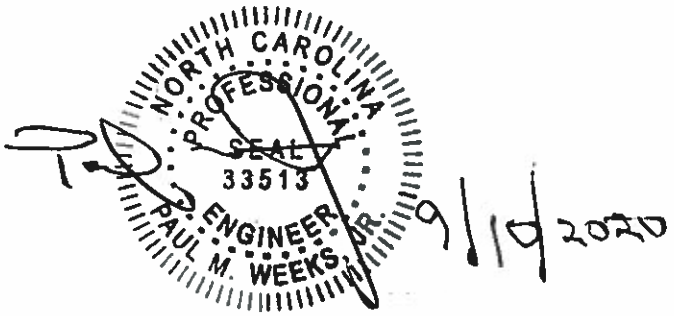
GENERAL SPECIFICATIONS

WATER MAINS & MATERIALS

SEPTEMBER 2020



CITY OF SANFORD
SANFORD, NORTH CAROLINA

WATER MAINS & MATERIALS

STANDARD SPECIFICATIONS

Scope of Work

Work to be performed under this contract shall consist of furnishing and installing, complete and ready for service, the water mains with various appurtenances as shown on the contract plans and as specified.

The Contractor for this project must understand that this type of work deals with many unforeseen situations. The City of Sanford will assist the Contractor in the control of the water system where work is to be performed. However, the City of Sanford hereby notifies the Contractor that completing this contract may include working with uncontrollable water flows; total control of the water system may not be possible.

All standard references contained within these specifications refer to the latest revision of that standard.

WATER MAINS

A. MATERIALS

1. Ductile Iron Pipe - All ductile iron pipe furnished for diameters four inches (4") through sixty-four inches (64") shall be as manufactured in accordance with ANSI/AWWA C151/A21.51 in eighteen-foot (18') lengths with single rubber gasket joints in accordance with ANSI/AWWA C111/21.11. Three-inch (3") diameter pipe shall be Class 54 wall thickness, four-inch (4") diameter pipe shall be Class 51 wall thickness, and six-inch (6") through sixteen-inch (16") diameter pipe shall be Class 50 wall thickness in accordance with ANSI/AWWA C150/A21.50, unless otherwise specified or shown on the plans. Larger pipe sizes shall be the thickness class indicated in the Drawings/Specifications. All ductile iron pipe shall be cement lined in accordance with ANSI/AWWA C104/A21.4. Joint restraint, if specified, shall be accomplished using manufactured restrained joint pipe systems or mechanical joint fittings with gripper glands such as Megalug by EBAA Iron, Grip Ring by Romac Industries or an approved equal.

2. PVC (Polyvinyl Chloride) Pipe Four Inch or Larger - Pipe shall be JM Eagle "Blue Brute" or Robintech "White Knight" Class 235 minimum or approved equal conforming to all requirements of AWWA C900. No PVC fittings shall be used under any circumstances. Pipe shall be joined by means of a

rubber ring bell joint which shall be integral and homogeneous part of pipe barrel.

3. Tracer Wire - Provide and install tracer wire directly to the top over any PVC pipe. Tracer wire shall be a minimum #14 high strength copper clad steel conductor wire secured to the pipe at 10' maximum spacing and rated for direct burial uses at 30 volts. Wire shall be insulated with 30 mil, high density polyethylene (HDPE). Wire break load shall be a minimum 250 pounds. A tracer wire testing station shall be installed in every valve box.

4. Warning Tape - A magnetic locator tape shall be installed over any PVC water main in the same trench one foot above the pipe. Tape shall not be measured separately, but included in the pipe cost.

5. Encasement Pipe – Encasement pipe shall be spiral welded steel pipe conforming to all the requirements of ASTM A139, Grade B, with a minimum yield strength of 35,000 psi. The minimum casing and wall thickness are as follows:

Carrier Pipe & Casing Size					
Carrier Pipe		**Railroad Casing**		**Road Casing**	
Nominal Size	O.D.	O.D.	Thickness	O.D.	Thickness
4	4.80	12.75	0.250	12.75	0.188
6	6.90	12.75	0.250	12.75	0.188
8	9.05	16.00	0.281	16.00	0.250
10	11.10	18.00	0.312	18.00	0.250
12	13.20	20.00	0.344	20.00	0.250
14	15.30	24.00	0.375	24.00	0.250
16	17.40	30.00	0.469	30.00	0.312
18	19.50	30.00	0.469	30.00	0.312
20	21.60	30.00	0.469	30.00	0.312
24	25.80	36.00	0.532	36.00	0.375
30	32.00	42.00	0.625	42.00	0.500
36	38.30	48.00	0.688	48.00	0.500
42	44.50	54.00	0.781	54.00	0.500

6. Carrier Pipe – Carrier pipe shall be restrained joint ductile iron pipe [as shown on the plans].

7. Fittings - All fittings shall be manufactured in accordance with ANSI/AWWA C110/A21.10. Fittings shall be all bell mechanical joint unless otherwise noted, and shall have interior cement mortar lining in accordance with ANSI/AWWA C104/A21.4.

   Compact fittings for any type of water distribution piping shall conform to all requirements of ANSI/AWWA C153/A21.53.

8. Gate Valves - All gate valves shall be American Darling, Mueller “O” – ring, M&H, or approved equal.

   Gate valves shall be vertical open-left of the non-rising stem type with mechanical joint ends and 2” square operating nut. Gate valves shall be iron body, double disc, parallel seat conforming to AWWA C500 or resilient wedge, fully bronze mounted conforming to AWWA C509.

   Gate valves shall be designed for the following pressures:

Valve Size	Working Pressure	Hydrostatic Test Pressure
6” - 12”	200	400

9. Tapping Sleeves and Valves – Where allowed by the Engineer, tapping sleeves shall be full body mechanical joint and made of ductile iron in accordance with ANSI/AWWA C110/A21.10. Stainless steel sleeves and same-on-same size taps are not permitted. Tapping sleeve and valves will not be allowed on AC pipe.

10. Butterfly Valves - Butterfly valves shall be class 150B, meeting or exceeding AWWA C504.

    Valve bodies shall be of close grain cast iron conforming to ASTM A126, Class B. Valve disc shall be cast bronze or gray iron with bronze or stainless steel sealing surfaces. The disc shall have adjustable stops preset by the factory. The seats shall be natural rubber warranted for five (5) years from the date of acceptance by the Owner. Butterfly valves shall be manually operated, with the operator assembly meeting all requirements of AWWA C504. Operating torques shall comply with AWWA C504 for Class 150B valves. They shall be open left and provided with 2” operating nut. The operator assembly shall be suitable for trench bury.

    Butterfly valves shall have mechanical ends. Each valve shall have a serial number permanently indented into the body. The number shall be kept on file by the manufacturer for future reference. Certified copies of the tests shall be forwarded to the Owner for record purposes.

    Butterfly valves shall be Val-Matic American-BFV, Henry Pratt “Groundhog,” or approved equal.

    Butterfly valves shall not be used unless specifically approved by the City Engineer.

11. Valve Boxes - Adjustable valve boxes shall be subject to the approval of the Engineer and shall conform to ASTM A48 and shall be Tyler Union 562-S or approved equal. Valve boxes shall be of close-grained gray cast iron in two pieces, consisting of a lower base piece which shall be flanged at the bottom to fit around the stuffing box gland and rest on tamped backfill and not touch the valve assembly, and an upper part which shall be manufactured on the lower end such that it will screw connect over the lower part and the upper end being constructed in the form of a socket to receive the cover. The cover shall have cast on the upper surface, in raised letters, the word "WATER." Valve boxes shall be painted prior to shipment with a coat of protective asphaltum paint.

12. Hydrants - Fire hydrants shall be of the compression type and shall be Mueller Super Centurion A421, American Darling 73-5, M&H 129, or approved equal, conforming to AWWA C502, designed for a minimum working pressure of 150 psi and a hydrostatic test pressure of 300 psi with the valve in both the open and closed position.

The hydrant valve opening shall be a minimum of 4½". Hydrants shall be equipped with two (2) 2½" hose nozzles and one (1) 5" Storz connection nozzle. All 2½" nozzles in the City Limits and in Northview Fire District shall have City of Sanford threads which are 3.112" x 8 threads per inch measured on the outside of the male diameter. All other 2½" nozzles shall be National Standard Thread. The Storz connection shall have a brass hydrant nozzle connection, hard anodized aluminum Storz ramps and lugs (hydrant and cap side), and require a high-torque Storz spanner wrench in order for the cap to be removed. All nozzles shall be provided with cap and cap retaining chain. Nozzles shall be bronze.

All hydrants shall have bronze seating. The hydrant shall meet all other requirements as shown in the City of Sanford standard details.

The upper hydrant operating stem within the bonnet shall be sealed and lubricated by means of an oil or grease bath. The operating nut shall be National Standard pentagon-type measuring 1½" from point to flat. Hydrants shall be open left.

The hydrant shoe shall be 6" in size, of the mechanical joint type.

Hydrants shall be of the "safety" type so that if the upper barrel is broken off, the hydrant valve will remain closed and reasonably tight. All fire hydrants shall be painted red with all hydrant bonnets painted with reflective white paint.

All hydrants shall be furnished with barrel and stem extensions as required for the final field location. Nominal minimum bury will be 3'. Payment will

be allowed for these extensions based on the unit price stated in the proposal.

13. Hydrant Tags – Hydrant tags shall be manufactured from rust and corrosion resistant solid brass, Pollard Water sku PP69242 or equal. All tags shall be stamped with a unique identifier using Arial Narrow, 24-point font. Approximate dimensions shall be ¾" high, 2" wide. Bolt hole shall be 11/16 inches.

14. Copper Tubing – Copper tubing used for water services shall be Type K, annealed copper tubing conforming to all requirements of ASTM B88. Fittings on water services shall be flared- or compression-type, made of cast copper conforming to ASME B16.

15. Meter Boxes – Meter boxes shall be of gray cast iron conforming to ASTM A48 in two pieces, consisting of a lower base piece and a non-locking lid. Meters shall be furnished by from the City of Sanford unless otherwise specified.

    Water service piping greater than 2" in size shall be ductile iron; water service piping less than or equal to 2" in size shall be type K soft copper. Water meter yokes shall be used on water meters of 1" or less in size.

    For water meters greater than 1" and through 2" in size, custom setters shall be used. Only 17", long-body setters shall be allowed; short-body setters shall not be permitted.

    Water meter boxes may be used for meters up through 2" in size. Water meters greater than 2" in size shall be installed in a water meter vault. Vaults shall be constructed with a meter bypass inside of the vault, and shall be constructed with positive gravity drainage or a sump pump, depending on site conditions, so as to ensure proper drainage of the vault. Meter vault boxes shall require submittal of sealed shop drawings for approval.

16. Corporation Stops – Corporation stops shall be of brass or red brass alloy conforming with all requirements of ASTM B62. The inlet end shall be threaded for tapping according to AWWA C800 and the outlet end shall be a compression fitting suitable for copper tubing.

17. Connections - All connections shall have either a reduced pressured zone backflow preventer, double check valve, or other protection devices approved by the City Engineer and the Department of Environmental Health. All protection devices shall be above-ground. Positive gravity drainage is required on all reduced pressure zone backflow preventers.

B. CONSTRUCTION METHODS

1. General - Water mains shall be installed in strict accordance with plans and these specifications. Work shall be planned and arranged so that the existing service shall be interrupted to the least possible degree. Access to property along the route of proposed construction shall be maintained at all times. The Contractor shall coordinate any water service interruptions with the City a minimum one week notice prior to interruption of a water service. The City will develop the allowable cut-off schedule which may require after-hours work, such as night and weekend work, to accommodate user needs. Once the schedule is provided by the City, the Contractor may proceed according to the schedule which is subject to alteration or cancellation by the City on short notice.

   Only City staff shall operate valves that are owned by the City. The Contractor may operate all valves that are newly installed by the contractor prior to acceptance by the City and prior to the valves being placed in operation.

2. General Construction Safety

   a. The Contractor and any subcontractors shall be responsible for the total compliance to all federal, state, and local ordinances, laws and regulations as it relates to safe construction practices and to protecting the employees and the public's general health.

   b. The Contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.

   c. The City shall not be responsible for making the Contractor adhere to these OSHA regulations and standards. However, the City may report known violations or unsafe practices to the appropriate enforcement agency.

3. Trench Excavation - Excavation shall be made to the lines and grades as directed by the Engineer or as shown on the plans. The width of the trench shall not be more than is necessary for proper installation of the pipe. Depth of the trench shall, generally, be such as to provide a minimum depth of cover over the pipe of 3' below the finished grade of the street or ground.

   Bell holes shall be hand dug at each joint to permit proper joint installation. Bottom of the trench shall be shaped to support the pipe throughout its entire length. It shall be the responsibility of the Contractor to provide

adequate bearing for all pipe lines laid in uncertain soil conditions. If the trench bottom is softened by rain, flooding, or other causes, the unsuitable material shall be removed and replaced with suitable material properly shaped and tamped to grade. The Contractor shall, however, make efforts to prevent surface water from flowing into the trench. The Contractor shall, at his expense, remove any water which may accumulate in the trench by pumping or other approved means. The Contractor shall make every effort to prevent water and other materials from entering the pipe during construction. At the end of the day the line shall be plugged or capped and the trench filled in to protect the line. The use of timber or other material to support the pipe shall not be used. If rock is encountered, the excavation shall be carried to such depth below the established grade as to provide clear space of not less than 6" between the rock at any point along the line. This space shall be filled with suitable material or stabilizing material and shall be included in the unit price for pipe as stated in the proposal. All excavation is unclassified. Cost of any rock excavation shall be included in the unit price bid per linear foot for pipe, complete in place. If blasting is allowed by the Owner, the Contractor shall obtain the proper permits from the Fire Department before bringing explosives to site or using explosives on site. The Contractor shall be responsible for any damage done to adjacent structures, properties, or other site improvements

4. Boring and Jacking – Shall be performed in a manner that will not interfere with the operation of any street, highway, railway, or other facility, and will not weaken or damage the roadbed or structure. See below for more information which include casing and jacking pipe and excavation for approach trenches and pits.

5. Pipe Laying - Shall be accomplished in accordance with the pipe manufacturer's published instructions and with AWWA C600 and C605. At least 36 inches of cover shall be provided. Additionally, a minimum distance of 12 inches shall be maintained between the outside of a water main and the outside of other utilities. All pipe shall be installed by experienced, skilled workmen. Pipe shall be laid with straight and smooth lines and to the grades indicated on the plans, with all joints perfectly fitted. Changes in alignment or grade without fittings shall be made uniformly with several joints, with deflection at joint not to exceed the recommendations of the pipe manufacturer.

6. Backfilling - After the pipe has been satisfactorily installed, the trench shall be backfilled with approved material free from large stones or clods in 6" layers, loose measurement, and shall be thoroughly tamped and compacted with a rapid hitting mechanical tamper capable of exerting at least 185 lbs/square foot of tamping area per blow. Other mechanical equipment may be used if approved by the Engineer. The backfill material shall be moistened when necessary, in the opinion of the Engineer, to obtain

desired compaction. Water settling or puddling shall not be permitted. The backfilling shall be done on each side of the pipe simultaneously to prevent possible displacement of the pipe. Any material not suitable for use in backfilling in the opinion of the Engineer, shall be removed and suitable material hauled in at the expense of the Contractor. After backfilling has been completed, the Contractor shall thoroughly clean the street of all dust and dirt by brooming and/or washing with water. Backfill within State Highway rights-of-way shall conform to State Highway specifications.

7. Water Main Crossing Sewer/Reclaimed Water Distribution Lines - Whenever it is necessary for a water main to cross over or under a sewer/reclaimed water distributions line, the water main shall be laid a minimum vertical distance of 18 inches from the outside of the water main and the outside of the sewer/reclaimed water distribution line, either above or below the sewer, with preference to the water main located above the sewer. One full length of water pipe shall be located so that both joints will be as far from the sewer/reclaimed water distribution line as possible.

   Whenever it is necessary for a water main to cross under a sewer/reclaimed water distribution line, both shall be constructed of ductile iron pipe materials and with joints equivalent to water main standards for a distance of ten feet (10') on each side of the crossing. A section of water main pipe shall be centered at the crossing. Both the water main and sewer reclaimed water distribution line shall be pressure tested to assure water tightness prior to backfilling.

   Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation, in which case:

      (1) the water main shall be laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or
      (2) the water main shall be laid in the same trench as the sewer, with the water main located at one side on a bench of undisturbed earth and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

   Water lines shall be located at least 10 feet horizontally from or at least 18 inches above water pipes carrying treated and disinfected wastewater in reclaimed water distribution lines.

8. Installation of Hydrants and Valves - Hydrants shall be set plumb as indicated on the plans with the pumper connection 18" above grade. Hydrants shall be set on a slab of concrete 15" square x 4" thick. The back of the hydrant, opposite the pipe connection, shall be firmly blocked against

the vertical face of the trench with poured-in-place concrete to prevent the hydrant from blowing off the line and, in addition, bridle rods and rod collars shall be used (see details "Typical Pipe Tie Rods"). Bridle rods and collars shall not be less than 5/8" diameter stock and shall be protected by a coat of bituminous paint. Joint restraint, if specified, shall be accomplished using manufactured restrained joint pipe systems or mechanical joint fittings with gripper glands such as Megalug by EBAA Iron, Grip Ring by Romac Industries or an approved equal. A minimum of 7 cubic feet of stone shall be placed around the hydrant base to ensure drainage. The backfill around hydrants shall be thoroughly compacted to grade line. Hydrants and valves shall have the interior cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the hydrant or valve shall be inspected in both the open and closed position to see that all parts are in working condition. Normal hydrant installations shall be within and as near as possible to the right-of-way limit. Normal valve installation for hydrants will be no greater than three feet (3') from the main line.

Until accepted by the City, all hydrants shall be bagged or tagged as out of service.

9. Valve Box Installation - Valve boxes shall be installed on each valve. The bell of the valve box shall completely enclose the valve operating nut and shall be seated on tamped backfill and shall not touch the valve assembly. When valve boxes are located in pavement, the box shall be adjusted to finished street grade by a method approved by the Engineer. When valves are located out of pavement, the boxes shall be adjusted to finish grade by a method approved by the Engineer, and surrounded by a precast concrete donut or a poured concrete block two feet (2') square and six inches (6") thick one-half inch (½") from the top. Normal valve box installations shall be flush with the edge of pavement.

10. Service Taps - All service taps will be made according to City of Sanford standard details. Any services being reconnected will be brought up to the City's specifications which includes, but is not limited to, the replacement of the service saddle, service line with K copper tubing, corporation stop, meter stop, yoke, dual check valve, expansion wheel, meter box, or gate valve with riser (for lines larger than 1").

    Service taps will be made by boring from main line to the existing meter. Any disturbed pavement, curbs, sidewalks, etc., will be restored by the Contractor. Open cuts will only be allowed on an individual basis upon approval of City Engineer.

11. Hydrostatic Pressure Testing of Water Mains - Upon completion of water mains, the Contractor shall hydrostatically test between each main line valve. The Contractor shall furnish a suitable test pump, measuring device,

materials, labor, equipment, etc., to perform the test to the satisfaction of the Engineer. Hydrostatic testing of ductile iron mains shall be in accordance with AWWA C600 and hydrostatic testing of PVC mains shall be in accordance with AWWA C605.

The line shall be filled slowly, with care being taken to ensure complete removal of air from the line. The Contractor shall install, at their expense, any corporation stops which may be required for this purpose. Corporation stops should be rated for the design pressure of the pipeline. After the line has been filled, each portion between valves shall be hydrostatically tested to a pressure of not less than 1.25 times the stated working pressure of the pipeline measured at the highest elevation along the test section and not less than 1.5 times the stated working pressure at the lowest elevation of the test section and maintained for a period of at least two (2) hours. The testing allowance shall be defined as the maximum quantity of makeup water that is added into a pipe undergoing hydrostatic pressure testing, or any section thereof, in order to maintain pressure within 5 psi of the specified test pressure. Testing allowances for ductile iron and PVC mains shall not exceed those defined in AWWA C600 and AWWA C605, respectively. Any visible leakage shall be repaired to a water-tight condition. Defective materials disclosed by the test shall be replaced at no additional cost to the City and the test repeated. The cost of all testing shall be included in the unit price per foot of the pipe. Care will be taken to maintain the pipe in a reasonable sanitary condition during installation.

12. Disinfection of Water Main - Before being chlorinated, the entire line shall be thoroughly flushed at a rate to produce a minimum flow of 3 feet per second in all parts of the pipe, to remove mud and other foreign materials. The flushing shall be done after the pressure tests on the line are made. If necessary, the contractor shall furnish, at his expense, any tap necessary to produce the proper flow for flushing.

    The line shall be chlorinated in accordance with AWWA C651, continuous feed method, except as may be specified otherwise. Chlorine may be applied by the following methods: Liquid Chlorine Gas-Water Mixture, Direct Chlorine Gas Feed, or Calcium Hypochlorite and Water Mixture.

    The chlorinating agent shall be in accordance with AWWA C651 and AWWA B300-10, and shall be applied at the beginning of the section adjacent to the feeder connection and shall be injected through a corporation cock, hydrant or other connection ensuring treatment of the entire line. Swimming pool chlorine or similar shall not be used for disinfection. Powdered hypochlorite and hypochlorite tablets shall not be added directly to piping systems.

Water shall be fed slowly into the new line with chlorine applied in amounts to produce a concentration of 65% free chlorine solution entering the pipe. The solution shall be added so as to cause the line to have a uniform minimum concentration not less than 50 ppm total chlorine immediately after introduction. The table below provides the required quantity of 65% sodium hypochlorite solution to be applied to each 1,000' section of water line to yield the specified minimum concentration of 50 ppm:

Nominal Pipe Diameter (inches)	Pounds Concentrated Sodium Hypochlorite (65%) per 1,000-feet of Pipe)
2	0.10
3	0.24
4	0.42
6	0.94
8	1.68
10	2.61
12	3.77
14	5.13
16	6.70
20	10.51
24	15.10

Chlorine application shall continue until the entire main is filled with chlorinated water. The chlorinated water shall be retained in the main for at least 24 hours. At the end of this 24-hour period, a residual of not less than 10 mg/L free chlorine shall be produced in all parts of the line.

The Contractor shall coordinate all disinfection activities with the City and the Engineer. During the chlorinating process all new valves and accessories not yet accepted by the City shall be operated by the Contractor. The City shall operate all existing valves. All valves on the lines being disinfected shall be opened and closed several times during the disinfection contact period, except those used to isolate the pipe from the main system. After chlorination, the water shall be flushed from the line at its extremities until the replacement water tests are equal chemically and bacteriologically to those of the permanent sources of supply. Contractor shall coordinate with the City to collect the samples, have necessary tests conducted by a State Certified Laboratory, and to provide a certificate of same. The number and locations of samples to be collected and tested shall

be per AWWA C651. The cost of the samples and tests shall be the responsibility of the Contractor.

If test results are unsatisfactory, the Contractor shall re-flush and re-sample the line at no additional cost to the City. If check samples fail, then the disinfection procedure shall be repeated until two (2) consecutive tests, taken 24 hours apart, provide acceptable results. Following completion of disinfection and testing, the Contractor shall replace permanent system devices that were removed during disinfection activities.

C. METHOD OF MEASUREMENT

1. D.I. and PVC Pipe - Pipe will be measured from the bell or connection at the end of the line, such measurements to be made through all intermediate valves and fittings. Where changes in size or direction occur, measurement shall be to the center of the connecting fitting. In the case of hydrant branches, measurement shall be from the center of the main to the center of the hydrant barrel. Such measurement shall include the total linear feet of pipe installed, complete, in place, and accepted by City or Engineer, including the furnishing of labor, tools, materials, and equipment necessary for benching, laying pipe, jointing, testing, sterilization, backfilling, and all other necessary incidentals.

2. Valves - Valves shall be counted by unit, complete in place and accepted by City or Engineer, including tapping valve and boxes.

3. Tapping Sleeves and Valves – Tapping sleeves and valves shall be counted by each connection installed, including all labor, equipment, and materials to furnish and install.

4. Ductile and Cast Iron Fittings – Fittings shall be measured individually or by weight as indicated on the bid sheet, for fittings complete in place and accepted by City or Engineer.

5. Hydrant Assemblies – Hydrant assemblies, including the hydrant, leg, tee, and valve, shall be counted by unit, when complete in place and accepted by City or Engineer.

6. Service Tap Assemblies – Tap assemblies, including saddle, yoke, corporation stop, and meter box, will be counted by unit, complete in place and accepted by City or Engineer, including connection of old services and new installations, and restoration of grass, pavement, curb and gutter and sidewalk, etc.

D. BASIS OF PAYMENT

Payment will be made for all items based on the unit and lump sum prices stated in the proposal and measured as previously described. The prices stated in the proposal shall cover all work required to properly install the water mains complete with all necessary appurtenances in accordance with the plans and specifications.

BORING AND JACKING ADDITIONAL INFORMATION

Scope of Work

1. Furnish all labor, equipment, materials, and incidentals necessary for installing encasement pipe and carrier pipes under highways, railroads, streets, or other locations by the bore and jack method as specified herein.

2. Perform construction in a manner that will not interfere with the operation of any street, highway, railway, or other facility, and will not weaken or damage the roadbed or structure. Furnish and maintain barricades and lights to safeguard traffic and pedestrians as required by authorities having jurisdiction until such time as the operation has been completed. It is the contractor's responsibility to provide and maintain any and all devices necessary to ensure the safety of employees, pedestrians, and the general public at all times until full project completion.

3. The omission from the Drawings and Specifications of any details required for the satisfactory installation of the work in its entirety shall not relieve the CONTRACTOR of full responsibility for providing such necessary items.

Section Includes

1. Casing and jacking pipe.

2. Excavation for approach trenches and pits.

REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

   1. AASHTO HB-17 - Standard Specifications for Highway Bridges.

B. American Railway Engineering and Maintenance-of-Way Association:

   1. AREMA - Manual for Railway Engineering.

C. American Welding Society:

   1. AWS D1.1 - Structural Welding Code – Steel.

D. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A139 - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)

3. ASTM C33 - Standard Specification for Concrete Aggregates.

4. ASTM C150 - Standard Specification for Portland Cement.

E. National Utility Contractors Association:

1. NUCA - Guide to Pipe Jacking and Microtunneling Design.

F. State of North Carolina Department of Transportation

1. Standard Specifications for Roads and Structures, latest revision

2. Policies and Procedures for Accommodating Utilities on Highway Rights of Way

G. Occupational Safety and Health Administration

1. Safety and Health Regulations for Construction

COORDINATION

A. For all work within the Department of Transportation right-of-way, notify the appropriate office of the Department of Transportation at least 72 hours prior to beginning construction.

B. No blasting will be done without prior written approval of the Department of Transportation. If requested, furnish the Department of Transportation with details of the proposed blasting method.

C. At all times, ensure the free and unobstructed use of the right-of-way for the passage of traffic without delay or danger to life, equipment, or property.

PREINSTALLATION MEETINGS

A. All parties, including the OWNER, ENGINEER, CONTRACTOR, installer, any subs and the product manufacturer, shall meet prior to any work is started to review the specification and discuss job specific expectations, needs and requirements.

SUBMITTALS

A. Product Data: Submit product data on steel casing pipe, casing spacers, and end seal materials.

B. Shop Drawings:
   1. Indicate details of casing, jacking head, sheeting, and other falsework for trenches and pits, and support for excavation, field sketches, and other details to complete Work.

   2. Indicate relationship of proposed installation to existing facilities and/or natural features over installation, angle of installation, right-of-way lines, and general layout of built facilities.

   3. Indicate cross-section(s) from field survey, showing installation in relation to actual profile of ground.

   4. Submit description of proposed construction plan, dewatering plan, and plan to establish and maintain vertical and horizontal alignments.

C. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for shoring and bracing.

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

   1. If any movement or settlement occurs which causes or might cause damage to existing facilities or structures over, along, or adjacent to the work, immediately stop any and all work except that which assists making the work secure and prevents further movement, settlement, or damage. Resume installation activities only after all necessary precautions have been taken to prevent further movement, settlement or damage, and repair the damage, at no additional cost to the OWNER, to the satisfaction of the ENGINEER.

E. Submit written report results of visual check of entire length of casing prior to installation of carrier to verify that there are no voids or defective joints.

F. Qualifications Statements:

   1. Submit qualifications for installer and licensed professional.

   2. Welders: Qualify procedures and personnel according to AWS D1.1.

CLOSEOUT SUBMITTALS

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

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

QUALITY ASSURANCE

A. Perform Work according to AREMA, NUCA, OSHA, and AASHTO guidelines.

B. Comply with all Federal, State, and local laws, ordinances, rules, and regulations affecting the work under this section.

C. Where applicable, perform Work according to State of North Carolina Department of Transportation standards.

D. All welding procedures used to fabricate and install steel casings shall be performed in accordance the provisions of ANSI/AWS D1.1.

QUALIFICATIONS

A. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience.

B. Welders: AWS qualified by an independent local, approved testing agency within previous 12 months for employed weld types.

   1. A minimum of 3 years recent experience within the last 5 years with welding procedures required on this project.

C. Licensed Professional: Professional ENGINEER experienced in design of specified Work and licensed in State of North Carolina.

DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage. If any defective material is discovered, remove it and replace with sound pipe or repair defective material in an approved manner and at the CONTRACTOR’s expense.

B. Handling: Support casing and carrier pipes with nylon slings during handling. Do not place pipe within pipe of a larger size and do not roll or drag pipe over gravel or rock.

C. Storage:

   1. Store products according to manufacturer instructions.

   2. Use wooden shipping braces between layers of stacked pipe.

3. Stack piping lengths no more than three layers high.

4. Store field joint materials in original shipping containers.

5. Do not store any plastic materials in direct sunlight.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Provide temporary end caps and closures on piping and fittings and maintain in place until installation.

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

4. Provide additional protection according to manufacturer instructions.

E. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, the ENGINEER will reject the material as being unfit for installation.

AMBIENT CONDITIONS

A. Storage Temperature: Maintain 60 to 85 degrees F.

WARRANTY

A. All materials shall be warranted to be free from defects in workmanship and materials for one (1) year following final acceptance by the OWNER.

EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

CASING AND JACKING PIPE

A. Steel Casing Pipe:

1. Comply with ASTM A139, Grade B.

2. Minimum Yield Strength: 35,000 psi.

3. Welded Joints:

    a. Comply with AWS D1.1.

    b. Full circumference.

4. Interior and exterior coating.

    a. Additional coating requirements, if any, may be included in the encroachment agreement. The encroachment agreement is included and made a part of the Contract Documents.

5. Pipe Sizing:

    a. The encasement pipe shall be of the diameter and wall thickness indicated on the drawings, but in no case shall they be less than required by authorities having jurisdiction.

B. Performance and Design Criteria:

1. Casing Pipe: Leakproof.

2. Loading:

    a. Highways:

        1) Earth cover.

        2) H-20 live loading, according to AASHTO HB-17.

        3) Impact loading according to AASHTO HB-17.

    b. Railways:

        1) Earth cover.

        2) Comply with AREMA - Manual for Railway Engineering.

        3) Impact loading according to AREMA guidelines.

3. Bracing, Backstops, and Jacks: Of sufficient rating for continuous jacking without stopping except to add pipe sections, and to minimize tendency of ground material to freeze around casing pipe.

CARRIER PIPE

A. Site Water Distribution System Piping: As specified.

B. Sanitary Sewage System Piping: As specified.

MATERIALS

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

B. Filling and Sealing Grout at Pipe Ends: Grout shall be a mixture of approximately one part cement, 1-1/2 parts sand, water reducing retarder and sufficient water to make a stiff workable mix.

C. Pressure-Grout Mix: One part portland cement and two parts mortar sand, mixed with water to consistency applicable for pressure grouting.

D. Mortar Sand: Comply with ASTM C33.

E. Portland Cement:

    1. Portland cement shall be ASTM C150 Type II or Type V, containing less than 0.6 percent alkali.

ACCESSORIES

A. Steel and Plastic Supports and Insulators:

    1. Bands: 14-gage stainless steel.

    2. Flange Bolts: 5/16-inch stainless steel.

    3. Liner: Heavy-duty PVC.

    4. Skids: UHMW Polyethylene.

        a. Wood skids are not an acceptable method of supporting the carrier pipe.

    5. For Carrier Pipes up to 36 Inches in Diameter Conveying Water or Wastewater
        a. Casing spacers shall be spaced a maximum of eight (8) feet apart along the length of the carrier pipe with one casing spacer within two (2) feet of each side of a pipe joint and the rest evenly spaced.

        b. The casing spacer polymer shall contain ultraviolet inhibitors and shall have a minimum compressive strength of 3,000 psi, an 800 Volts/mil dielectric strength

and impact strength of 1.5 ft-lbs/inch. Each casing spacer shall have full length, integrally molded skids extending beyond the bell or mechanical joint of the carrier pipe.

B. Steel Strapping: Comply with ASTM A36.

C. Casing End Seals

1. Casing end seals shall be used to completely close both openings on either side of the casing.

2. End seals shall be 1/8-inch thick synthetic rubber secured with stainless steel banding straps. Other end seals may be constructed only as pre-approved by the ENGINEER or as required by authorities having jurisdiction.

EXAMINATION

A. Verify that connection to existing piping system, sizes, locations, and invert elevations are as indicated on Drawings.

B. Examine the areas and conditions under which the boring is to be installed and become familiar with the conditions under which the work will be performed, all necessary details, and the suitability of the proposed equipment and methods for the orderly prosecution of the work.

C. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

D. Notify the ENGINEER immediately if conditions do not permit a bore and jack installation.

PREPARATION

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

B. Existing Utilities:

1. Locate and identify utilities indicated to remain and protect from damage.

2. Notify ENGINEER of any potential utility conflicts immediately.

3. Establish minimum separation of proposed installation from existing utilities according to authorities having jurisdiction.

C. Maintain access to existing facilities and other active installations requiring access.

D. Furnish, install and remove, to the extent required, thrust blocks or whatever provisions may be required for driving the casings/sleeves and pipes forward.

INSTALLATION

A. Safety:

1. Provide all necessary bracing, bulkheads, and/or shields to ensure complete safety to all traffic at all times during the progress of the work, and perform the work in such a manner as to not interfere with normal traffic over the work.

B. Dewatering:

1. Intercept and divert surface drainage precipitation and ground water away from excavation through use of dikes, curb walls, ditches, pipes, sumps, or other methods.

2. Develop substantially dry subgrade for subsequent operations.

3. Comply with requirements of local and state authorities for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

4. Keep all excavations free from ground and surface water during the operation and be prepared to implement groundwater control on short notice as directed by the ENGINEER, even if observed water levels prior to construction are below the invert elevation of the casing pipe.

C. Pits or Approach Trenches:

1. Suitable pits or trenches shall be excavated for the purpose of jacking operations and for placing the end joints of pipe.

2. All excavations shall be protected with suitable fencing or barricades to prohibit unauthorized access to the work site.

3. Excavate approach trenches or pits as Site conditions require.

4. Ensure that casing entrance faces as near perpendicular in alignment as conditions permit.

5. Establish vertical entrance face at least 1 foot above top of casing.

6. Where necessary, trenches shall be securely sheeted and braced to prevent caving.

7. The pits or trenches shall be backfilled immediately after the operation has been completed.

D. Casing Pipe:

1. The driven portions of the casing shall be advanced from the lower end of the casing unless specific permission to do otherwise is obtained from the ENGINEER.

2. Boring:

   a. Boring operations shall be continuous to their completion, and unnecessary or prolonged stoppages shall not be allowed to prevent the pipe from becoming firmly set in the embankment.

   b. Steel rails or beams embedded in concrete shall be used in the pit for placement and alignment of each piece of casing during installation operations.

   c. Push pipe into ground with boring auger rotating within pipe to remove soil.

   d. Do not advance cutting head ahead of casing pipe, except for distance necessary to permit cutting teeth to maintain clearance for pipe.

   e. Arrange machine bore and cutting head to be removable from within pipe.

   f. Arrange face of cutting head to provide barrier to free flow of soft material.

   g. If unstable soil is encountered during boring, retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.

3. Abandonment of Bore: In the event that an obstruction is encountered during the dry boring operation, the casing shall be inspected by the ENGINEER and determined if it may be removed or left in place.

   a. If an obstruction is encountered during the dry bore operation which prohibits further extending of the bore, terminate the bore if approved by ENGINEER as follows:

      1) Remove the boring auger and the casing pipe.

      2) Fill the void created by the removal of the pipe with grout as specified at a minimum pressure of 25 pounds per square inch.
      3) Provide suitable temporary forms to retain the grout within the limits of the former casing pipe.

      4) Remove forms after the grout has set.

5) Move to another bore site as directed by the ENGINEER.

4. Jacking:

   a. The pipe to be jacked shall be set on guides, braced together, to properly support the section of the pipe and direct it to the proper line and grade.

   b. Construct adequate thrust wall normal to proposed line of thrust.

   c. Impart thrust load to pipe through suitable thrust ring sufficiently rigid to ensure uniform distribution of thrust load on full pipe circumference.

   d. Remove any pipe damaged in boring and jacking operations and replace at no additional cost to the OWNER.

5. Pressure Grouting: If voids in excess of 3-inch are encountered, install grout holes of a size suitable for injecting grout between casing pipe and surrounding earth.

   a. The grouting operation shall take place immediately after completion of the bore.

   b. Grout holes shall be installed at intervals not exceeding 10-feet.

   c. Inject grout into the void under sufficient pressure to prevent settlement.

   d. No additional compensation will be paid for grouting.

E. Carrier Pipe:

1. Clean, inspect, and handle pipe as specified.

2. Prevent damage to pipe joints as carrier pipe is placed in casing.

3. Supports:

   a. Support pipeline within casing using skids or rollers such that no external loads are transmitted to carrier pipe.

   b. Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.

   c. No blocks or spacers shall be wedged between the carrier pipe and the top of the casing.

4. The carrier pipe shall extend a minimum of 2 feet past casing pipe on each end.

5. Install an end seal on each end of the casing pipe so that annular space between the casing and carrier pipe is sealed.

TOLERANCES

A. Excavation:

1. Minimize overbore by matching the cutter diameter to the diameter of the encasement pipe as closely as practicable. Do not overcut excavation by more than 1 inch greater than OD of casing pipe.

B. The alignment and grade of the encasement pipe shall be carefully maintained and the encasement pipe installed in a manner that will allow of the installation of the carrier pipe to the lines and grades shown on the plans.

C. Casing Pipe Vertical and Horizontal Alignment:

1. Horizontal: Variation in the final position of the pipe from the line and grade established by the ENGINEER will be permitted only to the extent of 0.5% in lateral alignment.

2. Vertical Alignment: Where the carrier pipe is to be laid on a uniform grade (i.e. gravity sewer line or gravity storm drain) the variation in vertical alignment will be as follows:

Carrier Pipe Size	% Grade Tolerance
8	±0.04
10	±0.028
12	±0.022
14	±0.017
15	±0.015
16	±0.014
18	±0.012
20	±0.01
21	±0.01
24	±0.008
27	±0.0067
30	±0.0058
33	±0.0052
36	±0.0046

3. In no instance shall the grade of the carrier pipe be less than the minimum grade required by OWNER or State Regulations.

D. Pipe Bells: Minimum 1/2-inch clearance to casing.

FIELD QUALITY CONTROL

A. Manufacturer Services: Furnish services of manufacturer's representative experienced in use of equipment and installation of products furnished under this Section as necessary to ensure compliance with the requirements of this Section throughout the course of the work.

CLEANING

A. Remove temporary facilities for casing installation and jacking operations.

B. Repair all damage and restore the property to its original condition.

PROTECTION

A. Protect plant life, lawns, rock outcroppings, and other features of final landscaping.

B. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

END OF SECTION