SECTION 02741

PIPE BURSTING METHOD FOR
WATER MAIN REPLACEMENT

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies the installation of water mains by pipe bursting, including employing temporary water supply system, connecting to existing mains, connecting to existing services, or installing building service connections.

B. All gate valves, hydrants, and other appurtenances will be installed using the related Section 02660 and Section 02661, and standard details for the local water authority.

C. Related Sections:
1. Section 02315 – Utility Trenching, Backfill and Compaction
2. Section 02660 – Water Main Systems
3. Section 02661 – Ductile Iron Water Main Pipe
4. Section 02662 – High Density Polyethylene Water Main Pipe
5. Special Provision for Pre-Chlorinated Pipe Bursting

1.2 MEASUREMENT AND PAYMENT

A. **Water Main, _____, ____ inch, Pipe Burst……Foot**:
The Owner shall pay for **Water Main** installed by pipe bursting of the material and diameter specified at the contract unit price per lineal foot, measured in place along the centerline of pipe, which price shall be payment in full for furnishing the materials including specials and fittings, tracer wire, all necessary excavation, sheeting, shoring or bracing, draining, laying, jointing, bedding, testing, disinfecting, backfilling, disposal of surplus excavated materials, restoration and final cleanup, and all other work required for the construction of the water main. All labor, tools and material necessary to excavate for, lay, join, backfill, test, disinfect, and finish the water mains complete, shall be considered as part of the water main construction. Measurement of **Water Main** will be taken from end to end along the surface above the main with no reductions for fittings and valves.

B. The cost associated with excavating, supporting, dewatering, using, and backfilling insertion and pulling shafts, access or exit pits, or other necessary excavations will not be paid separately, but shall be included in the unit price bid for **Water Main, _____, ____ inch, Pipe Burst**.

C. The costs associated with installing segments of water main pipe and fittings by open-cut methods in accordance with installation requirements of the material specified on the plans, including, but not limited to, necessary joint restraints, inline pipe restraint, stone bedding and initial backfill, permanent and temporary thrust blocking and specified tracer wire will not be paid separately, but shall be included in the unit prices bid for **Water Main, _____, ____ inch, Pipe Burst**.

D. The costs associated with providing temporary water supply system, which may include provisions for temporary fire protection, shall not be paid separately, but shall be included in the unit price bid for **Water Main, _____, ____ inch, Pipe Burst**, unless specifically provided for in the Proposal.

E. All appurtenances proposed as part of the project including but not limited to, physical connections to the existing system, gate valves, gate wells, hydrant assemblies, blow-offs, and air release valves will be paid for separately as described in the related Section 02660.

1.3 REFERENCES

A. Abbreviations and Acronyms
1. ANSI – American National Standards Institute (www.ansi.org)
2. ASTM – American Society for Testing and Materials
3. AWWA - American Water Works Association (www.awwa.org)
4. IPBA – International Pipe Bursting Association (www.nassco.org)
5. NSF – National Sanitation Foundation

B. Definitions
1. Pipe Bursting - Method of trenchless construction where a host pipeline is split or fractured in place to allow for the simultaneous insertion of a new pipe in place of the host pipeline.
2. Expander - A device that pushes pieces of burst or cut pipe into the surrounding soil, creating a temporary opening large enough to accommodate insertion of a new pipe.
3. Splitter - A tool used to fracture the host pipe and is pulled in front of the expander.
4. Host pipe – the existing pipe that is to be burst and replaced with a new pipe.
5. Product pipe – the piping to be permanently installed for the project.
6. Pneumatic Pipe Bursting - Method that uses a percussive force, applied by a reciprocating hammer driven by compressed air, to displace fracturable pipes.
7. Static Pipe Bursting - Pipe bursting in which a pull force is applied to an expander through steel pulling rod assemblies inserted through the host pipe. The expander transfers the horizontal pulling force into a radial force that breaks the existing pipe. Roller blade cutting wheel assemblies enable bursting of nonfracturing types of pipe.
8. Temporary Water Supply System - temporary potable water supply piping, fittings, and appurtenances constructed to provide water to buildings in the project area while the existing water main is out of service and being replaced by Pipe Bursting. May include integrated or separate temporary fire protection supply and hydrants.
9. Burst Pit – the access pit where the bursting machine or winch system is placed.
10. Insertion Pit – the access pit where the product pipe is inserted into the host pipe.
11. Rod Payout – process of assembling a string of rods and pushing them in a stepwise manner from Burst Pit, through the interior of the host pipe to the Insertion Pit.
12. Pre-Chlorinated Pipe Bursting Method - A specific method of pipe bursting where the replacement pipe is fused, assembled and tested and disinfected

above ground; before being pulled into place by pipe bursting. Service taps are immediately completed on the newly installed water main, which is put into service at the end of each workday.

C. Reference Standards
1. AWWA C651, “Disinfecting Water Mains”
2. ANSI/AWWA C622-19 Pipe Bursting of Potable Water Mains 4 In. (100 mm) to
36 In. (900 mm)
3. International Pipe Bursting Association (IBPA), “Guideline for Pipe Bursting (2012)”
4. NASTT’s Pipe Bursting Good Practices Guidelines, Third Edition, 2019
5. All work shall comply with the reference standards unless specifically stated otherwise in the Specification.
6. References to documents and standards which are made part hereof shall be latest edition thereof.

1.4 PROJECT WORK PLAN

A. Prepare a Project Work Plan (PWP) a minimum two (2) weeks in advance of the pre-construction meeting which clearly defines the pipe bursting installation methods in conformance with the requirements of the Contract Documents. The PWP shall at minimum contain:
1. Bursting Schedule, refer to Article 1.6.B
2. Pipe Burst Plan, refer to Article 1.6.C
3. Schedule of Submittals.
4. Traffic Control Plan
5. Temporary Water Supply System, if applicable, refer to Article 1.6.D
6. Fire Protection Plan, refer to Article 1.6.E
7. Water main material type, size, and class, including manufacturer recommended maximum allowable pulling force for the pipe and joints.
8. Equipment and method for joining water main pipe.
9. Method and materials for installing tracer wire.
10. Pipe bursting system specifications, size, capacity, setup requirements, etc.
11. Type of Splitter and Expander
12. Method of monitoring and controlling the grade.
13. Arrangement of equipment in access pit.
14. Proposed shoring, support or temporary earth retention systems for access pits.
15. Location of product pipe joining areas and staging areas.
16. Method of construction and restoration of existing water service connections
17. Dewatering plan and method, if applicable
18. Project contact list and defined responsibilities.
19. Communications plan for public notifications
20. Settlement/Heaving Monitoring Plan, refer to Article 1.6.F

B. Compensation for all work required for the preparation of the PWP shall be included in the cost of the project.

C. If during construction, the Contractor determines that modifications to the method and equipment as stated in the original submittal is necessary, then the Contractor shall submit a plan describing such modifications, including the reasons for the modifications, to the Owner for review and concurrence prior to making the modification.

1.5 SUBMITTALS

A. Comply with Specification Section 01300.

B. All relevant pipe and materials submittals must be approved by the Engineer before work can proceed. Delays to the project resulting from multiple reviews of incomplete or insufficient submittals will not be cause for contract time extension.

C. Refer to the related sections within the specifications for submittals required for the proposed product pipe to be installed.

D. Project Work Plan as detailed in Article 1.4.
   1. Owner reserves the right to request the PWP prior to award to assist in the bid review and assess which submission best meets the needs of the project and the Owner.
   2. Failure to provide the requested information within one (1) week of the request will result in the Contractor being removed from consideration for award of the Contract.

E. Project Experience
   1. Projects that include nominal water main diameters of 14-inches and less;
      a. Submit documentation showing three (3) continuous years of pipe bursting experience with at least 25,000 feet of water main installation via pipe bursting for projects similar in the scope and value to the project specified in the contract documents.
      b. Provide evidence of completion of at least five (5) projects of similar magnitude and soil and groundwater conditions.
   2. Projects that include nominal water main diameters 16-inches and greater;
      a. Submit documentation showing three (3) continuous years of pipe bursting experience with at least 15,000 feet of water main installation via pipe bursting for projects similar in the scope and value to the project specified in the contract documents.
      b. Provide evidence of completion of at least three (3) projects of similar magnitude and soil and groundwater conditions.
   3. Projects that specify pre-chlorinated pipe bursting;
      a. Provide evidence of at least two (2) successfully completed pre-chlorinated pipe bursting projects in the past five (5) years
      b. Pre-chlorinated pipe bursting experience shall be included in addition to the information required based on nominal water main diameter.
   4. Include the following information at a minimum;
      a. Date, duration and location of the work,
      b. Pipe information (i.e. length, diameter, depth of installation, pipe material, etc.),
      c. Project owner information (i.e. name, address, telephone number, contact person, etc.), and,

d. Contents handled by the pipeline (i.e. water, wastewater, conduit, gas, etc.).

F. Personnel Experience
1. Submit a list of field supervisory personnel and their experience with pipe bursting systems and operations
   a. Field supervisory personnel shall have a minimum of three (3) years' experience in the performance of the work and tasks as stated in the contract document.
   b. At least one of the field supervisors listed must be at the site and be responsible for all work at all times when pipe bursting operations are in progress.
2. Personnel responsible for operating the pipe bursting system must be trained and have up-to-date certifications from the manufacturer of the pipe bursting system for the pipe sizes specified in the contract documents..
   a. Provide all current certificates for personnel that will be operating the pipe bursting equipment.
3. Include certifications for all operators, including the operator assigned to this job.
4. Pipe bursting operations will be postponed until the resume(s) of the Contractor's field supervisory personal have been received, reviewed, and approved by the Owner.

G. Public Relations Plan
1. Provide example notifications for the proposed work and any water service interruptions that would be a direct result of the work.
2. Confirm with the Owner the expectation for notification requirements such as notification content, distribution lists, breadth of coverage and timing of notice.

H. Submit all drawings, catalog cuts and other descriptive data covering related items in the same system at the same time in order that their complete integrated applicability in the entire system may be adequately reviewed.

1.6 QUALITY ASSURANCE

A. Verify horizontal and vertical location of all known utility crossings along the proposed burst path in accordance with PA 174.

B. Bursting Schedule
1. Provide a pipe bursting schedule prior to the pre-construction meeting that generally describes the following;
   a. Identification number for each pipe burst segment
   b. Length of each pipe burst segment
   c. Diameter of each pipe burst segment
   d. Submit schedule electronically in Microsoft Excel format (or similar) for use by the Owner.

C. Pipe Burst Plan
1. Provide a pipe burst plan prior to the pre-construction meeting that generally describes the following;
   a. Sequence of installation and schedule for each pipe burst segment identified in the bursting schedule.

b. Dimension and shoring typicals for all access pits
c. Location of access shafts by station from the Drawings and location of any other planned excavations necessary for completion of the work, including reconnecting water services.
d. Various methods of pipe joining are proposed to be used.
e. Where inline restraint measures are to be installed.
f. Demonstrate how each part of the water system is to be isolated from the existing system at each stage of the sequencing process.

D. Temporary Water System Plan
1. Provide a schematic layout of the proposed temporary water system that generally describes the following;
a. Provide sizing, layout and material specifications of temporary water system
1) Use 2-inch diameter tubing for main branch of temporary system providing domestic service, at a minimum
2) Use 3/4-inch diameter piping for individual services at a minimum.
b. Provide calculations for maintaining system pressure
1) Supply a minimum of 35 psi to each temporary connection.
2) If extent of area being serviced by the temporary water supply system is such that the 2-inch main branch does not provide required minimum pressures, increase the size of the main branch or reduce the area being served.
c. Provide details of ramps and pavement crossings to protect temporary water system

E. Fire Protection Plan
1. Provide a fire protection plan that generally describes the following;
a. Identify the minimum fire flow goals for the project area.
b. Demonstrate how minimum fire flows and necessary level of fire protection will be achieved during the execution of the project.
c. Use minimum 4-inch tubing when providing water supply to temporary fire hydrants.

F. Settlement/Heaving Monitoring
1. Monitor potential heave or settlement at each shoulder point, each edge of pavement, the edge of each lane of pavement (or centerline for two lane roads), and otherwise at 50 foot intervals along the pipe centerline.
2. Perform baseline survey one day prior to initiating this operation at each required monitoring location.
a. Perform daily follow-up surveys at the monitoring points established in the baseline survey until the pipe bursting operations are complete.
b. Record all survey readings to the nearest one-hundredth (0.01) of a foot.
3. Take digital photographs of the ground surface conditions prior to and after pipe bursting operations.
4. Stop pipe bursting operations immediately whenever monitored points indicate a vertical change in elevation of ½ inch or more, or any surface disruption is observed.
a. Immediately report the amount of settlement to the Owner's resident project representative or permitting agencies inspector.

G. As-Built Survey
   1. Provide a tabulation of coordinates referenced to the Burst Pit, Insertion Pit and all utility crossing pits to accurately describe the location of the product pipe.
   2. Provide a log of the pullback pressures for each setup upon completion of the installation of each length of pipe.

1.7 SITE CONDITIONS

A. Pipe bursting operations shall not interfere with, interrupt or endanger surface and activity upon the surface, and will be confined to the area of work as shown on the project drawings.

B. The Contractor shall carry out his operations in strict accordance with all OSHA and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving working with earth retention systems and entering confined spaces.

C. When rock stratum, boulders, underground obstructions, or other soil conditions that impede the progress of pipe bursting operations are encountered, notify the Owner and Engineer immediately.
   1. The Owner, Contractor and Engineer shall review the situation and jointly determine the feasibility of continuing bursting operations, making adjustments or switching to an alternative construction method if necessary.
   2. When it is determined that it is impossible to continue bursting operations, the Contractor will be directed how to proceed by the Owner and the Engineer.

PART 2 PRODUCTS

2.1 WATER MAIN PIPE

A. Material requirements for water main pipe of the material specified on the plans is included in the related Section for that type of pipe

2.2 EQUIPMENT

A. Pipe Bursting System (Static & Pneumatic)
   1. Designed and manufactured to force its way through a host pipe by fragmenting the pipe and compressing the broken pieces into the surrounding soils as it progresses
   2. System shall generate sufficient force to burst and compact the host pipe.
   3. Refer to manufacturer's specifications for what size unit should be used based on existing site conditions, diameter of pipe to be pulled, percent of upsize and any other relevant parameters recommended by the manufacturer.
   4. System must be capable of providing continuous tension throughout the burst.

B. Splitter
   1. Shall be designed based on the host pipe material to be fragmented.

2. Splitter design shall consider number and type of repair sleeves or couplings incorporated into the main to be burst.
    a. It is the responsibility of the Contractor to obtain this information from the water system Owner if the information is not provided on the Drawings.

C. Expander
1. Shall be sized based on the percent upsize of the product pipe to be installed.
2. Burst head diameter must be a minimum of 15% over size to the outside diameter of the Product Pipe.

D. Pneumatic Bursting Head
1. Select Bursting Head based on diameter of host pipe and winch model selected for the project.

2.3 TEMPORARY WATER SUPPLY

A. Piping Materials
1. High Density Polyethylene (HDPE) pressure pipe, refer to Section 02662
2. High Density Polyethylene (HDPE) pressure pipe and tubing, refer to Section 02662
3. Polyvinyl Chloride (PVC) pressure pipe, C-900
4. Polyvinyl Chloride (PVC) pressure pipe and tubing, ASTM D1785
5. All pipe and fittings must be NSF/ANSI 61 and NSF/ANSI 14 listed by the manufacturer and bear the NSF-pw logo or mark.
6. At a minimum, piping used for temporary water supply will have a pressure rating greater than or equal to 200 psi.

PART 3 EXECUTION

3.1 GENERAL

A. Prepare an area or areas for staging pipe fusion and assembly operations
1. Allow for adequate space to set up all equipment and necessary materials.
2. Isolate staging area from public access by using property protection fencing, barrels, barricades or other means.
3. Follow manufacturer’s requirements for handling and storage of pipe materials.
4. Protect stored and assembled pipe segments from damage.

B. Prepare for protecting existing utilities during bursting operations.
1. Perform necessary exploratory excavation and utility locating to verify the location and depth of any underground utilities and structures that could be impacted by the pipe bursting operations.
2. Contact Miss Dig a minimum of 3 working days before any work is to begin.
3. Existing utilities within the path of the proposed pipe burst shall be “pot holed”, to determine the depth.
4. The costs of any “pot holing” will be borne by the Contractor and included in the unit bid price for installing the new watermain, unless a specific item is provided in the Proposal for exploratory digging and locating of utilities.

5. Where potential conflicts may occur, install water main by open-cut method at a sufficient depth so that there is 18 inches of clearance between the new water main and the other utility or provide specified bedding or bridging techniques to spread the load to adjacent utilities at the discretion of the Owner's field representative.
6. No additional costs will be allowed for installing water main by open-cut means or installing the specified bedding or bridging techniques in these instances.
7. Contractor is responsible for all damages resulting from failure to verify the location of existing utilities before performing pipe bursting.

C. Dewatering
1. Dewatering of pits and excavations must meet the general provision and specifications for watermain construction in effect per the Owner's requirements.
2. The dewatering plan and method used by the Contractor, must be approved by the Owner, prior to commencing with the dewatering activity.
3. When water is encountered, the Contractor must provide a dewatering system of sufficient capacity to remove water, keeping any excavations free of water until the backfill operation is in progress.
4. Dewatering will be performed in a manner that removal of soil particles are held to a minimum.
   a. Refer to soil borings, if provided, in the Contract Documents
   b. The groundwater level is subject to change, and the contractor shall be responsible for making his own determination of water levels that may exist during construction.
5. All dewatering work, if necessary, shall be considered incidental to the unit bid price for Pipe Bursting unless specifically listed in the project proposal.

3.2 PREPARATION

A. Initiate Public Relations Plan
1. Before disrupting water service to any residents, assist the Engineer and Owner with notifying affected residents. Notifications will consist of door-hangers and will be distributed three (3) days in advance of project start-up, and again the day before their services are disrupted.

B. Install Temporary Water Supply System
1. Install temporary water supply system in accordance with the approved Temporary Water System and Fire Protection Plans.
2. Perform hydrostatic pressure testing and disinfection of the temporary water supply system in accordance with ANSI/AWWA C651 before putting into service.
3. Protect temporary tubing at residential driveway or sidewalk crossings using fabricated ramps or planks. Ramps must comply with ADA requirements.
4. Protect temporary tubing at road, street, or commercial drive crossings by sawcutting and removing pavement materials to create a trench for placing the tubing and covering with steel road plates.
5. Maintain the temporary system throughout the duration of the project, completing all necessary repairs if damaged or if leaks are detected.
6. Provide 24-hour a day, 7-day a week emergency call service for maintenance and repairs to temporary water service to maintain constant service.

C. Pipe Joining
   1. Complete in accordance with requirements specified in the related Sections for the pipe material being installed.
   2. Every assembled pipe segment installed shall be uniquely identified.
   3. Identify, locate and record each fusion joint with reference to each assembled pipe segment.

D. Remove trees, landscaping, pavement or concrete as needed to meet the general provisions and specifications for watermain construction per the Owner's requirements.
   1. Any removals not specifically noted on the drawings must be authorized by the Owner or Engineer.

3.3 PIPE BURSTING

A. Access Pit Excavation
   1. Excavate access pits at the locations and dimensions to allow installation of the water main pipe at the required depth without exceeding the manufacturer's recommended bending radius for the size of pipe being installed.
   2. Complete all excavations in accordance with the applicable provisions in related Sections 02315 and 02660.
   3. Construct excavation in accordance with MIOSHA Construction Safety Standards for "Excavation, Trenching and Shoring".
   4. Install adequate supports and bracing in the access shafts to resist the forces resulting from the pipe bursting equipment pulling the product pipe through the host pipe.
   5. Install protection fencing or barriers adjacent to equipment and supplies to prohibit pedestrian access to the work site.
      a. Equipment shall not be used as fencing to protect access pits
   6. All excavations left open overnight must be secured with construction fencing or steel plates within roadways, drives or sidewalks.

B. Water Service Connections
   1. Expose all water service connections and disconnect from the existing main before decommissioning the water main to be burst.

C. Decommission Host Pipe
   1. Ensure isolation of water system before cutting or removing any water main to minimize disruption of service to area residents.
      a. Existing valves are to be operated by the Owner or their designated representative.
         1) Request that valves be checked and exercised prior to beginning work to minimize chance of delay if any are found to be inoperable.
         2) Allow adequate time for the Owner to repair with their forces, or repair if requested by the Owner.
      b. Install temporary water-stops where indicated on the plans or where necessary to isolate the desired portion of the water system.
      c. Install caps on cut water main only where shown on "Pipe Burst Plan" and allowed by Owner.
   2. Disconnect water service connections from existing pipe before bursting to prevent introduction of debris into or contamination of the water service.

D. Burst Machine Location & Shoring
   1. Burst pit shall be shored in accordance with Article 3.3.A.
   2. Shore the forward face of the Burst Pit (surface that the machine bears against while pulling product pipe) to maintain perpendicular burst machine alignment to the pipe during pullback.
      a. Slope the Burst Pit such that the rear of the burst machine sits 2 to 3 inches lower than the front of the burst machine upon setup to help maintain alignment during bursting.
      b. Loss of perpendicular alignment during the pull-back operation may result in the stopping of the bursting process and improvement of the forward face shoring.
   3. Provide rearward shoring to react rod thrust forces during Rod Payout.
      a. Helps stabilize the bursting machine to maintain perpendicular alignment of the machine during Rod Payout.
      b. Using the weight of the burst machine to resist thrust forces is not acceptable.
      c. Host pipe at rear face of Burst Pit may only be used for rearward shoring if it is scheduled for replacement.
   4. Cut off the pipe face for cast iron, ductile iron or PVC pipe using a saw or similar device to produce a square face for the bursting machine forward face to bear against.
      a. Remove a sufficient length of the host pipe to accommodate the burst machine.
      b. Follow asbestos abatement regulations for the removal of asbestos cement host pipe to produce a square face.
   5. Position burst machine so the rod centerline is located at the approximate centerline of the host pipe.
   6. Accommodate for rod box delivery and removal between temporary rod storage location and Burst Pit with appropriate lifting equipment and techniques.

E. Rod Payout Operation
   1. Use caution when lifting rod boxes into and out of Burst Pit, follow OSHA or other applicable requirements with respect to equipment and method.
   2. Clean threads of foreign matter before assembly.
   3. Monitor the counting of rods during payout or quantity of rods per box such that the operator is aware of the distance between the burst machine and the lead end of the rod string.
   4. Monitor the thrust force during payout.
      a. Halt the payout process should an unexpected sudden and significant increase in thrust force be experienced.
      b. Review with the Owner potential features or obstructions that may have caused the issue.
      c. Either continue with the Rod Payout should the obstruction be determined to be an encrustation or excavate an additional pit at the location of the obstruction to remove or accommodate for the obstruction.
   5. Cut the host pipe within the insertion pit prior to the arrival of the rod string.
      a. Remove a sufficient length of the host pipe to allow the burst tooling and product pipe to enter the host pipe.
      b. Position the second end of the host pipe at the rear of the Insertion Pit so as to not damage the product pipe as it travels through the Insertion Pit.

6. Do not enter the Insertion Pit when the rod string is nearing.
    a. A workman shall be in visual or radio contact with the burst machine operator so as to have payout halted in a position that allows attachment of the burst tooling without subsequent repositioning of the rod string.

F. Pullback Operation
1. Station personnel at the Insertion Pit, Burst Pit and strategically along pipe the product pipe to ensure proper communication during the burst and to watch for entanglements of the product pipe with above ground obstructions.
2. Paint the lead and second rods of the rod string to give notice to the burst machine operator the position of the bursting tool.
3. Attach the bursting tool to the rod string to allow for at least 45 degrees of pivot to the rod axis.
4. Attach the bursting tool to the product pipe such that;
    a. The rear of burst head overlaps the front of the product to reduce the risk of damage to the leading edge of the product pipe.
    b. The bursting tool can swivel around the product pipe to relieve torsional stress on the product pipe.
5. Maintain the minimum rate of pullback until the bursting tool has completely entered the host pipe and closely monitor, at minimum, the first 20 feet of pullback.
6. Pullback forces are typically experienced by the expander and the pull head and not the pipe and tracer wire
    a. Should the pull force on the burst machine exceed the allowable pulling forces for the product pipe or tracer wire, notify the Owner and Engineer and document the exceedance.
    b. Review the pipe that is pulled into the Burst Pipe for signs of elongation and check wall thickness and tracer wire continuity to ensure the pipe and tracer wire did not experience the full force of the pullback.
7. Communicate with the burst machine operator at all utility crossing pits.
8. Rework the forward face shoring in accordance with Article 3.3.D should the shoring yield significantly to bring the burst machine out of square with the host pipe.
9. Pull the product pipe face beyond the forward face of the Burst Pit sufficiently to anticipate longitudinal shrinkage and provide lengths required for pipe joining
    a. The distance the product pipe is pulled past the face of the Burst Pit is at the discretion of the Contractor and should be confirmed with the Owner.
10. Seal the pipe ends after pullback operation has been completed to avoid the entry of foreign matter or ground water into the product pipe.

G. Repair damage caused by displacement of soils from the pipe bursting operations at no expense to the Owner.
1. This applies to underground utilities and structures, and surface features.
2. Complete repairs in accordance with the appropriate sections of the Specifications.

H. Monitor ground vibrations induced by the pipe bursting operations.

1. The peak particle velocity of the soil shall not exceed 1/2-inch per second as measured at the right-of-way line or easement limit, or within 30 feet of any nearby structures or buildings, whichever is closest to the nearby structure or building that is susceptible to damage from vibration.
2. Make adjustments to the construction methods being employed to keep vibrations below established thresholds.

3.4 FIELD QUALITY CONTROL

A. Provide and maintain instrumentation which will accurately perform the following functions:
   1. Monitor and measure pullback pressure.

B. Always provide the Owner and Engineer access to the instrumentation.

3.5 WATER SERVICES

A. After completion of pipe bursting and acceptance of new water main for use, reconnect existing services or install new service connections as specified on the Drawings.

B. Water service piping shall be as specified on the Drawings and required by Owner, and shall use compatible transitions, fittings or couplings as specified for making connection to the existing service line.

3.6 HYDROSTATIC PRESSURE TESTING

A. Conduct hydrostatic pressure testing in accordance with the specification for the material specified on the plans.

3.7 DISINFECTION

A. Disinfect water main in accordance with ANSI/AWWA C651 and as described in Section 02660.
B. Unless otherwise indicated, Contractor to coordinate bacteriological samples with a certified laboratory and the Owner.

3.8 FINISH

A. The finished product pipe shall be as commercially practicable from visual defects such as foreign inclusions, scratches, gouges, pinholes and delamination.

B. For non-metallic product pipe, check the tracer wire continuity.

C. Disassemble and remove the temporary water supply system after connections are made to the new water main. Complete any necessary repair or restoration to disturbed surfaces.

D. Restore to existing condition all excavations required for proper installation and inspection of the product pipe. Site restoration for the pipe bursting operation is considered included in the cost of construction unless otherwise indicated under separate pay items listed in the Proposal.

3.9 NON-CONFORMING WORK

A. Non-conforming work is any work outside of the acceptable tolerances for the item of work identified within these specifications that is considered to affect the performance and/or future maintenance of the new product pipe.

B. The finished product pipe shall be continuous over the entire length of the pipe section and be as free as commercially practicable from visual defects such as foreign inclusions, scratches, gouges, pinholes and delamination.
   1. Any visual defects shall be repaired at the Installation Contractor's expense in a manner mutually agreed upon by the Owner and the Installation Contractor.
   2. Damage to the product pipe in excess of the manufacturer's established tolerances are not acceptable and will require removal and replacement.

END OF SECTION