



SPECIAL PROVISIONS

FOR

WATER MAIN

Linn County

Project Numbers

NHSX-100-1(59)--3H-57 and

ESP-100-1(61)--2S-57

Effective Date
October 20, 2009

THE IOWA DEPARTMENT OF TRANSPORTAION STANDARD SPECIFICATIONS,
SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND
ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL
OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS AND GENERAL
SUPPLEMENTAL SPECIFICATIONS.

PART 1 GENERAL

1.01 - Section Includes

- A. Water Mains.
- B. Bolts and Fittings.
- C. Valves and Valve Boxes.
- D. Fire Hydrant Assemblies.
- E. Blowoff Assemblies.
- F. Air Release Assemblies.
- G. Testing and Quality Control.
- H. Trench Excavation.
- I. Dewatering.
- J. Bedding and Backfill.
- K. Open cut installation of casing pipe.
- L. Casing pipe, spacers, and end seals.
- M. Water Services
- N. Adjust Water Service Stop Box
- O. Relocate Water Service Stop Box

1.02 - Description Of Work

- A. Water Mains.

This item includes furnishing and installing water pipe in accordance with the Contract Documents. All main shall be enclosed in Polyethylene Wrap. Joints shall be restrained a minimum distance from each fitting as shown on the drawings.
- B. Bolts and Fittings.

This item includes furnishing and installing bolts and fittings in accordance with the Contract Documents.
- C. Valves and Valve Boxes.

This item includes installing valves and valve boxes, in accordance with the Contract Documents. Valves will be provided by the City of Cedar Rapids Water Department.
- D. Fire Hydrant Assemblies.

This item includes installing fire hydrant assemblies in accordance with the Contract Documents. The City of Cedar Rapids Water Department will supply all piping, valves, hydrants, valve boxes, and fittings for fire hydrant assembly. All other materials to complete the temporary hydrant assemblies for testing, disinfection, blowoff, etc. shall be supplied and installed by the Contractor.
- E. Blowoff Assemblies.

This item includes installing blowoff assemblies associated with a water main, in accordance with the Contract Documents. Blowoff assemblies will be provided by the City of Cedar Rapids Water Department.
- F. Air Release Assemblies.

This item includes installing air release assemblies associated with a water main, in accordance with the Contract Documents. Air release valve will be provided by the City of

Cedar Rapids Water Department. All other materials necessary to complete the air release assembly shall be supplied and installed by the Contractor.

G. Testing and Quality Control

This item includes the furnishing of material samples and testing of the Work as set forth in the Contract Documents. This includes, but is not limited to, samples and testing pertaining to pipe bedding, trench backfill, pipe leakage, turbidity and bacteriological tests, pipe deflection.

H. Trench Excavation.

This Work includes the excavation of trenches for storm sewer, subdrains, sanitary sewer, water main, and appurtenances, through all normal earth materials, such as loam, silt, gumbo, peat, clay, soft shale, sand, gravel, fragmentary rock and weathered ledge rock which may be handled in a manner similar to normal earth materials. This also includes any required sheeting, shoring and bracing.

I. Dewatering.

This Work includes the removal of ground water from the trench excavation utilizing a well system, portable pumps, or some other means appropriate to maintain a reasonably dry trench.

J. Bedding and Backfill.

This Work includes backfilling and compacting the trench with material in accordance with the Contract Documents. Bedding and backfill are incidental.

K. Open cut installation of Casing Pipe

Work includes any required sheeting, shoring, and bracing, dewatering, and the excavation and trench installation of a casing pipe by open cut methods.

L. Casing Pipe, Spacers and End Seals

Work includes any required spacers, bracing, end seals, and miscellaneous equipment, labor and materials for the installation of carrier pipe in a casing pipe.

M. Adjust Water Service Stop Box

This work includes adjusting the existing stop box vertically to final grade.

N. Water Service and Stop Box

Work includes new water service from the water main to, and including the stop box, reconnecting the private line to the stop box. This work may also include horizontal and vertical relocation of the existing stop box and curb valve per the plans. Contractor is to reuse existing curb valves and stop box. Service tap at the main will be made by the City Water Department.

1.03 - Submittals

A. Submit test results as set forth in the Contract Documents.

B. Submit certificate of compliance indicating the materials incorporated into the Work comply with the Contract Documents.

C. The substitution of materials is allowed as set forth in General Conditions.

D. Submit joint restraint system.

E. Submit dewatering plan to the ENGINEER if dewatering is necessary.

F. Submit Shop Drawings on carrier pipe support systems.

G. Submit pipe and casing manufacturer's recommendation for casing spacer placement.

H. Submit shop drawings on casing spacers and end seals.

1.04 - Delivery, Storage And Handling

- A. Store material in accordance with the manufacturers' recommendations and in locations which will minimize the interference with operations, minimize environmental damage, and protect adjacent areas from flooding, runoff and sediment disposition.

1.05 - Scheduling And Conflicts

- A. Schedule Work to minimize disruption of public streets and facilities.
- B. Discontinue Work which will be affected by any conflicts discovered or any changes needed to accommodate unknown or changed conditions and notify the ENGINEER.

1.06 - Special Requirements

- A. The use of explosives is not permitted unless provided for in the special provisions of the Contract Documents.
- B. All work under this section shall be performed by a plumber or pipe layer licensed by the Metro Plumbing Licensing Board. Licensing may be obtained at the Cedar Rapids Building Department for all metropolitan area jurisdictions.
- C. Testing performed by the CONTRACTOR or by the ENGINEER indicating acceptable results does not relieve the CONTRACTOR of the responsibility to construct the Work in accordance with the Contract Documents or responsibility to correct any defects that are present.
- D. The test results submitted by the CONTRACTOR must meet the minimum requirements as established by the Contract Documents. If test results do not indicate compliance with the Contract Documents, additional tests in the area following the CONTRACTOR's re-work will be provided to the ENGINEER at the CONTRACTOR's expense.
- E. The CONTRACTOR shall give the ENGINEER 24 hours notice prior to performing assurance testing.
- F. The CONTRACTOR shall be responsible for repair of any trench settlement up to the level of the adjacent grade that occurs during construction as well as the warranty period. This shall include restoration of the finished surface, as required.
- G. All trench excavation shall be in accordance with OSHA Standards.
- H. CONTRACTOR shall maintain cleanup operations within 400 feet of excavation.
- I. The CONTRACTOR shall be required to obtain all necessary permits and shall be responsible for all applicable fees.
- J. Notify the Engineer immediately if contaminated soils, historical artifacts, or other similar such conditions are encountered.
- K. All Work and materials incorporated into this Project shall conform to all applicable local, state, and federal requirements.
- L. Coordination of Service Taps:
 - 1. Water main to be in service and all tests passed prior to ordering taps.
 - 2. Call Engineering (319-286-5957) at least 24 hours ahead of need for all taps.
 - 3. Confirming and/or cancellation call the day of installation (taps 2-inch and smaller)
 - 4. To have taps made in morning, call Meter Shop at 398-5230 between 7:30 a.m. and 8 a.m.
 - 5. To have taps made in afternoon, call Meter Shop at 398-5930 between 11:30 a.m. and 12:00 noon.
 - 6. Schedule taps larger than 2 inches with Engineering (319-286-5957) and Distribution (319-286-5967) at least 24 hours prior to when tap is needed. To cancel scheduled 2-inch and larger taps, call Distribution (319-286-5967) by no later than 7:00 a.m. on the day of the scheduled tap.

7. Taps 2-inches and smaller are made by the Meter Shop.
8. Taps larger than 2-inches and up to 12-inches are made by the Distribution Shop.
9. Taps larger than 12-inches are made by the CONTRACTOR after notification to the Water Department.
10. For taps larger than 12 inches, notify Distribution (319-286-5967) at least 24 hours in advance of commencement of work. Taps are not allowed without authorized City Staff on site.
11. CONTRACTOR shall furnish and install all pipe fittings, and appurtenances, except the mainline tapping valves and valve boxes.

PART 2 PRODUCTS

2.01 - Water Mains

A. Ductile Iron Pipe

1. Minimum thickness class
 1. 4-inch through 12-inch; Class 52 per ANSI/AWWA C151/A21.51
 2. 16-inch through 20-inch; Pressure Class 250 per ANSI/AWWA C151/A21.51.
 3. 24-inch; Pressure Class 200 per ANSI/AWWA C151/A21.51.
2. Cement-mortar lined, per ANSI/AWWA C104/A21.4 with asphaltic seal coat.
3. External coating: asphaltic.
4. Joint Type: Use push-on type, except where specifically authorized by ENGINEER.
 4. Push-on: per ANSI/AWWA C111/A21.11.
 5. Mechanical: per ANSI/AWWA C111/A21.11.
 6. Restrained, buried: Pipe manufacturer's standard field removable system.
 7. Restrained, in structures: Restraining gland, flanged or grooved.
 8. Flanged: ANSI/AWWA C111/A21.11.
 9. Grooved: ANSI/AWWA C606.
 10. Gaskets: Per ANSI/AWWA C111/A21.11.
5. Markings on pipe
 10. Name of manufacturer.
 11. Size and class.
 12. Spigot insertion depth gauge.

B. Disinfection Agent – Chlorine

1. Meet requirements for
 1. Calcium Hypochlorite Granules, per ANSI/AWWA B300, approximately 65 percent available chlorine by weight.
 2. Liquid Chlorine, per ANSI/AWWA B301, 100 percent available chlorine.
 3. Sodium Hypochlorite Solution, approximately 5 to 15 percent available chlorine by weight.
2. Chlorine containers must have AWWA stamp.

2.02 - Water Services

A. Controlling standards: Local water service, plumbing and fire codes.

B. Materials

1. Copper Pipe
2. Conform to ASTM B88.
3. Wall thickness: Type K.

4. Ductile Iron Pipe: As specified in Section 2.01. Polyethylene wrap is required.

C. Corporation stop.

1. Stop inlet with AWWA threads.
2. 1" minimum.
3. Manufacturer: Mueller H-15000, Mueller 4701, AY McDonald 6104, Ford F600, Ford B22-M, or approved equal.

D. Curb stop.

1. 1" minimum Oriseal ball valve full open.
2. Quarter turn check.
3. Manufacturer: Mueller H-15154B.

E. Curb box.

1. 5-1/2 feet in height.
2. 1-inch diameter upper half.
3. Stem arch pattern.
4. Manufacturer: Mueller H-10302, AY McDonald 6104.
5. Minneapolis pattern, 1 ½ inch upper half.

F. Tapping Saddle

1. Ductile iron bodies with fusion bonded epoxy coating.
2. Double straps with Buna-N gasket seal.
3. Manufacturer: Smith Blair Model 317, Romac 202N.

2.03 - Bolts For Water Main Pipe And Fittings

A. Corrosion resistant.

1. Bolts for Water Main Pipe and Fittings:
Corrosion resistant, high strength, low alloy steel in accordance with ANSI/AWWA C111/A21.11 (current version).

2.04 - Fittings

A. For Ductile Iron Pipe

1. ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.
2. Joint Type: Mechanical or restrained, per plans.
3. Cement-mortar lined per ANSI/AWWA C104/A21.4 with asphaltic coating, or unlined with fusion bonded epoxy per AWWA C116.
4. Restrained Joints
 1. Restrained Mechanical Joints: Pipe manufacturer's standard field removable system.
 2. Flanged: ANSI/AWWA C110/A21.10.
 - i. Nuts: ASTM A 563, Grade A, heavy hex head.
 - ii. Gaskets: Rubber or approved composition; 0.125-inch thick; full face.
 3. Grooved
 - i. ANSI/AWWA C606.
 - ii. Face to face dimensions: Equivalent to flanged, ANSI/AWWA C110/A21.10.
5. Wall thickness: ANSI/AWWA C153/A21.53.
6. Gaskets: Per ANSI/AWWA C111/A21.11
7. Fittings shall be smooth and pit free. Coatings shall be uniform and undamaged.

2.05 - Special Fittings

A. Restrained Joints

1. Utilize to restrain mechanical joint where required by ENGINEER.
2. Pipe manufacturer's standard field removable restraint system.
3. Suitable for buried service.
4. Corrosion resistant components.
5. Designed by pipe manufacturer, conforming to DIPRA "Thrust Restraint Design for Ductile Iron Pipe", latest edition.
6. Joint restraint system to be field installable, field removable and re-installable.
7. Restraint systems involving pipe clamps and connecting rods are not acceptable unless specifically required in the Contract Documents.
8. Joint restraint system approval; in writing from ENGINEER.
9. Contract Documents shall identify locations and number of joints to be restrained.

2.06 - Concrete Thrust Blocks

A. Application:

1. For use with pipe sizes up to 16 inch diameter unless approved by Engineer.
2. For pipe sizes greater than 16-inch diameter, use restraining glands or manufacturer's standard restraint system per paragraph 2.04.

B. Refer to the plan details for drawings of the dimensions and installation of thrust blocks.

C. Concrete minimum compressive strength is 3000 psi.

2.07 - Pipe Line Accessories

A. Polyethylene Wrap

1. Conform to ANSI/AWWA C105/A21.5.
2. Minimum thickness: 8 mil.
3. Utilize polyethylene wrap on all ductile iron pipe and fittings in buried service.

B. Tracer System

1. Use on ductile iron pipe larger than 16-inch diameter and on all PVC pipe.
2. Tracer Wire: #12 solid single strand, type TW or THHN.
3. Ground Rod: 3/8-inch diameter, 60-inch long steel rod uniformly coated with metallicity bonded electrolytic copper. Ground-rod clamp: High-strength, corrosion-resistant copper alloy.
4. Splice Kit: Buried service wire splice.
5. Receptacle Post: 1 lb/ft. channel post 4 feet long.
6. Receptacle Box: Top-hinged ABS plastic enclosure or equal.
7. Terminations: Scotchcast terminating kit or equal.
8. Splice Bolt: #8F brass split bolt

C. Insulation

1. Extruded polystyrene, ASTM C-578
2. High density
3. Moisture resistant
4. Suitable for underground installation

2.08 - Gaskets, Special

- A. Use special pipe gaskets in contaminated soils if so directed by ENGINEER.
- B. Soils contaminated with gasoline; Neoprene or Buna N material.

C. Other soil contaminants; as required by ENGINEER.

2.09 - Valves

A. General

1. Same size as pipeline in which it is installed, unless noted otherwise on Drawings.
2. Manufacturer's name or initial and working pressure cast on valve body.
3. Opening direction arrow shall be cast on operating nut.
4. Open when turned left or right as required by jurisdiction – See Appendix A.
5. Factory tested to twice the rated working pressure.
6. Buried service: Mechanical joints, unless noted otherwise.
7. Service within structure:
 1. Flanged, per ANSI/AWWA C110/A21.10.
 2. Flanges, drilled to conform to ASME/ANSI B16.1 class 125, unless noted otherwise.
 3. All valve operators to be supplied by valve supplier.
8. Bolts for joints: Refer to paragraph 2.03.A.

B. Butterfly Valves, Buried Service

1. Utilize: 12" diameter and larger
2. Type: Rubber seat.
3. Pressure rating: 150 psi working pressure.
4. Bubble-tight at rated pressures with flow in either direction.
5. Comply with: ANSI/AWWA C504 class 150B.
6. Body
 1. Cast iron per ASTM A 126 class B.
 2. Two trunnions for shaft bearings.
7. Ends: Mechanical joint, except as otherwise shown in the Plans.
8. Disc:
 1. Material: Cast iron ASTM A126 class B, with plasma applied nickel-chromium edge.
 2. Connection to shaft: Mechanically fixed stainless steel pins.
9. Shaft
 1. Material: Stainless steel, type 304.
 2. Turned, ground and polished.
10. Seat
 1. Material: Synthetic rubber compound
 2. Simultaneously molded in, vulcanized and bonded to body.
11. Bearings
 1. Corrosion resistant and self-lubricating, sleeve type.
 2. Bearing load: Not greater than 1/5 the compressive strength of the bearing or shaft material.
12. Packing: O-ring type
13. Operator
 1. Type: Buried service.
 2. Three bolt, minimum, mounting to valve.
 3. Hold valve in any intermediate position between fully open and fully closed without creeping or fluttering.
 4. Equipped with mechanical stop-limiting devices to prevent over-travel of the disc in the open and closed positions.

5. Fully enclosed, gasketed and grease packed.
 6. Designed to operate the valve under full rated working pressure with a maximum of 80 foot-pounds applied force.
 7. Withstand an input of 450 foot-pounds at extreme operator position without damage.
 8. 2-inch square nut.
14. Finish:
 1. In accordance with ANSI/AWWA C504.
 2. Exterior Finish – See Appendix A.
 15. Exposed bolts and hex nuts: Per paragraph 2.03 of this section.
- C. Gate Valves, Buried Service
1. Type: Non-rising stem, resilient seat.
 2. Pressure rating: 200 psi working pressure up to and including 12" and 150 psi over 12".
 3. Comply with: ANSI/AWWA C509
 4. Body, Bonnet and Discs: Cast iron per ASTM A 126 class B.
 5. Ends: Mechanical joint, except as otherwise noted.
 6. Seat, disc rings, stem and spindle: solid bronze bearing against bronze surface.
 7. Shaft seals: Double O-rings permanently lubricated between seals. Lubricant certified for use in potable water.
 8. Mechanism design: travel of discs ceases before discs begin to seat in closing; travel of discs commences after disc is fully unseated in opening.
 9. Operator: 2-inch square nut.
 10. Exterior finish: Fusion bonded epoxy per ANSI/AWWA C550.
 11. Interior finish: In accordance with AWWA C550
 12. Approved Manufacturers: Mueller, Clow, Kennedy, M&H.
- D. Tapping Valve Assemblies
1. Valve: Tapping valve conforming to ANSI/AWWA C509.
 2. Gasket.
 1. To completely surround pipe.
 2. Minimum thickness 0.125 inch.
 3. Material: nitrile rubber.
 3. Bolts: Per 02500, 2.03
 4. Tapping Sleeve (Tap size larger than one-half pipe size).
Cedar Rapids Water Department will provide tapping valve.
 5. Tapping Sleeve (Tap size one-half pipe size or less).
 1. Sleeves shall have fusion bonded epoxy coating per AWWA C213, interior and exterior.
 2. Sleeves shall be furnished with type 304 stainless steel bolts and accessories.
 3. Approved sleeves: Smith-Blair Tapping Sleeve 622, Romac FTS 420, Dresser, or Approved equal.
- E. Valve Box
1. Applicability; For all buried gate or butterfly valves.
 2. Type
 1. In paved areas; slide type.
 2. In all other areas; screw extension.
 3. Material: Cast iron.

4. Cover: Cast iron, labeled "WATER".
5. Wall thickness: 3/16-inch, minimum.
6. Inside diameter: 5-inches, minimum.
7. Length: Adequate to bring top to ground surface.
8. Factory finish: Asphalt coating.
9. Manufacturer: East Jordan Iron Works, Tyler, or Approved Equal

2.10 - Fire Hydrant

- A. Supplied by OWNER.

2.11 - Blowoff and Air Release Assemblies

- A. Construct according to Detailed Drawings.
- B. Nominal size: 2 inch
- C. Locations: Where shown on the Plans.
- D. Components: Pipe, valve, curb box, thrust block, elbow, pipe cap and miscellaneous fittings, all as specified or shown. All components shall have iron threads.
- E. Drain-back holes are not acceptable.

2.12 - Trench Stabilization

- A. Trench Bottom Stone required for excessively unstable trench bottoms shall have a sieve size which is predominately 1-1/2 inch to 2-1/2 inch crushed stone. The aggregate passing the No. 16 sieve shall not exceed 10%. The quality of the aggregate shall be as specified below for aggregate bedding.

2.13 - Bedding

- A. Aggregate Bedding shall meet the following gradation:

Sieve Size:	1-1/2	1	3/4	1/2	3/8	4	8
Percent Passing:	100	95-100	50-100	20-65	10-65	0-20	0-8

Aggregate for this material shall be either gravel or crushed portland cement concrete, limestone, dolomite, or quartzite, free of clay and objectionable clay coatings. The abrasion loss, as determined by AASHTO T96, Method A or B, shall not exceed 45 percent. The aggregate shall not contain more than 5% shale particles retained on the No. 16 sieve.

- B. Compacted aggregate bedding shall be required on RCP Casing Pipe. Under the bottom of the pipe, the bedding shall be a minimum of 4" thick for casing diameters of 27" and smaller, 6" thick for casing diameters of 30" to 60", and 8" for casing pipe diameters 66" and larger. In addition to the bedding below the pipe, the bedding shall extend 1/2 way from the bottom of the casing pipe to the springline of the casing pipe.
- C. Water mains 16" diameter and smaller shall be bedded with compacted select excavated materials. The compacted bedding shall extend from the bottom of the pipe to the springline of the pipe.
- D. All bedding shall extend the full width of the trench.

2.14 - Backfill

- A. Granular backfill, when specified, shall meet the requirements of Iowa DOT Standard Specification 4109, Gradation No. 11.
- B. Drainable backfill, when specified, shall meet the following gradation:

Sieve Size:	1-1/2	1	3/4	1/2	3/8	4	8
Percent Passing:	100	95-100	50-100	20-65	10-65	0-20	0-8

Aggregate for this material shall be either gravel or crushed portland cement concrete, limestone, dolomite, or quartzite, free of clay and objectionable clay coatings. The abrasion loss, as determined by AASHTO T96, Method A or B, shall not exceed 45 percent. The aggregate shall not contain more than 5% shale particles retained on the No. 16 sieve.

- C. Native backfill, when specified, shall be free of organic and other deleterious materials, and in general shall meet the following requirements:
 - 1. A minimum optimum density of 95 pcf (ASTM D698)
 - 2. Plasticity index of less than 19 (AASHTO M145)
 - 3. Soils placed below standing water shall be clean granular material.

D. Flowable Mortar:

- 1. Flowable mortar materials shall meet the following mix ratio (approximately 1 cubic yard):

	Standard	Diggable
Portland Cement	100 lbs.	40 lbs.
Fly Ash	400 lbs.	250 lbs.
Fine Aggregate	2,600 lbs.	2,900 lbs.
Water	60-90 gals.	45 gals.

- 2. Portland cement shall meet requirements of AASHTO M-85, Type I.
- 3. Fly ash shall meet requirements of ASTM C618, Class C, from an approved source.
- 4. Fine aggregate natural sand shall be of the following gradation:

Sieve Size:	¾	200
Percent Passing:	100	0-10

- 5. The material shall be predominately passing the No. 30 sieve, and shall be flowable during placement. Clean concrete sand shall not be used

K-Krete commercial mix shall only be used with approval of the ENGINEER.

2.15 – Casing Pipe

- A. The water main casing shall be noted in the Contract Documents.

2.16 – Casing Spacers

- A. Casing spacers for pipe sizes larger than 6 inches shall be stainless steel with HDPE, nylon, or PVC runners.
- B. Casing spacer shall be a two piece shell made from T-304 stainless steel of a minimum 14 gauge thickness. Each shell section shall have one bolt flange formed with ribs for added strength. Each connecting flange shall have a minimum of three 5/16" T-304 stainless steel bolts. The shell shall be lined with a ribbed PVC extrusion with a retaining section that overlaps the edges of the shell and prevents slippage. Bearing surfaces (runners) shall be ultra high molecular weight polymer for abrasion resistance and a low coefficient of friction. The runners shall be attached to support structures (risers) at appropriate positions to properly support the carrier within the casing and to ease installations. The runners shall be attached mechanically by punched riser section and bolt heads TIG welded for strength. Riser shall be made of T-304 stainless steel of a minimum 10 gauge. All risers over 6" in height shall be reinforced and MIG welded to the shell. Standard positioning within the casing will require the height of the risers and runners combined shall be sufficient to provide not less than three fourths inch between the casing pipe and the outside diameter of the bell. Centered positioning within the casing will require the risers and runners to be dimensioned to center the carrier pipe in the casing with a top clearance of one half inch minimum. All welds and metal surfaces shall be chemically passivated.
- C. Use of wooden shims to support pipes shall not be permitted.

2.17 – Vents and Cathodic Protection

- A. Vents and cathodic protection shall be as set forth in the Contract Documents.

2.18 – End Seals

- E. For single carrier pipe installations, provide watertight mechanical rubber end seals.

PART 3 EXECUTION

3.01 - General Pipe Installation

- A. Install only approved materials.
- B. Protect pipe joints and valves from damage while handling and storing.
- C. Use no deformed, defective, gouged, or otherwise damaged pipe or fittings.
- D. Excavate and prepare trench.
- E. Prepare the trench bottom with sufficient exactness so that only minor movement of the pipe will be necessary after installation.
- F. Clean pipe interior prior to placement in the trench.
- G. Install pipe with fittings and valves to the lines and grades shown in the plans, with a maximum allowable variation of 3 inches.
- H. Provide uniform bearing along the full length of the pipe barrel. Provide bell holes.
- I. Clean joint surfaces thoroughly and apply lubricant approved for use with potable water.
- J. Make joints according to pipe manufacturer's recommendations and these Specifications.
- K. Tighten bolts in a joint evenly around the pipe.
- L. Install concrete thrust blocks or joint restraints where shown or required. Refer to Construction Details.
- M. Install remaining pipe bedding in accordance with Construction Details using material conforming to these Specifications.
- N. Do not install pipe in water. Keep trench free of water. Refer to ANSI/AWWA C651 for wet trench installation procedures, if such installation is approved by ENGINEER.
- O. Keep exposed pipe ends closed with rodent-proof end gates at all times when pipe installation is not occurring.
- P. Close ends of installed pipe with water-tight plugs during nights and non-working days.
- Q. Do not allow any water from the new pipeline to enter existing distribution system piping.
- R. Do not locate water service lines under proposed driveway locations and sidewalks.
- S. The CONTRACTOR shall install water stops in the trench at locations set forth in the Contract Documents. They shall be constructed of clayey excavated material compacted to 95% of optimum density (ASTM D698).

3.02 - Additional Requirements For Ductile Iron Pipe Installation

- A. Install in accordance with AWWA C600.
- B. Install with minimum cover per pipe size as follows:

12" to 20"	5' 0" cover
24" to 30"	4' 6" cover

- C. Install pipe with a maximum depth of 6'-6", unless approved otherwise by Jurisdictional ENGINEER.
- D. Cut pipe perpendicular to pipe barrel. Do not damage cement lining. Bevel cut ends for push-on joints according to AWWA C600.
- E. Encase pipe, valves and fittings with polyethylene wrap, as required by the respective Jurisdiction.

F. Refer also to AWWA C600.

3.03 - Polyethylene Encasement Installation

- A. Application: All buried ductile iron pipe, fittings, fire hydrants and appurtenances.
- B. Install in accordance with AWWA C105.
- C. The polyethylene encasement is to prevent contact between the pipe and the bedding material, but need not be airtight or watertight.

3.04 - Trench Excavation

- A. Trench excavation shall not commence until appropriate temporary erosion and sediment control is in place, the area has been cleared and grubbed, and topsoil has been excavated and stockpiled, removal of existing facilities and improvements have been completed, and construction surveys have been completed in accordance with the Contract Documents.
- B. Trench excavation for shallow crossings under pavement areas shall not commence until after the completion of subgrade preparation and granular subbase preparation, both compacted to required specifications.
- C. Topsoil shall be stripped to a minimum 8-inch depth or as otherwise identified in the Contract Documents.
- D. Trenches shall be excavated to a width sufficient to provide ample room for proper installation of the pipe and for placing and compacting backfill material, in accordance with the Contract Documents. Sheet piling, shoring and bracing shall be provided to the extent necessary to provide adequate safety to the workers engaged in the Work.
- E. The trench shall be excavated to the line and grades as indicated in the Contract Documents. The trench bottom shall be firm earth. If the trench bottom is not firm and stable, the CONTRACTOR shall be responsible to contact the ENGINEER prior to over excavating.
- F. Trench shall be free of standing water prior to placement of bedding.
- G. During non-working hours, the trench shall be protected by safety fence or other appropriate measures when open. No more than 20 feet of trench shall remain open over night or through a weekend or holiday. No more than 200 feet of trench shall be open at any time during performance of the Work.
- H. Excavation below grade:
 - 1. Where the bottom of the trench has been excavated by mistake to a greater depth than required, the CONTRACTOR shall refill this area using crushed stone bedding. No additional compensation shall be given to the CONTRACTOR. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.
- I. Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipes, appurtenances and structures for pipes, 16 inches in diameter or less and clearance of at least 8 inches for pipes larger than 16 inches in diameter. All voids shall be filled with crushed stone bedding.
- J. Where pavements are to be removed, make saw cuts along all pavement edges which are to remain. Pavement shall be removed down to subgrade elevations.
- K. Trenching in Advance of Pipe Laying:
 - 1. Trenches shall always be completed at least 20 feet in advance of pipe laying except in quicksand where pipe laying shall follow as closely as the best interests of the Work may require.
- L. The CONTRACTOR shall make arrangements for legal disposal of all water and sewage received in the trench from temporary connections or stoppage. The CONTRACTOR shall not discharge onto public or private property outside of the construction area.

3.05 - Trench Excavation Through Rock

- A. The CONTRACTOR is responsible to contact the ENGINEER if rock is encountered which cannot be excavated using normal methods.
- B. The ENGINEER will review the conditions and, if appropriate, authorize the CONTRACTOR to proceed with rock excavation.
- C. Rock shall be excavated to the trench width as specified in the Contract Documents and to a depth 6 inches below the bottom of bedding material, per the Contract Documents.
- D. The ENGINEER shall measure the length, and depth of rock excavation for use in determining payment for this item. Width beyond that indicated in the standard details, and depth in excess of that required to allow for 6 inches of bedding material shall not be measured for payment.
- E. Unless otherwise allowed by the ENGINEER, excavated rock shall be disposed of legally offsite. No rock shall be incorporated into the Project without the ENGINEER's approval.

3.06 - Dewatering

- A. The dewatering operation shall be performed in accordance with the dewatering plan submitted to the ENGINEER by the CONTRACTOR. Dewater to a minimum of 2 feet below the bottom of bedding elevation.
- B. Dewatering operations may be modified from the plan for actual field conditions, with approval of the ENGINEER.
- C. Provide for handling water encountered during construction. Prevent surface water from flowing into the trench.
- D. Do not discharge trench water into sanitary sewers. The discharge of trench water into storm sewers requires the approval of the ENGINEER.
- E. Do not discharge trench water onto adjacent property without written approval.
- F. Trench water discharge points shall be protected from erosion.
- G. Backfill trenches prior to discontinuing dewatering operations.
- H. CONTRACTOR shall operate dewatering systems so as to not damage adjoining structures and facilities.
- I. CONTRACTOR shall monitor adjoining structures and facilities during dewatering operations. Dewatering operations shall cease and the ENGINEER shall be notified if damage is observed.
- J. Trench water discharge shall be maintained and controlled as necessary so not to create a safety hazard for vehicular and pedestrian traffic. Trench water discharge shall be directed away from electrical facilities or equipment, and intersections. Dewatering equipment shall include noise and fume reduction devices to minimize disturbance.
- K. CONTRACTOR shall provide at least two operating pumps for each trench opened in wet ground and at the same time shall have one pump in reserve.

3.07 - Trench Stabilization

- A. If the trench bottom is not firm and stable, prior to over excavating, or placing bedding material, the CONTRACTOR shall contact the ENGINEER. The ENGINEER will review the conditions and, if appropriate, authorize the CONTRACTOR to proceed with trench stabilization work. Trench stabilization shall not be substitute for adequate dewatering.
- B. The trench shall be over excavated until a firm and stable bottom is reached, but in no case shall the over excavation exceed one foot.
- C. Following over excavation, the CONTRACTOR shall place trench stabilization material in the trench to an elevation such that following consolidation, the top of the stabilized trench bottom is approximately equal to the trench bottom before over excavation was authorized.

- D. Width beyond that indicated in the standard details, and depth in excess of that required to a firm and stable trench bottom or 12 inches, which ever is less, shall not be measured for payment.

3.08 - Bedding And Backfill

- A. The CONTRACTOR may place bedding material after a suitable trench bottom has been obtained.
- B. The pipe shall be bedded in accordance with the Contract Documents based on pipe material, pipe stiffness, and application. Install bedding material to support the full length of the pipe barrel. Shape the bedding as required to accommodate the pipe bells and fittings. Compacted thickness of bedding material shall be 6 to 8 inches.
- C. Following consolidation and preparation of the bedding material, the pipe shall be placed on the line and grade as indicated in the Contract Documents.
- D. Once in place, the pipe must not be pushed out of alignment for any reason.
- E. The trench shall then be backfilled in accordance with the Contract Documents based on the type of pipe material being placed. Material layers shall be an uncompacted thickness of 8 to 12 inches, and be properly moisture conditioned within a range of -2% and +2% of optimum moisture content. Compaction shall be a minimum 95% of optimum density (ASTM D698) within City right-of-way and at locations receiving vehicular or pedestrian traffic, and any other location specified by the ENGINEER. Compaction shall be a minimum 90% of optimum density at locations not within City right-of-way and locations not receiving vehicular or pedestrian traffic or not otherwise specified by the ENGINEER.
- F. Compaction of soils with greater than 6% fines shall be accomplished with an impact device.
- G. Compaction of soils with less than or equal to 6% fines shall be accomplished with vibratory devices.
- H. The CONTRACTOR shall be responsible for providing results of compaction tests as set forth in the Contract Documents.
- I. Areas of backfill which do not meet the compaction requirements shall be reworked and retested until they are in compliance with the Contract Documents.

3.09 - Trench Plates

- A. The CONTRACTOR shall maintain access for emergency equipment and service vehicles, as well as employee access across the trench excavations by installation of steel trench plates. The steel plates shall be capable of withstanding HS-20 vehicle loads without substantial deflection and shall be fastened in place to prevent movement and vibration. Provide the trench plates at vehicle crossings, outside building doors and on the principal access drives around the buildings.

3.10 - Sheeting And Bracing

A. General:

1. Sheeting and bracing of all excavations shall conform to the latest state and federal regulations governing safety of workers in the construction industry. When necessary or required, adequate sheeting and bracing shall be installed to prevent ground movement that may cause damage or settlement to adjacent structures, pipelines and utilities. Any damage due to settlement because of failure to use sheeting or because of inadequate bracing, or through negligence or fault of the CONTRACTOR in any other manner, shall be repaired at the CONTRACTOR's expense.
2. Sides of trenches in unsuitable, loose or soft material, shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect employees working within them.

B. Sheeting Requirements:

1. Where excavations are made with vertical sides which require supporting, the sheeting and bracing shall be of sufficient strength to sustain the sides of the excavations and to prevent movement which could in any way injure the Work, or adjacent structures, or diminish the working space sufficiently to delay the Work. Sheeting shall be of a material that will not split in driving. Special precautions shall be taken where there is additional pressure due to the presence of other structures or moving vehicles.

2. It shall be the CONTRACTOR's responsibility to select timber for sheeting and bracing of sufficient dimensions and strength to adequately support the sides of trenches and excavations. The CONTRACTOR shall submit details of the proposed sheeting and bracing to the ENGINEER.

3. Timber sheeting shall conform in quality to select structural douglas fir lumber and shall be sound, live timber, free from sap, large checks, shakes, loose or decayed knots, worm holes, and other imperfections which may impair its strength or durability.

4. Sheeting shall be driven to true alignment and in such a manner as to avoid splitting to insure contact of adjacent pieces. In wet excavation grooved sheeting shall be used to prevent passage of soil. Any voids between sheeting and face of excavation shall be filled with suitable material.

5. Sheeting and bracing shall not be removed before the completion of the Work, unless otherwise directed in writing by the ENGINEER. Sheeting may be left in place if approved by the ENGINEER. Sheeting which is left in place shall be cut off 18 inches for clearance below the bottom of the pavement in streets/highways and 18 inches below the original ground surface, unless otherwise required by the ENGINEER.

3.11 - Water Main Testing

A. Tests shall be performed by the CONTRACTOR. The CONTRACTOR shall be responsible to perform quality assurance testing in accordance with the Contract Documents. The intent of the testing is to provide an indication of the effectiveness of the means and methods being employed by the CONTRACTOR.

B. Scheduling

1. Notify ENGINEER one working day in advance of testing or disinfection operations to coordinate the operations.

2. ENGINEER or his representative must be in attendance during testing or disinfection.

C. Regulatory Requirements

1. Conform to Iowa Division of Natural Resources "Iowa Water Supply Facilities Design Standards."

D. Sequence of Operation

1. Perform operations in the following sequence

1. Remove any debris from within pipe. Clean and swab out pipe if required.

2. Secure any unrestrained pipe ends against uncontrolled movement.

3. Fill the main and add Chlorine.

4. Wait 24 hours to check the chlorine content. Must be over 25 mg/l.

5. Dispose of highly chlorinated water.

6. Wait 24 hours for bacteriological testing and turbidity testing.

7. Perform pressure and leak testing.

8. Make taps after passing all tests.

2. Successfully complete each operation before commencing to the next operation.

3. Jurisdiction will provide reasonable quantities of water for flushing and testing.

E. Method Of Chlorination

1. The chlorination will be accomplished in accordance with AWWA C651. The preferred method from that standard shall be the method utilizing HTH granules placed in the water main as it is being installed and then filling the main with potable water when installation is complete.

2. To utilize this method the pipes and appurtenances must be kept clean and dry during construction.

3. During construction, calcium hypochlorite granules (HTH) shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main and at approximately 60-foot intervals in the new pipe as it is laid in accordance with the quantities of granules shown in Table 4 for various pipe sizes.

TABLE 1

Ounces of Calcium Hypochlorite Granules to Be Placed at Beginning of Main, Beginning of Each Branch, and At Each 60-Foot Interval of Pipe.

Pipe Dia.(in.)	HTH Granules(oz.)	Pipe Dia.(in.)	HTH Granules(oz.)
16	6	24	13

4. The quantities of calcium hypochlorite granules listed in Table 1 will result in initial chlorine concentrations of 45 - 55 mg/l.

F. Filling and Initial Flushing

1. When installation is completed, the main shall be slowly filled by opening the inlet valve just enough turns to start the water running. Air release valves and fire hydrants shall be opened to release air pockets at the high points of the line. Check all interconnecting valves to the existing system to be sure they are completely closed. CONTRACTOR personnel are permitted to operate valves and hydrants internal to the new main only. Valves which separate the existing city distribution system from the new main are to be operated only by the Jurisdictional Water Department.

2. The chlorinated water shall remain in the pipe for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the disinfecting solution shall have a residual of not less than 25 mg/l as free chlorine.

3. After the completion of the 24-hour period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration is less than 4 mg/l. A chlorine residual determination shall be made to ascertain that the chlorine concentration of the water in the new main is compatible with that in the city distribution system.

4. The CONTRACTOR shall furnish and install all hoses, equipment and appurtenances necessary to direct the flushing water to the proper discharge point.

5. Highly chlorinated water shall be discharged to sanitary sewers. If sanitary sewers are not available in the area, the highly chlorinated water shall be trucked to a sanitary sewer, or neutralized by treating with one of the chemicals listed in Appendix B of AWWA C651. The rate of discharge to sanitary sewers shall be controlled and coordinated with the Jurisdictional Sewer Department to prevent surcharging the sewer.

G. Final Flushing

1. Once the chlorine content of the flushing water has declined to less than 4 mg/l as determined by the Jurisdictional Water Department, the water shall be directed to natural water ways or storm sewer intakes. The CONTRACTOR is responsible to direct the flushing water away from the Site in a safe and non-destructive manner. The CONTRACTOR shall continue flushing to remove debris and sediment from the new main until preliminary grab samples indicate that the turbidity has been reduced sufficiently to warrant samples to be taken for laboratory testing. In addition to the end of the new main, hydrants at intermediate points along the main and all blowoffs on branches shall be opened and flushed.

2. Where the water main consists of looped water mains, the CONTRACTOR shall develop a Plan, subject to approval of the Jurisdictional Engineer, for closing valves and flushing the loop to insure that all parts of the loop are flushed completely.

3. The flushing velocity for mains 16 inches in diameter and smaller shall be 2.5 feet per second. For larger mains, the flow shall be as required by the Jurisdictional Engineer. The rate of flow required to produce a velocity of 2.5 fps is shown in Table 2 along with the required openings at 40 psi residual pressure to produce this flow.

TABLE 2

Required Openings To Flush Pipelines
(40 psi residual pressure)

Pipe Size	Flow Required For	Hydrant Nozzle Size
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<u>(inches)</u>	2.5 fps <u>Velocity</u>	Orifice Size	<u>Number</u>	<u>(inches)</u>
	<u>(gpm)</u>	<u>(inches)</u>		
16	1,565	3-5/8	2	2-1/2

4. With 40 psi residual pressure, one 2 ½ inch hydrant nozzle will discharge approximately 1,000 gpm and a 4 ½ inch hydrant nozzle will discharge approximately 2,500 gpm.

H. Sampling Procedure

1. Once preliminary samples indicate that turbidity has been reduced sufficiently to warrant laboratory testing, samples shall be collected from blowoffs and hydrants at the end of the main, and at intermediate branches and hydrants. In the case of looped mains, valves shall be operated to insure that samples are drawn from all parts of the new main. Samples shall be collected by Jurisdictional Water Department personnel in sterile bottles treated with sodium thiosulfate as required by Standard Methods. No hose shall be used in the collection of samples.

I. Special Conditions

1. If, during construction, trench water has entered the main, or if in the opinion of the ENGINEER, excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at intervals of approximately 200 feet and shall be identified as to location. Samples shall be taken of water that has stood in the main for at least 16 hours after final flushing has been completed.

J. Turbidity and Bacteriological Testing

1. Samples shall be tested by the Department for turbidity and bacteriological quality in accordance with Standard Methods procedures. Turbidity shall be 1.0 ftu, or less, and bacteriological tests shall show the absence of coliform organisms. A standard plate count may be required at the option of the Jurisdictional Engineer.

2. If satisfactory turbidity and bacteriological test results are obtained from the initial disinfection process, no further disinfection is required and the CONTRACTOR may proceed with pressure testing of the main.

3. If the test results are not satisfactory, further flushing and testing of the main is required.

K. Redisinfection

1. If the initial disinfection fails to produce satisfactory bacteriological samples, the main shall be reflused and resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated by the continuous feed or slug method of chlorination until satisfactory results are obtained.

L. Pressure and Leak Testing

1. Isolate new piping from the existing water system.

2. Fill and flush all new piping with potable water. Ensure that all trapped air is removed.

3. Pressurize the new pipe to the test pressure at the highest point in the isolated system. Do not pressurize to more than five psi over the test pressure at the highest point in the isolated system.

4. Test the completed piping system at 1½ times the system working pressure or 150 psi, whichever is greater, for two hours.

5. Monitor the pressure in the line for a period of not less than two hours.

6. If at any time during the test the pressure drops to five psi below the test pressure, re-pressurize the pipe by pumping in potable water in sufficient quantity to bring the pressure back to the original test pressure.

7. Accurately measure the amount of water required to re-pressurize the system to the test pressure.

8. Maximum Allowable Leakage Rate at 150 psi (not applicable at other pressures).

Pipe Diameter (inches)	Maximum Allowable Leakage Rate, (gallons per hour per 1,000 feet of pipe)
16	1.47

24	2.21
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Note: For unusual conditions or for water lines shorter than 500 feet, consult Jurisdictional Engineer for allowable leakage rate. The following formula shall apply:

$$L = \frac{(S)(D)(P)^{1/2}}{133,200}$$

Where:

L = leakage, allowable

S = length of pipe test section, in feet.

D = pipe diameter, in inches.

P = average test pressure, psig.

9. If the average measured leakage per hour exceeds the Maximum Allowable Leakage Rate, repair and retest the water line.
10. If the measured pressure loss does not exceed 5 psi the test will be considered acceptable.
11. Repair all visible leaks regardless of the amount of leakage.

M. Continuous Feed Method of Chlorination

1. Prepare a chlorine-water solution by dissolving granules of calcium hypochlorite in water in the proportion required for the desired concentration. A 1 percent chlorine solution requires approximately 1 pound of calcium hypochlorite in 8 gallons of water.
2. The chlorine solution shall be applied to the water main with a pump suitable for pumping chlorine solutions and the head conditions at the point of application. The point of application shall be through a tap in the new main within 10 feet downstream of the valve to be used for turning water into the new pipe. Water from the existing distribution system shall be turned into the new pipe at a constant measured rate. The rate may be measured with a hydrant meter mounted on the discharge outlet. The chlorine solution shall be fed at a rate to produce a chlorine concentration in the pipe of at least 25 mg/l free chlorine. Table 3 shows the minimum rate of chlorine solution to feed to obtain a 25 mg/l chlorine residual at various water flow rates. Feed rates may need to be adjusted upward to compensate for ammonia content of the water.

TABLE 3
Minimum Feed Rates For One Percent Chlorine Solutions
To Obtain 25 Mg/l Chlorine Concentration

Water Flow Rate In Water Main (gpm)	1.0% Chlorine Solution Feed Rate (gpm)
100	0.25
200	0.50
300	0.75
400 (max. for meter)	1.00

3. During application of the chlorine, valves shall be positioned to prevent the strong chlorine solution from contacting water in the existing distribution system. Chlorine application shall not cease until the main is completely filled with the chlorine solution. The chlorine solution shall remain in the main for at least 24 hours, during which period all valves and hydrants in the section being treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water in all parts of the main shall have a residual of not less than 10 mg/l free chlorine.
4. After the applicable retention period, the heavily chlorinated water shall be flushed from the main as specified above.

N. Disinfection Procedures When Cutting Into Or Repairing Existing Mains

1. The following procedures apply primarily when mains are wholly or partially dewatered. After the appropriate procedures have been completed, the main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water.

2. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

1. Trench Treatment - When an old main is opened, either by accident or design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.
2. Swabbing with Hypochlorite Solution - The interior of all pipe and fittings used in making the repair (particularly couplings and sleeves) shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed.
3. Flushing - Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the Work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

O. Putting Water Main In Service

1. Obtain Jurisdictional Engineer's approval to put the completed water system in service.

3.12 - General Requirements For Installation Of Valves And Appurtenances

- A. Install only approved materials.
- B. Install in accordance with the Contract Documents, the Construction Details, and the ENGINEER's instructions, as appropriate.
- C. Test and disinfect all valves, hydrants and appurtenances as components of the completed water main in accordance with Section 3.11.
- D. Apply polyethylene wrap to all valves, valve boxes, hydrants and fittings.
- E. Set tops of valve boxes to finish grade unless otherwise directed by ENGINEER.
- F. Check the working order of all valves by opening and closing through entire range.

3.13 - Flushing Device (Blowoff)

A. Install where shown on the plans, in accordance with Construction Details.

Install gravel backfill.

Install thrust block, bearing on perpendicular excavation face of undisturbed earth.

3.14 - Required Separations

A. Separate water mains from sanitary and storm sewers by horizontal distance of at least 10 feet unless:

1. Top of sewer is at least 18 inches below bottom of water main.
2. Sewer is placed in separate trench or in same trench on bench of undisturbed earth with at least 3 feet separation from water main.
3. Sewer is constructed of water main quality ductile iron pipe, and a two foot linear separation is maintained.

B. Separate sanitary sewer force mains from water mains by horizontal distance of at least 10 feet unless force main is constructed of water main materials meeting minimum pressure rating of 200 psi.

3.15 - Tracer System Installation

- A. Begin and terminate system at all connections to existing mains.
- B. Install wire continuously along lower quadrant of pipe. Do not install wire along bottom of pipe. Attach wire to pipe at midpoint of each pipe length; use 2-inch wide 10-mil thickness polyethylene pressure-sensitive tape.
- C. Install splices only as authorized by ENGINEER. Allow ENGINEER to inspect all below grade splices of tracer wire prior to backfill.
- D. Install one ground rod at one of the tie in points of the water main, or as required by ENGINEER.
- E. Bring double runoff wire to surface at the Air Release valve box location; strip ends of wire and connect together with split bolt.
- F. Terminate exposed tracer wire in receptacle box.
- G. Location of Receptacles: Inside the Air release valve box location, or as required by ENGINEER.
- H. The OWNER will conduct final inspection of the tracer system at the completion of the Project and prior to acceptance. Verify the electrical continuity of the system. Repair any discontinuities.

3.16 - Open Cut Installation Of Casing Pipe

- A. The trench excavation for a casing pipe shall be completed in accordance with all specifications including any required sheeting, shoring, and bracing and/or dewatering.
- B. The joints of a steel casing shall be welded with a continuous circumferential weld.
- C. Following the completion of the casing installation, the Contractor shall install the carrier pipe and seal the casing ends.
- D. The excavation shall be backfilled following the extension of the conduit beyond the backfilling operation.
- E. The Contractor is responsible to safely mark and protect the excavation until the operation is complete and the excavation is backfilled.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 - Trench Excavation

- A. Trench excavation for water main shall be incidental to the water main pipe. This item includes all excavation except Trench Excavation Through Rock, and includes excavating, stockpiling, shoring, backfilling, compacting the backfill, stripping, stockpiling, and respreading topsoil, and all other labor, materials, and equipment necessary to excavate and backfill the trench.

4.02 - Water Main

- A. Water main shall be paid on a lineal basis for each type and size as set forth in the Contract Documents. The quantity paid shall be as measured by the ENGINEER. Polyethylene wrap, bedding, and tracer wire shall be considered incidental.

4.03 - Water Main Fittings

- A. Fittings for water distribution systems shall be paid on a weight basis. The quantity paid shall be fittings as counted by the ENGINEER and converted to a weight basis in accordance with standard fitting weights as published in AWWA C153. The following items shall be considered incidental:
 - 1. Nuts and bolts.
 - 2. Retainer glands.
 - 3. Restraining rods.

4.04 - Blowoff

- A.** Installation of OWNER supplied blowoff assemblies shall be incidental. The quantity paid shall be as indicated in the Contract Documents. Polyethylene wrap and other piping materials required for installation shall be considered incidental.

4.05 - Fire Hydrant Assemblies

- A. Installation of OWNER supplied fire hydrant, testing, and disinfection shall be on a count basis. Contractor shall supply, install, and remove any additional temporary piping, blocking, fittings, or other materials necessary to complete the temporary installation for blow off, testing, and disinfection purposes. All work, associated with this item is incidental to the Water Main construction.

4.06 - Air Release Assembly

- A. Installation of Air Release Assembly shall be paid on a count basis for each type and size as set forth in the Contract Documents. This item shall include installation of OWNER supplied air release valves. The quantity paid shall be as indicated in the Contract Documents. Polyethylene wrap and other piping materials required for installation shall be considered incidental.

4.07 - Disinfection and Hydrostatic Testing

- A. Disinfection and hydrostatic testing shall be incidental. Includes furnishing all materials, labor, and equipment to disinfect the water main and re-disinfect if required, and perform the hydrostatic testing of the completed water main; including corporation stops, copper tubing, hoses, pumps, gauges and other equipment required for disinfection and hydrostatic testing. Also included are hoses, piping and accessories necessary to conduct the chlorinated water to a proper disposal point.

4.08 - Miscellaneous

- A. All other items, labor, material, and equipment necessary to complete the water main in place are incidental to the other water main items. This includes removal and disposal of the existing water main within the water main relocation limits shown on the plans.

4.09 – Adjust Water Service Stop Box (and other minor valve adjustments)

- A. This item is paid on a per each basis as counted by the ENGINEER. Payment for each water service stop box adjustment shall include all materials, labor, and equipment necessary to adjust the elevation of the existing stop box vertically to match the existing finish grade as shown on the plans.

4.10 – Water Service and Stop Box

- A. This item is paid on a per each basis as counted by the ENGINEER. Payment for each water service and stop box shall include all materials, labor, and equipment necessary to replace the existing water service from the main to the new stop box location, including remove, salvage, and reset the existing stop box, furnish and install the new water service pipe by boring under existing roadway pavement, connection of the new service to the stop box, reconnection of the private service to the stop box, coordination with the City for new service tap on the water main (if the existing service tap cannot be used), backfilling and restoring the surrounding area, and other miscellaneous other items to complete the water service and stop box in place as shown on the plans.

4.11 – Water Main Casing Pipe, Pipe Spacers, and End Seals

- A. Water Main Casing Pipe shall be paid on a lineal basis for each type and size as set forth in the Contract Documents. The quantity paid shall be as measured by the ENGINEER. Payment for water main casing pipe shall include the casing, excavation, trenching, bedding, backfill, compaction, casing spacers, end seals, joint restraints, any necessary blocking, and all other labor equipment and materials necessary to complete the water main casing in place, with spacers and end seals.

END OF SPECIAL PROVISIONS – WATER MAIN