lead and lag pumps on a continuous basis.

B. Control panel shall be provided as part of pump station package with manufacturer unit source responsibility. Base panel shall include all circuitry to control pumps including contacts, microprocessor, starters, circuit breakers, etc. Manufacturer shall be responsible for sizing of all components. Panels shall include the following:

1. Ground fault receptacle with circuit breaker.

2. Reduced voltage starters with under voltage release and overload coils for each phase (each pump).

3. NEMA starters

4. Local/remote dry contacts for alarms specified elsewhere

5. Sequential, selectable alternator

6. Lightning arrestor

7. Elapsed time meter for each pump, non-resettable

8. Time delay between pumps.

9. H-O-A switches for each pump

10. Contacts for either:
    i. four mercury switch level control floats; or
    ii. Two mercury switch level control floats and one pressure transducer

11. Auxiliary heater

12. Pump failure with dry contact.

13. Generator interlock

14. Phase loss monitor.

C. Pressure transducer and floats

1. Contractor shall provide both a pressure level transducer and float system. Pumps shall be controlled via pressure transducer with level floats utilized as a back-up system.

2. Provide stainless steel float hanger brackets.

D. Alarm system

1. If a control building is required, the control building shall have an intrusion alarm system integrated with the existing local alarm systems. The alarm system for the lift station will integrate the station alarms identified below, if possible. The alarms shall connect to the SCADA RTU to be provided with the pump control panel.

2. Pump run status

3. High wet well level

4. Station power failure

5. Low wet well level

6. Loss of phase (if three phase power)

7. Generator start failure

8. Grinder high water

9. Grinder motor fault

10. Others as determined by MOAW during design

E. Flow Monitor

1. Provide flow monitor, or meter where determined by the Owner, and/or as indicated on the Drawings. Flow monitor shall provide 1% accuracy totalized flow independent of fluid viscosity, density, and temperature, unaffected by most solids contained in fluids.

2. Flow monitor shall include the following features:

a) Standard size DIN enclosure for easy installation
b) Alphanumeric display for easy-to-read and easy-to-understand data
c) Clear plastic splash proof cover to protect the display, keyboard, RS-232 connector and PC Card slot
d) Seven digital inputs: three pumps and four user inputs
e) Two digital outputs (open collector) for alarms
f) Two analog outputs proportional to outflow and inflow for telemetry system, or sampler or chart recorder
g) RS-232 serial port for fast and easy access
h) Optional eight analog inputs: 4-20 ma, 0-5 VDC DIP switch-selectable (pressure, temperature, level, etc.)
i) Optional built-in 2400 baud auto-answer modem

F. Standby Power

a) Where determined by the Owner, the lift station shall be furnished with a standby generator. Purchase of the generator shall be coordinated with ILAW.

2.2 ELECTRICAL SPLICE JUNCTION BOX

A. The electrical splice j-box shall be in an easily accessible location adjacent to the wet well, shall provide easy access for inspection and servicing, and be of corrosion resistant materials. Junction boxes are not permitted to be located on top of the wet well. The electrical splice box shall be UL approved for wet locations.

PART 3 EXECUTION

3.1 PUMP STATION (GENERAL)

A. Conduct of operations

1. Contractor shall dispose of demolished or removed equipment and materials off site in an environmentally and legally manner daily. Products of demolition shall not be stored on site.

2. Maintain debris cleanup daily. Construction materials shall be located as designated by Owner.

3. Provide written and graphic information to describe operations for demolition work.

4. Protect existing equipment and facilities from damage. Replace damaged with new equipment and materials or repaired of the same as approved by the Owner.

5. Provide traffic safety measures at all times.

3.2 SITE WORK

A. Erosion control

1. Apply erosion control in accordance with Erosion and Sedimentation Control plan prepared by the Engineer.

2. Maintain construction entrance as required.

B. Soil backfill and compaction

1. Contractor shall backfill and compact soil around the wet well and valve vault. Soil shall be compacted in to 95 percent of maximum standard proctor density according to ASTM D698.

C. Provide a chain link fence in accordance with American Water Standard Details. The fence shall have a minimum height of 8 feet and shall be provided with three rows of strand barbed wire. The fence shall also be provided with separate vehicular and pedestrian gates.

D. Provide trees and shrubs surrounding the fence. Provide a plan indicating the type, size, spacing, and distance from the fence on the Drawings for approval by American Water.

E. Examination

1. Verify that lines and grades are correct.

2. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum standard proctor density according to ASTM D698 prior to placement of foundation material and base section.

3. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.

4. Maintain positive drainage of storm water. Provide erosion protection in accordance with standard specifications for State road and bridge construction. Provide stabilization of the worksite to prevent rutting and erosion. Store excavated material on site at the direction of ILAW.

F. Maintain construction entrance as required.

3.3 SETTING EQUIPMENT

A. EQUIPMENT

1. Set equipment plumb and level. Install in strict accordance with written instructions from the manufacturer. Use anchor bolts, grout leveling and and/or isolation pads as required by the equipment manufacturer. Provide anchor bolts and other ancillary materials necessary for an installation in compliance with manufacturer's requirements.

B. PIPE

1. Furnish support as required by the manufacturer and as shown on the drawings. Provide end restraint where pipe may be subject to movement when under pressure. Mechanical joint fittings shall be furnished with restraint devices. Test pipe in accordance with MOAW requirements.

C. PUMPS

1. Provide isolation fittings for intake and discharge, fittings directly installed on the pump joint connections. No stress from piping shall be transmitted to the pump connections.

3.4 FOUNDATIONS

A. Minimum compaction requirements for soils acting as foundations shall be 95% maximum Standard Proctor to a depth of 12 inches below the structure. Moisture content range of the soil shall be plus or minus 2% optimum.

3.5 TESTING

A. Provide copies of manufacturer's factory test results on equipment and materials provided. Notify ILAW within 24 hours of any site testing to be conducted.

B. The following equipment shall be tested after installation with a manufacturer's representative present to verify compliance with recommended testing protocol. Copies of test reports shall be furnished to ILAW. Provide copies of manufacturer's recommended site testing procedures not less than 48 hours prior to testing of equipment.

1. Pumps
   a. Pumps shall be tested for rotation direction, one-minute pump down and amperage draw during pump down.
   b. Record results and submit to owner.
   c. Exercise removal facilities using crane and hoist. Removal shall not present binding or tracking problems.

2. Control Panel
   a. Control panel shall be tested for each function provided to verify proper operation.
   b. Verify proper interface with SCADA and coordinate with SCADA requirements.

3. Crane
   a. Verify rotation and lifting capacity through exercise testing each capacity.

4. Grinder
   a. Test for torque and grinding capacity using manufacturer's recommended testing procedures.
   b. Verify absence of hydraulic oil leaks. Replace defective materials with new.
   c. Exercise removal facilities using crane and hoist. Removal shall not present binding or tracking problems.

5. Pipe:
   a. Pipe shall be tested in accordance with relevant MOAW Specification sections.
   b. Repair or otherwise correct leaks.

C. Clean Up and Touch Up

1. Repair marred painted surfaces of equipment with paint recommended by the manufacturer for that purpose. Remove debris of construction from the site daily and dispose of in a legal manner.

–END OF SECTION 17620–

SECTION 17700

AIR RELEASE VALVES FOR WASTEWATER SERVICES

PART 1 GENERAL

1.1 SCOPE

Furnish, install, and test all air release valves, vacuum relief valves, and combination air valves as shown on the drawings.

1.2 SUBMITTALS

Submit shop drawings and manufacturer's literature to the Engineer for approval in accordance with Specification Section 01300.

PART 2 PRODUCTS

2.1 MATERIALS

A. Bodies and Covers: shall be of cast iron (ASTM A126, Class B, or ASTM A48, Class 35) or ductile iron (ASTM A536, Grade 65-45-12). Cover Bolts and nuts shall be stainless steel.

B. Valve Connections: Flanged-end dimensions and drilling for cast-iron bodies and covers shall conform with ASME B16.1, Class 125 or Class 250. Flanged-end dimensions and drilling for ductile-iron bodies and covers shall conform with ASME B16.42, Class 150 or Class 300. Flanges shall be flat faced unless otherwise specified by the purchaser. Threaded-end connections shall conform with the requirements for tapered pipe threads for general use, per ASME B1.20.1.

C. Floats: Float balls and guides shall be stainless steel. For valves with inlet sizes less than 4 inches, the float shall be capable of withstanding a collapse pressure of 1,000 psig. For valves with inlet sizes 4 inches and larger, the float shall be capable of withstanding collapse pressures of 750 psig.

D. Venting: Air release valves and the air release mechanism of combination valves shall be designed to open positively and vent air to the atmosphere at system pressures up to the maximum working pressure. Orifices shall be sized accordingly. The vent pipe shall be continuous from the valve to 2 ft (minimum) above finished grade and shall be provided with a #14 mesh screened, downward-facing elbow.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the valves in strict accordance with the requirements contained in Specification Section 17000 – Piping General Provisions and Drawings.

B. If required by OWNER, provide services of technical representative of valve manufacturer available on-site during installation of valves.

C. Prior to installation, remove foreign matter from within valves. Inspect valves in open and closed position to verify that the parts are in satisfactory working condition.

D. Install vales and valve manholes and vaults where indicated on Drawings or as located by the OWNER. Set manholes and vaults plumb and as detailed. Center manholes on valves. Compact around each manhole and vault for a minimum radius of 4 feet, or to undisturbed trench face, when less than 4 feet. Provide above- ground vents for manholes and vaults as indicated on Drawings. The vent pipe shall be continuous from the valve to 2 ft (minimum) above finished grade and shall be provided with a #14 screened, downward- facing elbow

3.2 TESTING

A. Conduct pressure and leakage tests as required by Section 17010.

3.3 PAINTING OF PIPING AND VALVES

Paint piping and valves located in vaults, stations, and above ground.

–END OF SECTION 17700–