SECTION 5000
UTILITY TRENCHES

TABLE OF CONTENTS

5010 EXCAVATION AND PREPARATION

A. PREPARATION

1. General Requirements

a) Trenching for pipelines (water, sewer, pressure, natural gas and liquid petroleum), communication and power lines and drainage and irrigation pipes shall be excavated to the required depth to permit the installation of the pipe (inclusive of pipes, wires, cables, ducts, and conduit) along the lines and grades shown on the construction drawings.

b) Prior to trenching for the construction of any utility mains or connections, the Contractor shall locate all existing utilities within the construction zone. This may include at a minimum contacting the North Carolina One Call Center at 811 or 1-800-632-4949. Where critical Cary water and sewer utilities cannot be located by traditional means, specialized utility locating, such as vacuum excavation or ground penetrating radar (GPR) may be required to locate existing utilities before excavating.

c) In all cases where trenchless methods are planned to cross an existing utility corridor with water, sewer, force main, reclaimed water and/or other Cary maintained pipelines, an SUE (subsurface utility exploration) services firm shall be contracted to verify the depths of existing utilities prior to boring. Where SUE involves survey work, the survey shall be in accordance with the requirements of Section 10050 of these Standard Specifications.

d) The Contractor shall be responsible for implementing all required safety provisions for trenching in compliance with the Occupational Safety and Health Administration (OSHA) regulations and all other applicable safety requirements and procedures.

B. TRENCHING

1. Trench Dimensions

a) The minimum trench width at the top of the pipe shall be at least 24-inches greater than the outside diameter of the pipe. Rock shall be removed to a depth of at least 6-inches below the bottom of the pipe and the trench backfilled with suitable material.

b) Open trenches shall not exceed 100-feet.

c) All trenches shall be confined to the limits of the right-of-way or utility easement. Trenches in paved areas shall not be sloped.

d) All trenches in or along roadways shall be properly backfilled at the end of each working day.

2. Trench Protection

a) Wet trenches shall be stabilized with a base layer of #78 M or #57 stone. The bottom of the trench shall be shaped to provide uniform support along the entire length of the pipeline. Severely unstable trench bottoms requiring undercut excavation shall receive a foundation support system for the pipeline designed by a registered Geotechnical Engineer licensed in the State of NC.

b) A space shall be excavated at each bell to provide ample space to join the pipes with no misalignment.

c) The Contractor shall take all necessary measures to prevent water from entering the trench.

5020 PIPE LAYING AND BACKFILLING

A. GENERAL REQUIREMENTS

1. Pipe Laying

a) Open ends of pipe shall be plugged when pipe laying is not in progress to prevent trench water, soil, and debris from entering.

b) All pipe shall be laid in accordance with the manufacturer's recommendations and all applicable Cary Standards, Specifications and Details.

c) Pipe laying shall be accomplished in a manner and with the required resources to provide a properly aligned and sealed pipeline and joints.

d) Pipe deflection limits shall not be exceeded in accordance with manufacturer requirements.

e) All gravity mains shall be installed beginning with the downhill section at the lowest elevation, and advanced upgrade to the terminus of the main. All bell ends shall be oriented facing the uphill direction.

2. Backfill

a) Backfill material shall be free from construction material, frozen material, organic material, or unstable material. Backfill with a high clay content or high shrink-swell potential that cannot meet compaction requirements shall be deemed unsuitable and replaced.

b) Backfill materials that have been allowed to become saturated or with moisture contents non-conducive to meeting compaction requirements shall be deemed unsuitable and replaced.

c) When original excavated materials have been deemed unsuitable, granular material must be imported to the site to backfill utility trenches and meet compaction requirements. The following materials shall be acceptable forms of granular backfill: aggregate base course, soil type base course, select backfill material, sand or screenings in accordance with NCDOT Specifications.

d) In all open utility trenches, backfill shall be compacted to 95% maximum dry density as measured by AASHTO method T99. The Contractor shall be responsible for verifying that compaction requirements have been met or exceeded by providing soils testing data from an approved Geotechnical Firm. The soil test results shall be certified by a licensed Geotechnical Engineer.

e) Backfill for utility trenches shall be placed in 8-inch lifts or less of uncompacted soil and compacted with a mechanical tamp before placing additional layers.

5030 PAVEMENT REPAIRS

A. OPEN TRENCH PAVEMENT REPAIR

1. General Requirements

a) All pavement cuts shall be repaired within a maximum of three (3) days from the date the cut is made. If conditions do not permit a permanent repair within the given time limit, permission to make a temporary repair must be obtained from the Infrastructure Field Technician.

b) Pavement repairs shall be made in accordance with Cary Standard Details.

c) All asphalt pavement utilized to repair open trenches shall comply with all applicable Cary asphalt pavement material and installation Specifications.

d) All pavement patches shall be provided in such a manner that a uniform and smooth driving surface free of depressions and/or bumps is obtained. Pavement patches not meeting this standard shall be milled and replaced.

5040 TRENCHLESS PIPE INSTALLATION

A. DESIGN

1. General Requirements

a) All utility crossings within Cary streets shall be made by trenchless methods. State maintained streets within the Cary ETJ should also be crossed using trenchless methods. In cases where utility conflicts, rock, or other obstructions prevent trenchless crossings, Cary may consider approving other methods.

b) The preferred trenchless method shall be auger boring. Alternate trenchless methods including microtunneling, guided boring, conventional tunneling, horizontal directional drilling or hand tunneling may be approved after thorough evaluation by the Utilities Department.

c) In addition to meeting or exceeding all Cary requirements, all trenchless crossings shall be approved by and meet the requirements of all controlling legal authorities, such as NCDOT, Norfolk Southern Railway and CSX Corporation.

d) Direct bores may be made without a casing pipe on pipelines 6-inches in diameter and smaller.

e) Encasement pipe shall be installed with all trenchless construction methods (excluding horizontal directional drilling when it is approved and as noted above). There shall be a minimum cover of 4-ft between the pavement subgrade and the top of the casing pipe. Under no circumstances shall the pavement subgrade be disturbed.

f) Permanent easements (UPE) shall be provided at all trenchless pits to allow for future access to casing pipes.

B. MATERIALS

1. Encasement Pipe

a) Encasement pipe shall be new and manufactured of grade 'B' steel with minimum yield strength of 35,000-psi in accordance with ASTM A139 and A283.

b) All casing pipe shall have machine cut, bevel ends that are perpendicular to the longitudinal axis of the casing.

c) Size and minimum wall thickness of smooth wall or spiral welded steel encasement pipe shall be as shown in the below table. Actual wall thicknesses shall be determined by the casing installer based on their evaluation of the required forces to be exerted on the casing when it is installed.

Minimum Wall Thickness of Steel Encasement Pipe

Encasement Pipe Outside Diameter *(inches)*	Minimum Wall Thickness *(inches)*
12-3/4	0.188
14	0.250
16	0.250
18	0.250
20	0.250
24	0.250
26	0.312
28	0.312
30	0.312
36	0.375
42	0.500
48	0.500
54	0.500
60	0.500
66	0.625

d) Encasement pipe installed for railroad bores shall meet the requirements of the American Railway Engineering Association (AREA) for boring under railroads.

e) Encasement pipe shall have the following minimum sizes:

Minimum Allowable Steel Encasement Diameter Per Carrier Size

Carrier Pipe Size Inside Diameter (inches)	Carrier Pipe Outside Bell Diameter Typ. (inches)	Steel Encasement Nominal Diameter (inches)
6	9.19	12-3/4
8	11.33	16
10	13.56	18
12	15.74	20
14	19.31	24
16	21.43	26
18	23.70	28
20	25.82	30
24	29.88	36
30	36.34	42
36	42.86	48
42	49.92	60
48	56.36	66

2. Casing Pipe Spacers and End Closures

a) The carrier pipe shall rest on steel pipe alignment spacers. The spacers shall have either a bituminous or epoxy coating. A minimum of 2 steel spacers per joint shall be required on carrier pipe less than 36-inches. Carrier pipe greater than or equal to 36-inches shall have a third spacer. The steel spacers shall be located evenly along the carrier pipe alignment in such a manner that each spacer supports the same unit weight of carrier main. The spacing interval of the steel spacers shall assure the necessary grade, clearance, and support of the carrier main. The spacers shall be manufactured for the specific carrier pipe and casing pipe diameters being used such that the risers do not allow the pipe to float within the casing.

b) In cases where the encasement pipe is installed near facilities with stray current, such as gas lines, high voltage power transmission lines, petroleum lines, railroad tracks, etc., the steel spacers shall be provided with composite contacts on the runners such as an EPDM rubber liner or an ultra-high molecular weight polyethylene plastic skid to prevent transmitting the stray current to the carrier pipe.

c) In cases where PVC carrier pipe is installed in an encasement pipe, steel spiders with soft contact surfaces rated for use with PVC pipe shall be used.

d) The carrier pipe bells shall not be allowed to contact the interior of the encasement pipe under any circumstances.

e) No blocks or temporary spacers shall be wedged between the carrier pipe and the top of the encasement pipe.

f) The ends of the encasement pipe shall be sealed using 8-inch bricks and a non-shrink grout.

g) A 2-inch galvanized vent pipe shall be provided on the upper end of the casing on all stream and railroad crossings.

3. Carrier Pipe

a) All carrier pipe shall be manufacturer provided restrained joint ductile iron pipe except for reclaimed water mains in which restrained PVC C900 or C905 pipe in compliance with Section 6500 is utilized.

C. INSTALLATION

1. General Requirements

a) As the trenchless operation progresses, each new section of encasement pipe shall be joined using full penetration seal welds prior to installation of the casing. Joints shall be electric-fusion welded by operators qualified in accordance with the American Welding Society's standard procedure for arc welds. The welds shall be capable of transmitting all thrust and other loads across the joints.

b) If voids are encountered while installing encasement pipe thirty (30) inches and larger, 2-inch or larger grout holes shall be installed at ten (10) foot centers in the top section of the encasement pipe. The grout holes shall be used to fill the void spaces with 1:3 Portland cement grout at sufficient pressure to prevent settlement of the roadway, unless NCDOT approval stipulates otherwise. Other grout mixtures may be submitted for approval.

c) In the event that an obstruction is encountered during the trenchless operations, the equipment shall be withdrawn. The pipe shall be cut off, capped, and filled with 1:3 Portland cement grout at a sufficient pressure to fill all voids before moving to another boring site.

d) Restrained joint ductile iron carrier pipe shall be pulled into the casing pipe. Lined pipe for sewer application shall never be pushed into a casing.

2. Settlement Surveying

a) For all trenchless operations of 100-ft or more, the ground surface elevations shall be recorded prior to beginning work.
    i. At a minimum, survey points shall be identified with a nail or hub located as follows:
        - Road crossings: Centerline and each shoulder/curb
        - Utility and Pipeline Crossings: Directly above and 10-ft each side of the crossing
        - All locations: Points shall not exceed 50-ft spacing.
    ii. Elevations at each point shall be recorded with an accuracy of 0.01-feet.

b) Settlement observations shall be made each day until the pipe/casing is fully installed.

c) Readings shall be reported to the Infrastructure Field Technician.

d) In the case of observed settlement, the monitoring points and observation frequency shall be increased as determined by Cary.

5050 EXTERNAL CORROSION PROTECTION

1. General Requirements

a) External corrosion can occur at an accelerated rate in metallic pipelines such as steel and ductile iron when they are installed in aggressive soils or when they are installed near other structures or utilities that carry impressed currents. Such facilities that typically utilize impressed current cathodic protection are gas pipelines, such as owned by Colonial Pipeline, Cardinal Pipeline and Dixie Pipeline. Other potential sources that may create stray currents that contribute to accelerated pipeline corrosion are high voltage power transmission lines and railroad crossings.

b) In cases where metallic steel and ductile iron pipelines or encasement pipes are planned for installation in close proximity to any potential sources of stray current or aggressive soils, zinc coated pipe shall be specified and a field analysis consisting of stray current evaluation and soil testing shall be conducted by an experienced technician, as certified by the National Association of Corrosion Engineers, (NACE), to determine the potential for external corrosion and the need for additional protection measures. In cases where stray current conditions and/or aggressive soils are prevalent, a corrosion specialist certified by the NACE or other applicable certification board shall be consulted regarding the design of pipeline protection measures.

c) At a minimum, all stray current protection systems should include bonded joints and sacrificial anodes with a 50-year or longer design life

and test facilities in lieu of polyethylene encasement, unless otherwise approved by Cary. The cathodic protection element of the pipeline design package shall be sealed by Professional Engineer licensed in the State of NC.

d) Full impressed current cathodic protection shall only be utilized when extreme corrosion potential has been proven and/or as otherwise directed by the Utilities Department and the certified corrosion engineer of record.

END OF SECTION 5000