

02275 - TRENCHING, BACKFILLING AND COMPACTION OF UTILITIES

(Last revised 8/22/13)

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PART 1 – GENERAL

1.1 GENERAL:

- A. The Contractor shall furnish all labor, materials, tools, equipment, and perform all work and services necessary for or incidental to the furnishing and installation, complete, of all operations in connection with excavation, trenching, and backfilling of underground utilities as shown on drawings and as specified, in accordance with provisions of the Contract Documents, and completely coordinated with work of all other trades.

Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete and compatible installation.

Work included in the project consists of, but is not necessarily limited to, methods of installation of the following:

- 1) Sanitary Sewer Pipe Installation & appurtenances.
- 2) Water Distribution Pipe Installation & appurtenances.
- 3) Relocation of piping systems.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this specification.
- B. AWWA C600: *Standard for Installation of Ductile-Iron Water Mains and their Appurtenances*
- C. AWWA C605: *Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings*
- D. AWWA C900: *Pressure Pipe and Fabricated Fittings (4" through 12") for Water Distribution*

- E. City of Wilson *Pre-Approved Material/Product List*
- F. City of Wilson *Right-of-Way Regulations and Procedures*, latest edition
- G. Section 00825 – Product Substitutions
- H. Section 00950 – Measurement and Payment
- I. Section 02530 – Sanitary Sewer
- J. Section 02510 – Water Distribution
- K. Section 02630 – Storm Drainage
- L. Section 02920 – Seeding, Sodding, and Groundcover
- M. NCDENR Division of Land Resources, Land Quality Section's *Erosion and Sedimentation Control Planning and Design Manual*.
- N. Standard 29 CFR Part 1926, OSHA Subpart P "Excavation and Trenching," latest edition.
- O. UNI-PUB-6: *Recommended Installation Guide for PVC Solid-Wall Sewer Pipe (4-15 inch)*
- P. UNI-PUB-9: *Installation Guide for PVC Pressure Pipe*

1.3 SUMMARY

- A. This section includes:
 - 1) Excavating and backfilling trenches for buried water, sewer, storm drainage, buried utility structures, and appurtenances.
 - 2) Preparing subgrade for buried water and sewer, buried utility structures, and appurtenances.
- B. Construction and materials related to this section but covered elsewhere:
 - 1) Erosion Control: *North Carolina Sediment Control Law*.

1.4 DEFINITIONS

For the purposes of this specification, the following definitions refer to sanitary sewer, water distribution, and storm drainage systems that come under the authority of the City of Wilson as specified within this section and other sections of this manual.

- A. **Backfill:** Soil materials used to fill an excavated trench.
 - 1) **Initial Backfill** (Carefully Compacted Select Earth Backfill): Backfill placed beside and over the top 12-inches of the pipe in a trench, including haunches to support sides of pipe.

- 2) **Final Backfill** (Common Trench Backfill): Backfill placed over the initial backfill to fill a trench.

In terms of volume, backfill is defined as a compacted post-construction volume in-place.

- B. **Bedding Course:** Layer of clean coarse stone placed over the excavated subgrade in a trench to bring the trench bottom up to grade before laying pipe. When natural materials encountered in trenches are of fine grains and migration of material into the bedding is possible, use well graded bedding material without voids (coarse sand; [Unified Soil Classification System] SC, SM).
- C. **Borrow:** Borrow shall consist of approved fill material imported from off-site.
- D. **City Engineer:** The Director of Engineering or his designated representative.
- E. **City:** Refers to the City of Wilson
- F. **Classified Excavation (undercut):** Classified excavation shall consist of the removal and satisfactory disposal of all unsuitable material located below subgrade elevation. Where excavation to the finished grade section results in a subgrade or slopes of muck, peat, matted roots, etc., the Contractor shall remove such material below the grade shown on the plans or as directed; and areas so excavated shall be backfilled with approved select fill or stone as ordered by the City Engineer. See also [paragraph AA, Unclassified Excavation](#).
- G. **Clearing:** Clearing shall consist in the felling, cutting up, and satisfactory disposal of trees and other vegetation designated for removal in accordance with these specifications.
- H. **Competent Person:** Competent Person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
- I. **Contractor:** Refers to a Contractor licensed in the State of North Carolina to perform public utility construction.
- J. **Easement:** An instrument that depicts/describes and conveys rights and privileges to the City for the placement, access to and maintenance of a utility line across and/or on the property of a second party. Ownership of the land remains with the second party.
- K. **Force Main:** Pressurized sanitary sewer main.
- L. **Foundation Stone:** Clean well-graded stone, authorized by the City Engineer, used to strengthen and/or provide support to an otherwise weak subgrade. Foundation stone is placed and the subgrade improved before bedding stone is placed. Where voids may cause migration of native or backfill material, use well graded material without voids (coarse sands; [Unified Soil Classification System] SC, SM).

- M. **Grubbing:** Grubbing shall consist of the removal of roots 1 ½ inch and larger, organic matter, debris and stumps and the disposal thereof.
- N. **Haunching:** Layer of clean coarse stone placed and compacted up to the springline of the pipe. Where voids may cause migration of native or backfill material, use well graded material without voids (coarse sands; [Unified Soils Classification System] SC, SM).
- O. **Public Sanitary Sewer System:** Any sewer facility or line owned and maintained by the City of Wilson.
- P. **Rock Excavation for Trenches and Pits:** Rock excavation for trenches and pits includes removal and disposal off-site of materials and obstructions encountered that cannot be practically excavated with a track-mounted power excavator equivalent to a Caterpillar Model No. 325 or equivalent equipped with new rock teeth. Practical excavation is defined as the ability to remove at least 30 cubic yards during one hour of continuous digging. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.
- Q. **Rock in Open Excavation:** All boulder, solid ledges, bedded deposits, unstratified masses, and conglomerations of material so firmly cemented as to possess the characteristics of solid rock. Rock in open excavations includes removal and disposal on-site of materials and obstructions encountered in general excavation other than trenches and pits that cannot be dislodged and excavated with modern, track-mounted, heavy-duty excavating equipment without drilling, blasting, or ripping. Rock is defined as material which cannot be effectively excavated during general grading with a D-8 or equivalent dozer drawing a new single-tooth ripper. Effective excavation is defined as the ability to remove 10 cubic yards or more of material after one hour of continuous ripping. Typical of materials classified as Rock in Open Excavation are boulders larger than 1-1/2 cubic yards or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.
- R. **Shall:** Means a mandatory requirement.
- S. **Structures:** Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- T. **Subgrade:** Surface or elevation remaining after completing the trench excavation or, the top surface of a backfill (stone or soil) immediately below the pipe conduit or pipe bedding, as applicable.
- U. **Topsoil:** See [Division 02920 – Seeding, Sodding, and Groundcover](#).
- V. **Trench Borrow:** Trench borrow shall consist of approved material imported from off-site for use as fill or backfill required to be placed in trenches either as initial carefully controlled select earth backfill or final common trench backfill. Trench borrow shall not be used until all suitable trench excavation material has been placed in the trench, unless authorized by the City Engineer. Unless otherwise designated on the plans and in the contract documents, the Contractor shall make his own arrangements for obtaining borrow and pay all costs involved.

- W. **Water Main:** Exterior water systems for both domestic water and fire suppression needs.
- X. **Water Distribution ORC:** The City's *Operator in Responsible Charge* over the City of Wilson's water distribution system; a manager in the Water Resources Department.
- Y. **The Director of Water Resources:** The Director of Water Resources, Water Distribution ORC or their authorized representative.
- Z. **Wastewater Collection ORC:** The City's *Operator in Responsible Charge* over the City of Wilson's wastewater collection system; a manager in the Water Resources Department Division.
- AA. **Unclassified Excavation:** Removal and disposal of any and all material above subgrade elevation, except solid rock and undercut excavation, located within the limits of construction. See also paragraph [F, Classified Excavation](#).
- BB. The following are industry abbreviation for various pipe materials:
- 1) **AC:** Asbestos Cement Pipe
 - 2) **CAP:** Corrugated Aluminum Pipe
 - 3) **CI:** Cast Iron Pipe
 - 4) **DIP:** Ductile Iron Pipe
 - 5) **HDPE:** High Density Polyethylene Pipe
 - 6) **PCP:** Plain Concrete Pipe
 - 7) **PVC:** Polyvinyl Chloride Plastic Pipe
 - 8) **RCP:** Reinforced Concrete Pipe.

1.5 SUBMITTALS

- A. Submit product data and a sample of drainage fabric or separation fabric and fully document each with specific location or stationing information, date, and other pertinent information.
- B. **Material Test Reports:** Provided from a qualified testing agency which either indicate or interpret test results for compliance of the following requirements indicated:
- 1) Classification according ASTM D2487 of each on-site or borrow soil proposed for backfill, unless otherwise directed by City Engineer.
 - 2) Laboratory compaction curve according to ASTM D698 for each on-site or borrow soil material proposed for backfill.

C. Blasting:

- 1) Insurance Certificate naming the City as “additional Insured.” See [paragraph 3.8.1 – Blasting](#) for other blasting insurance requirements.
- 2) Qualifications, proposed procedures, and schedule shall be submitted at least 2 weeks prior to commencing any blasting operations.
- 3) Permits from local Fire Department and City officials.
- 4) Blasters shall, at all times, have their license and blasting permits on the job site, and shall allow examination of same by any official that may have jurisdiction.
- 5) If required by the City Engineer, seismic survey agency report, for record purposes.

B. Product Data:

- 1) Each type of plastic warning tape
- 2) Stabilization/Separation fabric
- 3) Drainage Fabric

1.6 QUALITY ASSURANCE

- A. **Geotechnical Testing Agency Qualifications:** An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock-definition testing as documented according to ASTM D3740 and ASTM E548. Testing Lab to be AMRL (AASHTO Materials Reference Laboratory) and CCRL (Cement and Concrete Reference Laboratory) certified.
- B. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.
- C. The contractor shall comply with North Carolina Department of Environment and Natural Resources, *Erosion and Sedimentation Control Handbook*, latest revisions.
- D. Comply with applicable requirements of NFPA 495, *Explosive Materials Code*, latest revisions.
- E. *Gravity Sanitary Sewer Design and Construction*, ASCE Manuals and Reports on Engineering Practice – NO. 60, WPCF Manual of Practice NO. FD-5, latest revisions.
- F. Comply with Uni-Bell PVC Pipe Association *Handbook of PVC Pipe: Design and Construction*, latest edition. Dallas: UNI, 1991 for the installation of PVC piping, latest revisions.

1.7 QUALITY STANDARDS

- A. Materials and operations shall comply with the latest revision of the Codes and Standards listed below:

American Society for Testing and Materials

ASTM C33	Concrete Aggregates
ASTM D698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³) (Standard Proctor).
ASTM D1556	Standard Method of Test for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (Modified Proctor).
ASTM D2049	Standard Method of Test for Relative Density of Cohesionless Soils
ASTM D2167	Standard Method of Test for Density of Soil in Place by the Rubber-Balloon Method
ASTM D2487	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
ASTM D2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D3740	Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
ASTM D4254	Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
ASTM D4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
ASTM E548	Standard Guide for General Criteria Used for Evaluating Laboratory Competence

American Association of State Highway & Transportation Officials

AASHTO T99	The Moisture-Density Relations of Soils using a 5.5-pound Rammer and a 12-inch drop.
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AASHTO T180	The Moisture Density Relations of Soils using a 10-pound Rammer and an 18-inch drop.
AASHTO M145	The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

American Water Works Association

AWWA C600	Installation of Ductile Iron Water Mains and Their Appurtenances.
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B. Standard Abbreviations:

AASHTO	American Association of State Highway Transportation Officials.
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
ANSI	American National Standards Institute
AREA	American Railway Engineers Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CISPI	Cast Iron Soil Pipe Institute
DWQ	Division of Water Quality
FS	Federal Specifications
MSDS	Material Safety Data Sheets
NCDENR	NC Department of Environment and Natural Resources
NCDOT	North Carolina Department of Transportation
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NSF	National Sanitation Federation International
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
WEF	Water Environment Federation

1.8 TESTING SERVICES

- A. The testing laboratory shall be approved by the City Engineer and will be responsible for conducting and interpreting tests. The testing laboratory shall state in each report whether or not the test specimens conform to all requirements of the Contract Documents and specifically note any deviation.
- B. Specific test and inspection requirements shall be as specified herein.

1.9 PROJECT CONDITIONS

- A. **Demolition:** Demolish and completely remove from the site existing underground utilities indicated on the plans to be removed. Coordinate with applicable utility companies to shut off services if lines are active.
- B. **Environmental - Wetlands:** Before crossing or entering into any jurisdictional wetlands, contractor shall verify whether or not a wetlands permit has been obtained for the encroachment and whether special restrictions have been imposed in that permit. Care shall be taken to prevent draining or otherwise destroying non-permitted wetlands. Restore as stated on either the project drawings, the contract documents, and/or as noted in the permit. All crossings, disturbances, and encroachments into wetlands shall be subject to US Army COE and NCDENR Division of Water Quality approval and permitting requirements and conditions.
- C. **Environmental - Buffer Crossing Requirements:** Before crossing streams or ditches or working within 50 feet of ponds, lakes, or rivers, the Contractor shall verify whether either the line is exempt or a permit has been obtained to encroach into a nutrient sensitive river basin buffer and if so, to what extent work is permitted to occur. Unless otherwise permitted, shown on the contract drawings, or exempted by NCDENR or other proper authority, water and sewer crossing stream, river, pond, or lake buffers are to be as near perpendicular as possible (the crossing is considered to be perpendicular if it intersects the stream or surface water between an angle of 75 and 105 degrees). Do not disturb more than 40 linear feet (longitudinal) of riparian buffer. When permitted to encroach into zone 1 (the lower 30 feet beside the stream or water), adhere to all of the following minimum, but not necessarily limited to, Best Management Practices in during construction.
 - 1) Woody vegetation is cleared by hand. No grading allowed.
 - 2) Stumps to remain except in trench where trees are cut. Minimize disturbance to roots in buffer zone.
 - 3) Backfill trench with the excavated soil immediately following installation.
 - 4) Do not use fertilizer except for the one-time application to reestablish vegetation.
 - 5) Minimize removal of woody vegetation, the amount of disturbed area, and the time the disturbed area remains disturbed.
 - 6) Take measures to ensure diffuse flow of water through the buffer after construction.
 - 7) In wetland areas, use mats to minimize soil disturbance.
 - 8) Schedule work in buffers to ensure exposure of denuded surface in the buffer is kept to a minimum

D. Safety

The contractor shall keep the surface over and along the trenches and other excavation in a safe and satisfactory condition during the progress of the work.

E. Geotechnical Investigation

- 1) Where a Geotechnical report has been provided to the Contractor by the City of Wilson, the data on sub-surface soil conditions is not intended as a representation or warranty of the continuity of such conditions between borings or indicated sampling locations. It shall be expressly understood that the City of Wilson will not be responsible for any interpretations or conclusions drawn there from by the Contractor. The data is made available for the convenience of the Contractor.
- 2) In addition to any report that may be made available to the Contractor, the Contractor is responsible for performing any other soil investigations felt necessary for proper evaluation of the site for the purposes of planning and/or bidding the project, at no additional cost to the City of Wilson.

F. Protection of pavement

Debris from the site shall be removed in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt, dust, and debris at all times. Employ the necessary measures required to meet this requirement.

1.10 SERVICE INTERRUPTION

For service interruption, operation of valves, taps, fire hydrant operation, etc, contact the Water Resources [Department](#) at 296-3403. Provide a minimum of 48 hours notice or desired utility interruption or necessary operation of valves or hydrants.

1.11 COORDINATION

- A. Coordinate tie-in to municipal water mains with the City Engineer and/or the [Director of Water Resources](#). Except as needed for fire suppression purposes, the City of Wilson will be the sole operator of all valves and hydrants on the City's water distribution system. When no customers will be affected, the City shall be notified at least 24 hours in advance of a request for the City to operate valves.

Service is to be continuously maintained to customers in the project areas except for the minimum amount of time required to make connections to the existing system. However, if service is to be interrupted by shutting off a main(s), adequate notification to water customers shall be given by the Contractor prior to any interruption of service. Residents are to be notified at least 24 hours in advance of cut off using flyers.

In the case of an emergency, a Contractor or plumber will be permitted to employ measures with respect to valve and fire hydrant operation as required for the protection of life and property. Notification must be made to the City as soon as

possible after the emergency occurs stating what the emergency was and the measures taken to mitigate the emergency.

- B. Coordinate tie-ins to municipal roadway system with the City of Wilson.
- C. At the direction of the City Engineer and/or **Director of Water Resources**, temporary bypass pumping of sewerage flow may be required to be provided. See **paragraph 3.6, Bypass Pumping** of Specification **Section 02530 – Sanitary Sewer** for bypass pumping requirements and procedures.
- D. When traffic signals, loops, or their appurtenances are likely to be damaged or interfere with construction, coordinate temporary operation with the applicable agency having jurisdiction of the signals. Provide a minimum of 1 weeks' notice prior to anticipated disturbance or interruption. At the discretion of the City Engineer, the notice may be required to be published in the newspaper.
- E. **Repair of pavement markings:** When cuts are made through any paved surface and the cuts extend through the pavement markings, the replaced pavement shall be marked to match the existing.
- F. **Benchmark/Monument Protection:** Protect and maintain benchmarks, monuments or other established reference points and property corners. If disturbed or destroyed, they must be replaced at Contractor's own expense by a Licensed Professional Surveyor and to the full satisfaction of Owner/City of Wilson.
- G. Contact **"NC One Call"** at 811 before digging.



Know what's below.
Call before you dig.

1.12 PUBLIC CONVENIENCE

The contractor shall at all times so conduct his work as to ensure the least possible inconvenience to the general public and the residents in the vicinity of the work. Fire hydrants on or adjacent to the work shall be kept accessible to fire fighting equipment at all times. Temporary provisions shall be made by the Contractor to ensure the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed except as approved by the City Engineer.

1.13 TRAFFIC CONTROL

- A. When working within any NCDOT System road or highway, conform to the *Manual on Uniform Traffic Control Devices*, latest revision (MUTCD) as well as the *NCDOT Standard Specifications for Roads and Structures*, latest revision.
- B. Traffic Maintenance shall comply with the latest revision of the *NCDOT Standard Specifications for Roads and Structures*, Division 9 – *Signing* and Division 11 – *Work Zone Traffic Control*, as well as other applicable sections.
- C. A traffic control plan shall be submitted to the City of Wilson Police Department and NCDOT (if applicable) for approval.
- D. When traffic signals or their appurtenances are likely to be damaged or interfere with construction, coordinate temporary operation with the NCDOT or the City Engineer. Provide a 1 week notice prior to anticipated disturbance or interruption.

- E. Whenever it becomes necessary to leave a section of trench open after completion of the days work, the contractor shall provide barricades and lights to protect the public. Operate warning lights during hours from dusk to dawn each day and as otherwise required for inclement weather and visibility.

1.14 EROSION AND SEDIMENTATION CONTROL AND NPDES MONITORING, CONTROLS, AND LIMITATIONS FOR PERMITTED DISCHARGES

The Project Engineer shall submit a sedimentation and erosion control plan to the appropriate authority and obtain all necessary construction permits. The Contractor shall follow all local and state requirements regarding sedimentation and erosion control. Construction methods shall minimize sedimentation and erosion.

It is the Contractor's responsibility to periodically monitor the Stormwater Discharge Outfall points at the specified frequency and maintain reports as outlined in these specifications.

A. Final Limitations and Controls for Stormwater Discharges

During the period beginning on the effective date of the permit and lasting until expiration, the Owner (Permittee) is allowed and authorized to discharge stormwater associated with construction activity. Such discharges shall be controlled, limited, and monitored as specified below.

- 1) The Contractor shall implement the Erosion & Sedimentation Control plan, which has been approved by the approval authority. The approved plan is considered a requirement or condition of the general NPDES permit. Deviation from the approved plan, or approved amendment to the plan, shall constitute a violation of the terms and conditions of this general permit except that deviation from the approved plan will be allowed:
 - a. To correct an emergency situation where sediments are being discharged off the site, or
 - b. When minor modifications have been made for the purpose of improving the performance of the erosion and sedimentation control measures and notification of the minor modification has been made to the Division of Land Resources (or approved local program).

Such a deviation from the approved plan shall be noted on the approved plan maintained at the job site. During active construction, a copy of the approved plan shall be maintained on the site.

- 2) Equipment utilized during the construction activity on a site must be operated and maintained in such a manner as to prevent the potential or actual pollution of the surface or ground waters of the state. Fuels, lubricants, coolants, and hydraulic fluids, or any other petroleum products, shall not be discharged onto the ground or into surface waters. Spent fluids shall be disposed of in a manner so as not to enter the waters, surface, or ground, of the state and in accordance with applicable state and federal disposal regulations. Any spilled fluids shall be cleaned up to

the extent practicable and disposed of in a manner so as not to allow their entry into the waters, surface or ground, of the state.

- 3) Herbicide, pesticide, and fertilizer usage during the construction activity shall be consistent with the Federal Insecticide, Fungicide, and Rodenticide Act and shall be in accordance with label restrictions.
- 4) All wastes composed of building materials shall be disposed of in accordance with North Carolina General Statutes, Chapter 130A, Article 9 – Solid Waste Management, and rules governing the disposal of solid waste (North Carolina Administrative Code Section 15A NCAC 13B).
- 5) The Contractor, for the Permittee, shall control the management and disposal of litter and sanitary waste from the site such that no adverse impacts to water quality occur.

B. Minimum Monitoring and Reporting Requirements

Minimum monitoring and reporting requirements are as follows unless otherwise approved in writing by the Director of the Division of Water Quality.

- 1) All erosion and sedimentation control facilities shall be inspected by or under the direction of the permittee (the Owner and his/her Contractor). Inspections shall be made:
 - a. At least once every seven calendar days (at least twice every seven days for those facilities discharging to waters of the State listed on the latest EPA approved 303(d) list¹ for construction related indicators of impairment such as turbidity or sedimentation),
 - b. And within 24 hours after any storm event of greater than 0.5 inches of rain per 24-hour period.

A rain gauge shall be maintained on the site by the contractor and a record of the rainfall amounts and dates shall be kept by the contractor.
- 2) Once land disturbance has begun on the site, stormwater runoff discharges shall be inspected by observation for stormwater discharge characteristics as defined below at the frequency in stated above to evaluate the effectiveness of the pollution control facilities or practices. If any visible sedimentation is leaving the disturbed limits of the site, corrective action shall be taken immediately to control the discharge of sediments outside the disturbed limits.

¹ The latest approved list may be obtained from the Division of Water Quality, or from the following website location: http://portal.ncdenr.org/c/document_library/get_file?uuid=9d45b3b4-d066-4619-82e6-ea8ea0e01930&groupId=38364 (This list is periodically updated. Check for updates.).

Stormwater Discharge Characteristics	Monitoring Type ¹	Monitoring Location ²
Clarity	By observation	SDO
Floating Solids	By observation	SDO
Suspended Solids	By observation	SDO
Oil Sheen	By observation	SDO
Other obvious indicators of stormwater pollution	By observation	SDO

Footnotes:

¹ Monitoring Type: The monitoring requires a qualitative observation of each stormwater outfall. **No analytical testing or sampling is required.**

² Sample (observation) location: **SDO= Stormwater Discharge Outfall**

- 3) The operator (Contractor) shall keep a record of inspections and forward copies of these reports to the City Engineer. Visible sedimentation found outside of the disturbed limits shall be recorded and a brief explanation kept with the records as to the measures taken to control future releases. Any measures taken to clean up the sediment that has left the disturbed limits shall also be recorded. These records shall also be made available to DWQ or an authorized agent upon request. If the City Engineer or his/her representative discovers sedimentation outside the limits of disturbance, the Contractor will be notified in writing and requested to remediate the situation.
- 4) All records of monitoring shall be turned over to the City along with the "red lined" record water and/or sewer drawings.

C. Schedule of Compliance

- 1) The Contractor shall comply with Final Limitations and Controls specified for stormwater discharges once disturbance has begun on the site and until completion of construction or development and the establishment of a permanent ground cover.
- 2) During construction and until the completion of a construction or development and the establishment of a permanent ground cover, the Contractor shall provide the operation and maintenance necessary to operate the stormwater controls at optimum efficiency.

PART 2 – PRODUCTS

2.1 SOIL, BEDDING AND BACKFILL

2.1.1 MATERIAL CLASSIFICATION

- A. **Bedding Material:** NCDOT #57 stone. For concrete pipe bedding material, see **Standard Detail 631.01.**

- B. **Excavation:** All excavation material shall be classified as either Rock or Unclassified Earth Excavation. Prices bid for the various sizes of pipe shall include excavation and backfilling.
- C. **Flowable Fill Concrete Backfill (Controlled Low Strength Material):** Concrete strength shall be liquid enough to flow, be self-leveling, excavatable, and have a minimum 28-day compressive strength of 30-psi but not more than 100-psi. Non-excavatable flowable fill concrete shall have a minimum 28-day compressive strength of 125-psi but no more than 200-psi (to be excavatable by machine equipment). Materials shall comply with the recommendations within chapter 3 of ACI 229, latest revision, which include cement, aggregates, fly ash, water, admixtures, slag and other non standard materials).

Excavatable is an application where it may be necessary to remove the flowable fill at a later date. Non-excavatable is an application where it is not necessary to remove or otherwise excavate the flowable fill at a later date.

- D. **Foundation Stone:** Foundation/Trench Stabilization Material: #57 stone. For Concrete Pipe foundation stone, see Standard Detail 631.01.
- E. **Select Earth Backfill:** Select earth backfill shall be free of debris, roots, frozen materials, organic matter, rock, or gravel larger than 1-inch in any dimension, or other harmful matter and shall generally meet NCDOT *Standard Specifications for Roads and Structures*, Section 1016 – *Select Material* for properties and gradation, Class II or III unless otherwise approved by the City Engineer. Stone screenings meet the intent of this specification.
- F. **Common Trench Backfill:**
- 1) **Satisfactory Soils:** ASTM D2487 soil classification group (Unified Soil Classification System) GW, GP, GM, SW, SM, SC, ML, and CL (Classes IA, IB, II, III and IVA soils; see [Standard Detail 511.02](#)) or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste frozen materials, vegetation, and other deleterious matter.
 - 2) **Unsatisfactory soils:** ASTM D 2487 soil classification group GC, CH, MH, OH, OL and PT (Classes IVA & V soils; see [Standard Detail 511.02](#)); soils which contain rock or gravel larger than 3 inches in any dimension, debris, waste frozen materials, vegetation, clumps of clay larger than 3 inches in any dimension, and other deleterious matter. Unsatisfactory soils also include satisfactory soils not maintained within +/- 3% of optimum moisture content at time of compaction, unless otherwise approved by the City Engineer.
- G. **Structures, Backfill around:** Backfill shall be approved by the City Engineer and shall be free from large or frozen lumps, wood, or rocks more than 3 inches in their greatest dimension or other extraneous material. The top 12 inches are to be free of material greater than 1-inch in their greatest dimension. Porous backfill shall be either #67 or #57 clean stone.
- H. **Topsoil:** Topsoil shall consist of friable clay loam, free from roots, stones, and other undesirable material and shall be capable of supporting a good growth of

grass. Topsoil shall be free of material greater than 1-inch in any dimension. See [division 02920 – Seeding, Sodding, and Groundcover](#).

2.1.2 PIPE BEDDING DEFINITIONS

A. Pipe Bedding Definitions (Water & Sewer)

- 1) **Class D Bedding** is that condition existing when the ditch is excavated slightly above grade by excavation equipment and cut to finish grade by hand. Bell holes are dug, to prevent point loading the pipe bells, so that pipe bears uniformly upon the trench bottom. Existing soil should be shovel sliced or otherwise compacted under the hunching of the sewer pipe to provide some uniform support. Soil is tamped to 90% of the standard Proctor maximum dry density around the pipe to a point one foot above the pipe. The remainder of the soil to the ground surface is to be compacted to the density specified in [Table 2275.3](#). In poor soils, granular bedding material is generally a more practical, cost effective installation. The bedding factor for class D bedding is 1.1.

A Class D bedding generally equates to a Type 1 Laying Condition as shown on [Standard Detail 511.02](#).

- 2) **Class C Bedding** is that condition where the sewer pipe is bedded in compacted granular material. The granular bedding has a minimum thickness of one-eighth the outside sewer pipe diameter, but not less than 4 inches or more than 6 inches, and shall extend up the sides of the sewer pipe one-sixth of the pipe outside diameter. The remainder of the sidefills, to a minimum depth of 6 inches over the top of the pipe, consists of lightly compacted backfill. The remainder of the soil to ground surface is to be compacted to the density specified in [Table 2275.3](#). The bedding factor for class C bedding is 1.5.

A Class C bedding is similar to a Type 3 Laying Condition as shown on [Standard Detail 511.02](#) except that the pipe has a minimum of 4 inches of stone bedding that extends up one-sixth of the pipe OD.

- 3) **Class B Bedding** is that condition where the sewer pipe is bedded in carefully compacted granular material. The granular bedding has a minimum thickness of one-eighth the outside sewer pipe diameter, but not less than 4 inches or more than 6 inches, between the barrel and the trench bottom, and covering the full width of the trench.

The haunch area of the sewer pipe must be fully supported; therefore, the granular material should be shovel sliced or otherwise compacted under the pipe haunch to the springline of the pipe. Both granular haunching (to the springline) and initial backfill to a minimum depth of 12 inches above the top of the sewer pipe should be placed and compacted. The initial backfill material, to a depth of 12 inches above the top of the pipe, should be compacted to no less than 90% of the standard Proctor maximum dry density. The remainder of the soil to the ground surface is to be compacted to the density specified in [Table 2275.3](#). The bedding factor for class B bedding is 1.9.

A Class B bedding generally equates to a Type 4 Laying Condition as shown on **Standard Detail 511.02** except that the haunches are backfilled with stone up to the springline of the pipe.

- 4) **Class B-1 Bedding** (*PVC pipe applications*) is the same as Class B Bedding except that granular backfill is placed to the **top of the pipe** rather than to the springline of the pipe. The remainder of the soil to the ground surface is to be compacted to the density specified in [Table 2275.3](#).

A Class B-1 bedding generally equates to a Type 5 Laying Condition as shown on **Standard Detail 511.02**.

- 5) **Class A Bedding** is that condition when the sewer pipe is bedded in a cast-in-place concrete cradle of either plain or reinforced concrete having a thickness equal to one-fourth the inside pipe diameter, with a minimum of 4 inches and a maximum of 15 inches under the pipe barrel and extending up the sides for a height equal to one-fourth the outside pipe diameter. The cradle width shall have a width at least equal to the outside diameter of the sewer pipe barrel plus 8 inches. The bedding factor for class A bedding is 2.2.

The haunching and initial backfill material above the concrete cradle should be crushed stone or a well graded granular material and carefully compacted to 12 inches above the crown of the sewer pipe. The remainder of the soil to the ground surface is to be compacted to the density specified in [Table 2275.3](#).

2.2 MISCELLANEOUS

2.2.1 GEOTEXTILE FABRIC

Geotextile fabric shall be protected from mud, dirt, dust, sunlight, and debris during transport and storage. Material shall be inert to commonly encountered chemicals; resistant to mildew, rot, insects, and rodents; and biologically and thermally stable. Geotextile fabric for subsurface installation shall not be exposed to direct sunlight for more than 24 hours before or during installation.

- A. **Filter Fabric for Rip Rap:** Filter Fabric for Rip Rap and Rip Rap Beddings shall conform to Section 1056 – *Engineering Fabrics* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Type 2 engineering fabric.
- B. **Soil Stabilization Fabric:** Generally, soil stabilization fabric shall conform to the requirements of Section 1056 – *Engineering Fabrics* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Type 4 engineering fabric. However, provide fabric meeting Geotechnical Engineers recommendations for the application and use intended.
- C. **Fabric for Subsurface Drains:** Non-woven needle-punched fabric shall conform to Section 1056 – *Engineering Fabrics* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Type 1 engineering fabric.

- D. **Silt Fence Fabric:** Silt fence fabric shall conform to Section 1056 – *Engineering Fabrics* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Type 3 engineering fabric, Class A or B as specified or shown on the plans.

2.2.2 WARNING TAPE

Metallic Underground Warning Tape: Metallic detectable underground warning tape shall consist of a solid aluminum foil core, 35-gauge minimum, encased on each side with plastic (minimum overall thickness 5 mils) and be 3 inches wide with black lettering imprinted on a color coded background that conforms to APWA uniform color code specification (BLUE) and silver with black ink letters. Minimum tensile strength shall be 22 lbs/inch. Soil tolerance range to be pH 2.5 to pH 11.0. On one side of the tape, the text shall include the wording “WATER (or SEWER if a sewer force main) LINE BELOW” repeated along the length of the tape. A detectable warning tape shall be used with all water and sewer mains. Underground warning tape is to be placed 12 to 18 inches above top of pipe. See [Standard Detail 511.01](#).

Standard color code for tape and wire.

Blue:	Water Systems
Green:	Sewer Force Mains

2.2.3 LOCATOR WIRE:

Number 12 AWG blue insulated single-strand solid or stranded copper locator wire shall be installed above all non-ferrous water and sewer mains; attached every 5 feet to the mains with zip ties. Electrical conductivity along the pipe shall be continuous and uninterrupted between valve boxes. Clamps used to bond wire to conductor to metal (in instances where both PVC and ductile iron are used in the same run of pipe) shall be heavy-duty stainless steel approved by the City Engineer. A sufficient excess length of wire shall be left in each valve box to provide at least a 6 to 12 inches length of wire above finished grade. See [Standard Detail 511.01](#).

2.2.4 DEFORMED REINFORCING STEEL

Reinforcing Steel bars shall meet ASTM A615 *Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement*, grade 60, latest revision.

2.2.5 WELDED WIRE FABRIC

Welded wire fabric shall meet ASTM A185 *Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete*, latest revision.

PART 3 – EXECUTION

3.1 PREPARATION

3.1.1 GENERAL REQUIREMENTS APPLYING TO ALL AREAS

- A. Contractor shall plan construction to minimize disturbance to properties adjacent to the water or sewer lines.
- B. The City Engineer reserves the right to limit the width of land to be disturbed and to designate on the drawings or in the field certain areas or items within this width to be protected from damage.
- C. **Access and/or Haul Roads:** Any grading or excavation required for equipment travel during the course of construction as well as erosion control, access or haul road removal, restoration, seeding and ground cover shall be provided by the Contractor.
- D. The Contractor shall be responsible for damage to areas or items designated by the City Engineer to be protected. Repairs to, replacement of, or reparations for areas or items damaged shall be made to the satisfaction of the City Engineer and affected property owners before acceptance of the completed project.
- E. The Contractor shall protect all buildings or structures located along the utility line. Hand trenching, shoring, or other methods may be required.
- F. Any fences disturbed by the Contractor shall be repaired to a condition equal to or better than their original condition or to the satisfaction of the City Engineer. This may require the use of new material.
- G. Contractor shall limit width of disturbed area through garden areas to a width absolutely necessary for construction of utility line.
- H. Contractor shall obtain written permission from property owners for use of any access other than ones located within public rights-of-way or easements. Written permission shall contain conditions for use and restoration agreements between property owner and Contractor.
- I. All areas disturbed shall be restored to a condition equal to or better than their original condition and shall be graded to drain.
- J. The Contractor shall replace or repair all damaged or destroyed hedgerows and property corners using the services of a licensed Professional Surveyor.

3.1.2 CONSTRUCTION LIMITS

- A. Contractor shall not disturb any areas outside the limits contained in this section without express written permission from the City Engineer.
- B. Except as indicated on the plans, no "clear cutting" of timber shall be permitted within the construction limits. Contractor shall make select cutting of trees, taking smallest trees first, that are mandatory for the construction of the utility line. The decision of the City Engineer shall be final on the determination of which trees are to be cut.
- C. Should it become necessary to move the position of any underground structure, the Contractor may be required to do such work and shall be paid on a "force account" basis or on an "extra work" basis as directed by the City Engineer.

Method of payment shall be agreed upon by the City Engineer and the Contractor prior to commencing work.

- D. If existing utilities are found to interfere with the permanent facilities being constructed under this section, immediately notify the City Engineer and secure instructions. Do not proceed with permanent relocation of utilities until instructions are received from the City Engineer.
- E. The widths measured from the centerline of the water or sewer lines shall be as shown on the contract drawings. The Contractor shall protect all areas outside these construction limits unless written variations are granted by the City Engineer.
- F. **Specific requirements applying to developed subdivision/lots**
 - 1) Unless directed otherwise by the City Engineer, all trees, shrubs, hedges, or other ornamental plantings located outside of the construction limits, easements, or public rights-of-way shall be protected by the Contractor. The City Engineer reserves the right to designate certain trees located within the construction limits for protection where deemed desirable.
 - 2) The contractor shall protect septic systems or springs located outside the construction limits.
 - 3) Excavated or blasted rock shall be removed from the site unless otherwise ordered by the City Engineer.

G. **Specific requirements applying to undeveloped areas**

- 1) In wooded areas, the clearing shall be limited to the easement or right-of-way limits unless indicated differently on the City of Wilson approved construction drawings, in which case, the work shall be confined to the limits defined on the plans. All permanent easements and rights-of-way shall be fully cleared as determined by the City Engineer. The City Engineer reserves the right to designate certain tree located within the construction limits for protection where deemed desirable.
- 2) In areas where livestock and pets are kept, the Contractor shall notify property owner prior to commencing work and keep owner advised of progress of work. Fences shall be kept secure at all times and livestock and pets protected from open ditches, machinery, blasting, and other hazards.

3.1.3 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. **Subsurface obstructions**

- 1) **Subsurface obstructions:** Take necessary precautions to protect existing utilities from damage due to any construction activity. The Contractor shall locate existing utilities, culverts, and structures (above or below ground), before any excavation starts and coordinate work with utility companies. The Contractor shall be responsible for notifying utility companies when working within the vicinity of the existing utilities. Omission from or inclusion of located utility items on plans do not

constitute non-existent or definite location. Even though for convenience, the utility may be shown on the plans, the Contractor is responsible for and shall call for utility location a minimum of 48 hours prior to excavation. Contact underground damage protection services NC One Call or current locator service. Secure and examine local utility surveyor records for available location data including building service lines.



- 2) Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to trenching. In excavating, care must be taken not to remove or injure any subsurface structure. All existing gas pipes, water pipes, steam pipes, telephone lines, cable TV lines, electrical conduits, poles, sewers, drains, fire hydrants, and other structures which, in the opinion of the utility company, do not require relocation shall be carefully supported, shored up, the flow maintained, if applicable, and the line/main/obstruction protected from damage by the Contractor. If damaged, the Contractor shall give immediate notice to the proper authorities. The utility shall be restored, at the Contractor's expense, by the appropriate utility to original or better condition. Where pipes, conduits, or sewers are removed leaving dead ends in the ground, such ends shall be carefully plugged or bulkheaded by the Contractor at the Contractor's expense and in accordance with the requirements of the affected utility agency. The Contractor shall be responsible for any damage to persons or property caused by such breaks. This includes water taps and sewer cleanouts installed by a contractor during new construction to be taken over by the City of Wilson.
- 3) The Contractor shall be responsible for anticipating and locating underground utilities and obstructions. When construction appears to be in close proximity to existing utilities, the trench(es) shall be opened a sufficient distance ahead of the work or test pits made to verify the exact locations and inverts of the utility to allow for changes in line and grade.
- 4) If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
- 5) Should it become necessary to move the position of any underground structure, when approved by the City Engineer, the Contractor may be required to do such work and shall be paid on a "force account" basis or on an "extra work" basis.
- 6) If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the City Engineer and secure instructions. Do not proceed with permanent relocation of utilities until written instructions are received from the City Engineer.

B. Protection of Surface Features

- 1) Whenever the utility line is to be placed in or near a paved street, the Contractor shall provide pads or take necessary precautions to protect the pavement from damage by the construction equipment. Pavement damaged by cleated or tracked equipment, or by any other means, shall

be repaired by the Contractor at his expense to the satisfaction of the City Engineer.

- 2) Where a utility line is placed in an existing paved area, the Contractor shall use care to cut in sharp, neat lines ahead of the excavating/ditching equipment and parallel to the pipe on each side as may be applicable. If the existing road to be cut is located within another jurisdiction other than the City of Wilson or within NCDOT rights of way, the Contractor is responsible for contacting the local representative or NCDOT, respectively about pavement repair/replacement.
- 3) Avoid overloading or surcharge by keeping equipment and material a sufficient distance back from edge of excavation to prevent slides or caving. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property.
- 4) Provide full access to public and private premises, to fire hydrants, at street crossings, sidewalks and other points as designated by the City Engineer to prevent serious interruption of travel.
- 5) Protect and maintain benchmarks, monuments, or other established points and reference points, and if disturbed or destroyed, items shall be replaced by a Licensed Professional Surveyor to the full satisfaction of the City Engineer and/or the jurisdictional agency.
- 6) See paragraph [1.11 D, Coordination](#), regarding traffic signals.

C. Procedures for repairing damaged utility services

- 1) If a located service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the City. Notification shall be made to the Utility owner.
- 2) **House services:** If a service pipe supplying water or gas to an adjoining house is broken, the Contractor shall repair it at once and at his expense. The City may, at the Contractor's expense, repair any such service without prior notice to the Contractor.
- 3) If damage results from the action of either a public or private party on a newly constructed project to be accepted by the City of Wilson (e.g. water, sanitary sewer, storm sewer, or street), immediate notification shall be given to the City Engineer or City Inspector. All damages or interruption shall be the responsibility of the party causing the damage.

3.1.4 PROTECTION OF PERSONS AND PROPERTY

- A. Barricade open holes and depressions occurring as part of the work, and post warning lights on property adjacent to or part of public access.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this or other related sections.

- C. **Protection and Restoration of Property:** The contractor shall not enter upon private property for any purpose without first obtaining permission. He shall use every precaution necessary to prevent damage or injury to any public or private property, trees, fences, monuments, and underground structures, etc., on and adjacent to the site of the work. He shall protect carefully from disturbance or damage all land monuments and property markers until an authorized agent has witnessed or otherwise referenced their locations, and shall not remove them until directed.

The Contractor shall be responsible for all damage or injury to property of any character resulting from any act, omission, neglect, or misconduct in his manner or method of executing said work, from his nonexecution of work, or from defective work or materials, and he shall not be released from said responsibility until the work shall have been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, the contractor shall restore such property, at his own expense, to a condition equal to or better than that existing before such damage or injury was done. The contractor shall make good such damage or injury in an acceptable manner by repairing, rebuilding or otherwise restoring as directed.

The Contractor shall, at his own expense, sustain in their places and protect from direct or indirect injury all pipes, poles, conduits, walls, roadways, buildings, and other structures, utilities and property in the vicinity of his work. Such sustaining and supporting shall be carefully done by the Contractor and as required by the Company or party owning the structures or Agency controlling it. The Contractor shall take all risks attending the presence or proximity of pipes, poles, conduits, walls, thereof and any costs associated will be deducted from any monies due the Contractor. Failure of the City Engineer or his/her authorized representative to direct the correction of unsafe conditions or practices shall not relieve the Contractor of his responsibility hereunder.

3.1.5 CLEARING AND GRUBBING

- A. **Description:** This work shall consist of clearing, grubbing, removing, and disposing of all vegetation and debris within the limits of construction, as designated on the plans or as required by the City Engineer. The work shall also include the preservation from injury or defacement of all vegetation or objects designated to remain. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, down timber, brush, rocks, projected roots, stumps, rubbish, laps, and other material within the limits of construction.
- B. A preconstruction meeting shall be held with appropriate urban forestry personnel (as may be applicable) and the City prior to any clearing, if required. The City Engineer may require tree protection fencing in sensitive areas, where specifically identified trees are desired to be protected, and when required by the landscape ordinance.
- C. The area within the limits of construction or as designated shall be cleared and grubbed of all trees, stumps, roots, brush, undergrowth, hedges, heavy growth of grasses or weeds, debris and rubbish of any nature that, in the opinion of the

City Engineer, is unsuitable for foundation material. Nonperishable items that are not deleterious to the project and will be a minimum of 5 feet below the finish elevation of the earthwork or slope of the embankment may be left in place.

- D. The Contractor shall provide barricades, fences, coverings, or other types of protection necessary to prevent damage to existing improvements, not indicated to be removed, and improvements on adjoining property. All improvements damaged by this work shall be restored to their original condition and to a condition acceptable to the owner or other parties or authorities having jurisdiction. Trees and shrubs that are to remain within the construction limits will be indicated on the drawings or conspicuously marked on site. Unless otherwise noted, trees within the construction limits shall become the property of the Contractor and shall be removed from the site.
- E. Contractor shall protect existing trees and other vegetation indicated by the City Engineer to remain in place against limb, bark or root damage such as cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. When such damage does occur, all rough edges of scarred areas shall be removed in accordance with accepted horticultural practices.
- F. Carefully and cleanly, cut roots and branches of trees indicated to remain where the roots and branches obstruct construction of the proposed utility line. If directed by the City Engineer, the Contractor shall provide protection for roots and branches over 1 ½ inches diameter that are cut during construction operations. Coat the cut faces with emulsified asphalt, or other coating especially formulated for horticultural use on cut or damaged plant tissues. Temporarily cover all exposed roots with wet burlap to prevent roots from drying out. Provide earth cover as soon as possible.
- G. If they are damaged by construction operations, trees and vegetation designated to remain shall be repaired or replaced at Contractor's expense in a manner acceptable to the City Engineer. The City Engineer may require that the tree and/or vegetation damage be repaired as directed by a qualified tree surgeon.
- H. Debris from the site shall be removed in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt, dust, and debris at all times.
- I. The method of stripping, clearing, and grubbing the site shall be at the discretion of the Contractor. However, all stumps, roots and other debris protruding through the ground surface or in excavated areas shall be completely removed and disposed of off the site by the Contractor.
- A. **Marginal Areas:** In marginal areas, with the City Engineer's permission, remove trees where the following conditions exist.
 - 1) **Root Cutting:** When clearing up to the "clearing limits," the Contractor shall also remove any tree which is deemed marginal such that when the roots are cut a tree could be rendered unstable by the affects of high winds and thus in danger of toppling into either the right-of-way or onto private property.

- 2) **Slender Bending Trees:** Where young, tall, thin trees are left unsupported by the clearing operation, and are likely to bend over into the right-of-way, the Contractor, during the clearing operation, shall selectively remove those trees which are located outside and adjacent to the clearing limits and City right-of-way or easement as well. During the course of construction and during the one-year warranty period, the Contractor shall remove such young trees that overhang into the right-of-way or cleared area. Removal outside of a public right-of-way or easement require permission from a private property owner. Coordinate owner contact with the City's inspector.
- J. **Stripping of Topsoil:** Remove the existing topsoil to a depth of 6 inches or to the depth encountered from all areas in which excavation will occur. The topsoil shall either be stored in stockpiles separate from the excavated trench material if the topsoil is to be respread or otherwise disposed of off-site. Topsoil stockpiles shall be graded to freely drain surface water, and shall have a silt fence placed around the base of the stockpile and/or other measures required by the Erosion and Sedimentation Control Plan/Permit.
- K. **Disposal:** All brush, tree tops, stumps, and debris shall be hauled away from site or otherwise disposed of in a manner acceptable to the City Engineer. The contractor shall clean up debris resulting from clearing operations continuously with the progress of the work and remove promptly all salvageable material that becomes his property and is not to be reused in construction. Sale of material on the site is prohibited.

Disposal of cleared material shall be in accordance with all local and state laws. Trees cut down on the construction site will be hauled away from the site for proper disposal unless instructed otherwise by the City. Stumps of trees cut down outside of the excavation area will be removed. Perishable material shall not be disposed of at the construction site. Brush, laps, roots, and stumps from trees shall be disposed of in a NCDENR approved and permitted land clearing and inert debris type landfill. The Contractor will be responsible for obtaining all applicable permits and paying all fees for the disposal of excess material.

3.1.6 DEWATERING

- A. **Water in trenches:** When ground water is encountered, the contractor shall remove the water that accumulates in the trenches or pits, which would affect the construction of the lines or their appurtenances, by pumping, bailing, well-pointing, or other approved dewatering method and shall perform all work necessary to keep the trenches or pits entirely clear from water while bedding is being placed, the pipe is being laid, masonry units are being placed, and structures are either being set or constructed. All water removed from the trench shall be conveyed in a proper manner to a suitable point of discharge and shall comply with applicable erosion and sedimentation control laws. Pipe laying and pipe jointing shall be made in the "dry."
- B. Maintain dewatering systems until dewatering is no longer required.
- C. No pipe shall be constructed in water and water shall not be allowed to drain through the pipe. The open end of the pipe shall be kept closed with a tight fitting plug to prevent washing of any foreign matter into or through the line.

- D. No structure shall be constructed in water and water shall not be allowed to flow over or rise upon any concrete masonry structure until the work has been accepted or permission has been otherwise granted by the City Engineer.
- E. The contractor shall dispose of water from the trenches in such a manner to cause no injury to public health, public or private property, work completed or in progress, street surfaces, or which may cause any interference with the use of the streets. Water, if odorless and stable, may be discharged into an existing storm drain, channel, or street gutter in a manner approved by the City Engineer. When required by the City Engineer, a means shall be provided for desilting (filtering) the water before discharge. Under no circumstances shall water be discharged to a sanitary sewer main or structure.
- F. Prevent surface water from ponding on prepared subgrades and from flooding project site and the surrounding area. Reroute surface water runoff away from or around excavated areas.
- G. Do not allow water to accumulate in excavations. Unless otherwise directed by the City Engineer, the cost of shoring, sheeting, well pointing, gravel bedding and other dewatering devices shall be included in the unit price of each respective item bid. Do not use excavated trenches as temporary drainage ditches.
- H. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation. Include cost of de-watering in proposal for water or sewer lines. No additional remuneration for this item is permitted.
- I. Where underground streams or springs are encountered, provide temporary drainage, well pointing, or bailing. Notify the City Engineer of such conditions.
- J. Backfilling shall not take place when the trench contains water in an amount to create soupy conditions.

3.2 TRENCH EXCAVATION

3.2.1 GENERAL

- A. **Classification of Excavated Material:** All excavated material shall be classified as either earth or rock. Prices bid for the various sizes of pipe shall include excavation and backfilling; such excavation shall be classified as earth. Rock excavation shall be paid for as a separate item.
- B. Remove all material of whatever nature, including but not limited to clay, silt, and gravel. Provided the material meets the requirements of paragraph [2.1.1 Material Classification, subparagraph F, Common Trench Backfill](#), material of a compactable nature that can be re-used as trench backfill shall be replaced and re-compacted to the requirements set forth in these specifications.
- C. **Unsuitable Material and Wasting:** When directed by the Owner's Engineer or the City Engineer, unsuitable material in the trench shall be removed to an appropriate depth and width. At the contractor's expense, dispose of all unsuitable material, of whatever nature, to a site which legally can accept such material as fill. Adhere to all applicable laws and ordinances regarding permitting of waste site, erosion control, zoning, etc. as may be applicable.

- D. Excavation shall be performed in accordance with OSHA Standard 29 CFR Part 1926, Subpart P - Excavations.
- E. **Sanitary and Storm Sewer Alignment and Grade:** Offset stakes set at each manhole, catch basin, or curb inlet shall indicate the line and grade of the sewer. Alignment and grade of the pipe by the Contractor shall be established by laser beam. The contractor shall employ personnel experienced in the use of laser beams. The alignment and grade of the sewer shall be constructed as indicated on the approved plans. Prior to making changes in the field, the City Engineer shall approve any change in grade or alignment which deviates from the approved plans.
- F. Concrete collars shall be installed when either shown on the approved plans or directed by the City Engineer.

3.2.2 PIPE COVER

- A. **General:** Where lines transverse public property or are subject to other governmental or utility company jurisdiction, provide depth, bedding, cover, and other requirements as set forth by the legally constituted authority having jurisdiction, but in no case less than the depth shown in the Contract Documents.
- B. **Minimum Cover:** Unless shown otherwise on the construction documents, provide minimum trench depth indicated below to maintain a minimum cover over the top of the installed item. Minimum cover on pipe is measured perpendicular from top of pipe or fittings to original ground or proposed finished grade as applicable and shall be per [Table 2275.1](#), below. Where the minimum cover is not provided, either use Ductile Iron Pipe or encase the pipe(s) in concrete as indicated. Provide concrete with a minimum 28-day compressive strength of 3000 psi.

Table 2275.1			
Minimum Cover Above Top of Main Pipe Lines			
Utility	Condition		
	Subject to vehicular traffic	NOT subject to vehicular traffic	With Concrete Encasement
Sanitary Sewer	36 ^b inches (use DIP if < 36 inches of cover)	24 ^b inches (use DIP if < 36 inches of cover)	As Designed
Sewer Services	At depth shown on plans but no less than 36 ^b inches (use DIP if < 36 inches of cover)	At depth shown on plans but no less than 12 ^b inches	As Designed
Water Distribution	36 ^a inches for lines 8 inches and smaller; 42 inches for lines larger than 8 inches	36 ^a inches for lines 8 inches and smaller; 42 inches for lines larger than 8 inches	24 inches (encasement, if required, shall extend to at least 5 feet beyond each side of a ditch or culvert crossing)
Water services	30 ^a inches	30 ^a inches	As Designed
Storm Drainage	As designed but no less than 12 ^c inches for reinforced concrete pipe	As designed	As Designed

^a**Minimum/Maximum Cover for Water Pipe:** The City Engineer must approve all installations of water line with less than 30 inches of cover or greater than 72 inches of cover. Lines which have less than 30 inches of cover at ditch or culvert crossings shall be Ductile Iron and encased in a steel casing. The casing shall extend through all areas until the depth of cover above the DIP is greater than 30 inches.

^b**Minimum/Maximum Cover for Sewer Pipe:** The City Engineer must approve all installations of sewer lines with 24 inches of cover or less or with greater than 18 feet of cover. Ductile iron pipe is required where depth of pipe exceeds 12 feet or the line is placed in fill.

^c**Minimum/Maximum Cover for Storm Drainage Pipe:** The City Engineer must approve all installations of storm drainage lines in areas subject to traffic load with less than 12 inches of cover or with greater than 12 feet of cover. The pipe class, trench width, and/or the bedding class shall be modified for the depths exceeding 12 feet of cover to accommodate the extra depth/loads. Pipe subject to vehicular traffic shall be reinforced concrete pipe. No plain concrete pipe is permitted in traffic areas.

- C. Water lines which have less than 30 inches of cover at ditch or culvert crossings shall be required by the City Engineer to be encased. The casing shall extend through all areas until the depth of cover above the DIP is greater than 30 inches.

3.2.3 TRENCHING

- A. **General:** The trench for gravity pipe shall be excavated to conform to **Standard Details 511.02** (water and sewer pipe embedment), **631.01** (storm drainage),

and **731.01** (sewer) as applicable. Where it is necessary to remove existing pavement, prepared road surfaces, sidewalks and curbs, these structures/surfaces must be replaced by the Contractor. When making a pavement cut, the Contractor shall use care to saw cut in sharp, neat lines ahead of the excavating/ditching equipment and parallel to the pipe on each side as may be applicable. If necessary due to damage, edges of existing pavement shall be re-cut and trimmed to square, straight edges after the pipe system has been installed and prior to placement of the new base and pavement. See **Standard Detail C01.03**.

All trenching shall be open-cut from the surface. No tunneling or boring will be allowed without the consent of the City Engineer. All trenches shall be excavated to the lines and grades as shown on the plans. Where utility lines are in an existing paved area, the edges of the pavement for the utility line shall be cut in a straight line, parallel to the pipe.

Trenches shall be excavated in straight lines, in general, following the contour of the ground, and shall be accurately graded in order to establish a true elevation of the invert of the pipe. Trenches for water lines may be curved within the limits of curvature of the pipe as allowed by AWWA C600. In no case shall the trench alignment exceed the allowable vertical or horizontal pipe deflection of offset recommended by the pipe manufacturer.

- 1) **Trench Width:** The sides of trench shall be uniform and vertical. The width of the trench at the top of the pipe shall be a width that will permit the proper construction of joints and compaction of backfill around the pipe and shall be equal to the largest outside diameter of the pipe plus 12 inches on each side of the pipe, measured transverse to the pipe at the top of the pipe. The sides of the trenches shall be vertical unless otherwise approved by the City Engineer. Unless otherwise shown in the standard details, vertical walls should project at least 2 feet above the top of the pipeline laid to existing construction grade unless the finished grade fill depth is less than 2 feet. Lowering trench wall height may necessitate a change in either pipe or bury classification. Notwithstanding, this section is subject to OSHA guidelines and regulations regarding trench protection and shoring.

Every effort shall be made to maintain the width of the pipe plus 24 inches but trench width must also be wide enough to provide adequate space for laying and connecting pipe and appurtenances. Sufficient space shall be allowed at the joints for the free use of wrenches for tightening of bolts.

The minimum trench width should generally be no less than 36 inches in order to accommodate a "Rammax" walk behind or infrared remote controlled trench roller/compactor (24- to 33-inch drum).

In excavating for the trench, it is essential that the trench bottom be uniform in grade and remains static during backfilling and under all subsequent trench conditions. To ensure a uniform depth of stone, the grade of the bottom of the trench shall be graded to within 0.04 foot (1/2-inch) of the plan specified grade. The stone shall be graded to the same tolerance.

Care shall be taken not to over excavate the trench. All trenches excavated below grade (over excavated) shall be refilled to grade with clean #57 stone. No extra compensation shall be allowed for this work unless such excavations are ordered by the City Engineer.

2) **Trench Depth:**

- a. **General:** All trenches shall be excavated to accommodate the bedding as shown in **Standard Details 511.01, 511.02**, (water and sewer), **631.01** (storm drainage), and **731.01** (sanitary sewer) as applicable. No extra compensation will be made for stone bedding used to bring the trench up to grade other than that required in **Standard Detail C01.02** where yielding or wet subgrade is encountered.
- b. **Water:** Trench depth shall generally conform to that shown on the plans and in conformity to the requirements of [Table 2275.1, Minimum Cover above top of Main Pipe Lines.](#)
- c. **Gravity sewer:** Excavate to the depth and grades shown on the plans. Trench depth shall generally conform to the requirements of [Table 2275.1, Minimum Cover above top of Main Pipe Lines.](#)
- d. **Storm drainage:** Excavate to the depth and grades shown on the plans. Trench depth shall generally conform to the requirements of [Table 2275.1, Minimum Cover above top of Main Pipe Lines.](#)

- 3) **Open trench exposure:** Once trench is opened, proceed immediately and with dispatch to place specified materials in trench, or to otherwise utilize trench for intended purpose. Long stretches of open trench ahead of pipe laying shall be avoided. Excavating, pipe laying, and backfilling must move forward at approximately equal rates of progress. The contractor shall only open as much ditch as he can completely install pipe, backfill, compact, and cleanup within that working day. The contractor shall string out the pipe that can be installed in one day, and unless approved otherwise by the City Engineer, no more than 300 feet of trench shall be open in advance of the completed work in any section. There shall be no trenches left open without proper supervision during working hours or after work has been completed for day. Any exception to this construction practice must be approved, in writing, by the City Engineer. Schedule work and order materials so that trenches are not left open for a longer period than is reasonably necessary. If the contractor should fail to heed the aforementioned requirement, the City Engineer may refuse payment until these conditions are complied with.

- 4) **Containment of Sediment (solids and mud):** The contractor shall at all times so conduct his work to ensure that all solids and mud are contained within the trench. This containment shall be by the employment of a brick or block weir at the junction of new construction and the existing City system in order to trap material for the Contractor's removal and City's inspection prior to acceptance. The installation and removal of this dam shall be at the Contractor's expense and shall be removed before the line is televised.

3.2.4 SHEETING AND BRACING, TRENCH BOXES

A Certified Competent Person designated by the Contractor shall be on-site at all times excavation or pipe installation is being conducted.

Provided there is no indication of a potential cave-in, trench walls may generally have vertical sides if less than 5 feet in depth (measured from subgrade elevation to existing grade). In excess of this depth, the entire side must be laid back or either shoring or a trench box, certified for the depths being used, must be used. The contractor shall be required to furnish, put in place, and maintain such sheeting, bracing, etc. as may be required to support the sides of the trenches. Brace and sheet trenches in full observation of the requirements of OSHA *Subpart P – Excavations*. Trench wall slopes and/or benching shall conform to the requirements of OSHA based on Soil Classification (Stable Rock, type A, B, or C type) and account for trench depth, surcharge loads, stored equipment or material, traffic, etc. When trenches are 4 feet or more in depth, a safe means of egress (stairway, ladder, ramp or other safe means) from the trench excavations shall be provided. Such egress shall be placed so that no more than 25 feet of lateral travel by employees is required to the egress.

Brace trenches running near walls or columns, to prevent any settlement or other disturbance of walls or columns.

Do not remove sheeting until backfilling has progressed to the stage that no damage to piping, utility service, or conduit will result due to removal of sheeting. All shoring and form material shall be removed before backfilling. When sheeting, bracing, or trench boxes are required, in order to prevent damage to existing facilities or structures, or as a matter of safety, or as directed by the City Engineer, the costs are to be included in the unit prices as bid for sanitary sewers, storm drains, water lines or structures as applicable and there shall be no additional cost for these items.

Sloping trench walls: If trench walls are to be sloped or benched, contractor is responsible for determining the proper and applicable slope based on soil type in order to meet OSHA requirements. Laying back slopes also applies for areas where the top of the trench box is lower than the top of the bank. Contractor shall employ the services of a Geotechnical Engineer for direction and guidance if unstable or difficult soils are encountered. In any event, the Contractor shall hold the City harmless for injuries and/or damages resulting from failure to properly adhere to trench protection regulations/requirements in force at the time of a failure or mishap including, but not limited to, damage to utilities, equipment, structures, paving, etc.

3.2.5 ROCK:

- A. **Rock Excavation:** See paragraph [1.4 P, Rock Excavation for Trenches and Pits](#) and paragraph [1.4 Q, Rock in Open Excavations](#) for definition of rock excavation.
- B. When rock is encountered in the trench, the City Engineer must be notified before any rock is blasted or removed. Do not perform rock excavation work until rock has been cross-sectioned, classified, and approved for removal by the City Engineer. The City Engineer will measure the rock, after which, the rock shall be excavated to a depth 6 inches below the grade of pipe and the bottom of trench

brought back to grade by using an approved fill material. See [paragraph 3.8, *Blasting*](#) for other requirements regarding rock excavation.

- C. Intermittent drilling, blasting, or ripping performed to increase production and not necessary to permit excavation of material encountered will be deemed to be unclassified excavation
- D. All overblasted rock which has been loosened must be removed prior to backfilling.
- E. The Contractor must use overburden, mats, or other means to minimize flyrock. Any damage caused by flyrock or excessive vibration will be the responsibility of the Contractor.
- F. **Cushioning pipe in rock:** Special precautions shall be exercised to prevent any pipe from resting on rock or any other hard projection that might cause breakage of pipe. At no time shall the pipe bell or the pipe barrel rest on rock. A minimum of 6 inches of sand or soil (select earth) cushioning is required between the barrel of the pipe and rock. A minimum of 12 inches of clearance is required between the sides of the pipe and the rock. Thicker cushioning may be required for deeper pipe on a case-by-case basis. See [Standard Detail C01.01](#).
- G. **Disposal of Rock:** Rock excavated from the trench shall be hauled off the site at the Contractor's expense. Borrow required to replace excavated rock shall be provided by the Contractor and shall be included in the unit price bid for rock excavation. No rocks or boulders shall be used as backfill in any part of the trench. Where rock has scattered over adjoining property as a result of blasting, the Contractor shall remove the rock and restore the area to its original condition at no cost to the City.

3.2.6 PREPARATION OF FOUNDATION FOR PIPE LAYING

- A. Excavation of trenches for all pipes lines shall be done to line and grade as established by the design Engineer. The bedding surface shall provide a firm, stable, and uniform support through the entire length of the pipe. Recesses shall be excavated to accommodate bells and joints. When bedded firmly on the subgrade, the pipe shall be on the exact grade of the completed water, sewer, or storm drainage line.

In excavating for the trench, it is essential that the trench bottom be uniform in grade and remains static during backfilling and under all subsequent trench conditions. To ensure a uniform depth of stone, the grade of the bottom of the trench shall be graded to within 0.04 foot (1/2-inch) of the plan specified grade. The stone shall be graded to the same tolerance.

Excavation in Class II, III, or IV soils shall be made to grade to provide undisturbed bedding in accordance with AWWA C600. (See [Standard Detail 511.02, sheets 2 & 3](#) for classification definitions.)

- B. **Unsuitable Trench Subgrade/Foundation Improvement:** Excavation in Class V, wet, yielding, unstable, inadequately supporting, or mucky soils shall be excavated 6 inches or more below the specified grade. The material shall be removed for the full width of the trench and the excavated area strengthened for foundation purposes. The over excavated material shall be replaced with

thoroughly compacted Class I, II, or III materials as directed by the City Engineer. The trench bottom shall provide a stable and continuous support for the pipe system with bell holes provided to permit jointing. See [Standard Detail C01.02](#).

Whenever the bottom of the trench is such that it cannot be reasonably stabilized, the City Engineer may require the utility to be laid in a concrete mud mat, concrete encasement, cradles, in cradles supported on piles, or a combination of these materials. When necessary, the Contractor shall provide for the temporary diversion of water in order to maintain the pipe foundation in a dry condition.

Observe the following requirements when unstable trench bottom materials are encountered:

- 1) Notify the City when unstable materials are encountered and define by drawing station locations and limits when encountered.
 - 2) Remove unstable trench bottom materials as directed and replace with subgrade stabilization material specified.
- B. **Over-excavation:** Unauthorized over-excavation consists of removal of material beyond indicated subgrade elevations or side dimensions, without specific approval of the City Engineer. Exercise care to avoid excavations below established grade where firm earth conditions exist. Where unauthorized excavations have been carried beyond points required, restore these areas to the elevations and dimensions shown on the drawings with approved fill material and compact as specified (as noted in the preceding paragraph). In no case shall the pipe be brought to grade by blocking under the barrel of the pipe. A uniform support shall be provided for the entire length of the pipe. Unauthorized excavation shall be replaced at Contractor's expense.

3.2.7 TRENCH PREPARATION FOR PIPE

A. Preparation of trenches for Gravity Sewer pipelines

The bottom of the trench for gravity pipelines shall be excavated to a minimum over depth as shown on [Standard Detail 731.01](#) to provide for improved pipe bedding material for the entire length of the gravity pipeline, including sewer lateral connections, except in rock where bedding shall be a minimum of 3 inches deep (see [Standard Detail C01.01](#) and paragraph [3.2.5 F](#), above). The bedding shall be shaped so that the bottom of the pipe rests on the bed. Bell holes and depressions as required of the joint shall be dug after the bedding has been graded and shaped, and shall be only of such length, depth, and width as required for properly making the particular type of joint. The trench for gravity sewers and lateral connections shall then be backfilled and compacted as indicated in [Table 2275.3](#).

B. Preparation of Trenches for Storm Drainage Pipelines

The bottom of the trench for storm drainage pipelines shall be excavated to a minimum over depth as shown on the construction drawings in accordance with the applicable type laying condition specified (as shown on [Standard Detail 631.01](#)) to provide for pipe bedding for the entire length of the gravity pipeline, including lateral connections if any, except in rock where foundation bedding

shall be prepared as specified on [Standard Detail 631.01](#). Unless otherwise directed by the City Engineer, the bedding shall be shaped to conform to [Standard Detail 631.01](#). Bell holes and depressions as required of the joint shall be dug after the bedding has been graded and shaped, and shall be only of such length, depth, and width as required for properly making the particular type of joint. Rock larger than 3 inches shall be removed from the trench bottom and any voids filled with compacted NCDOT Class II or III material. The trench for storm drainage and lateral connections, if any, shall then be backfilled and compacted as indicated [Standard Detail 631.01, Table 2](#) taking care to compact in no more than 8-inch lifts with the fill brought up evenly on both sides of the pipe at the same time to avoid unbalanced pressures. The balance of the trench backfill up to pavement subgrade, or finished grade as applicable, shall conform to [Table 2275.3](#) of this specification.

Where an unsuitable foundation is encountered, provide a stone foundation with NCDOT Type 4 soil stabilization fabric as shown on [Standard Detail 631.01](#).

C. Preparation of trenches for Water Mains and Force Mains

The trenches for water lines and sewage force mains shall be graded to avoid local high points. Trenches shall be graded either level or on a continuous upslope to the high points designated on the drawings. Trenches shall be of such depth as to provide a minimum cover over the top of the pipe as noted in [Table 2275.1](#). The trenches shall have 4 inches of loose soil in the bottom before pipe is placed, so pipe is firmly and continuous in contact with the soil. Pipe shall not bridge any areas. Rock larger than 3 inches shall be removed from the trench bottom and any voids filled with soil or clean stone. Bell holes shall be provided at each joint to permit proper joint assembly and proper pipe support. Rock shall be removed 6 inches below pipe and the void filled with coarse sand (SC, SM).

Unless directed otherwise by the City Engineer, DIP water mains and force mains shall have a [Type 1](#) laying condition with [Class D bedding](#). Bedding for DIP water mains shall conform to [Standard Details 511.01 and 511.02](#) as applicable. PVC water main pipe bedding shall conform to [Standard Detail 731.01](#). (See also [paragraph 2.1.2, Bedding Definitions](#))

D. Surface or Ground Water in Trenches/Pipe

When ground water is encountered, the Contractor shall pump, or otherwise remove any water that accumulates in the trenches and shall perform all work necessary to keep the trenches clear from water while pipe is being laid. No pipe shall be laid in water and the pipe shall not be used as a means of draining ground water from the trench. All water removed from the trench shall be conveyed in a proper manner to a suitable point of discharge and shall comply with the applicable erosion and sedimentation laws. See [paragraph 3.1.6 – Dewatering](#), of this specification.

The open end of water or sewer pipe shall be kept closed with a watertight plug to prevent washing of any foreign matter into the line. At the conclusion of the workday, or at any other time when pipe laying is not in progress, a watertight plug shall be placed in the bell of the last joint of pipe laid.

Storm drainage pipe shall either be plugged and/or an appropriate sediment trap placed at the upstream end to prevent siltation.

3.2.8 TRENCHING IN FILL

In areas where trenching for pipe will be in fill, the fill shall be brought to an elevation of at least 12 inches above the top of the pipe, and then the trench excavated in the compacted fill, as herein specified for trench excavation.

3.2.9 SUBSURFACE DRAINAGE

Installation of subsurface drainage systems shall conform to the requirements of Section 815 – *Subsurface Drainage* of the NCDOT *Standard Specifications for Roadways and Structures*

3.2.10 EXCAVATION FOR STRUCTURES

- A. Excavate to provide a minimum of 12 inches of horizontal clearance between outer surface of structure and trench wall.
- B. Where rock is encountered so that a built-in-place manhole, precast structure (such as a manhole or vault), or other structure will bear over rock, remove the rock to a minimum of 8 inches below the foundation or footing of the structure and place an 8 inch cushion of clean #57 stone over the rock.

3.2.11 WATER MAIN BEND BLOCKING INSTALLATION

- A. Excavate area to receive poured-in-place concrete blocking to exact dimensions shown in **Standard Detail 512.01**. Blocking is to be placed in undisturbed residual soils. If blocking is to be placed in areas where boulders or stumps have been removed or in areas of loosely compacted fills, such as in landscaped areas (outside of pavements or parking lots), contact the City Engineer for directions.
- B. Concrete shall be plain concrete with a minimum compressive strength of 3000 psi at 28 days.
- C. Wrap bolts in plastic or provide other acceptable means of protection, approved by the City Engineer before pouring concrete blocking.

3.2.12 DEPOSITION OF EXCAVATED MATERIAL

- A. All excavated material shall be placed on one side of the trench (a minimum of 2 feet from the edge of excavation but no less than that specified/required by OSHA regulations) away from the roadway unless permission is given by the City's representative to place it on both sides. Excavated materials shall be so placed as not to endanger the work and so that free access may be had at all times to all parts of the trench and to all fire alarm boxes, fire hydrants and gate valves on water pipes, which are located in the vicinity. Excavated material shall be placed to in such a way as to inconvenience the public as little as possible. All fences and walls shall be protected and, if damaged, shall be repaired or replaced in as good or better condition as before it was disturbed. Protect shade trees from stockpiling of material.

- B. Exercise care when stockpiling excavated material on the bank in order to prevent surcharging the bank of the trench and potentially rendering the excavation unstable.
- C. **Wasting of Unsuitable Material:** Material of an uncompactable nature, material unsatisfactory for backfill, trash, and excess material shall be removed from project site and disposed at the Contractor's expense. Where removal of unsatisfactory material is due to negligence on the part of the Contractor (i.e. resulting from inadequate shoring or bracing, failure to dewater, improper material storage exposing it to rain or flooding, or other failure to meet specified requirements), work shall be performed at no additional cost to the City. If additional material is required, the contractor shall supply same from an approved borrow pit at no additional cost to the City. Rock excavated from the trench shall be hauled off the site at the Contractor's expense.

3.3 BEDDING

3.3.1 BEDDING DEFINITIONS: see [paragraph 2.1.2, Pipe Bedding Definitions \(Water & Sewer\)](#).

3.3.2 MINIMUM BEDDING REQUIREMENTS (by utility type):

- A. **Sewer Pipe Bedding:** Unless otherwise noted below, provide #57 or smaller stone trench bedding material.
 - 1) **Minimum Bedding Allowed DIP Gravity Pipe:** Minimum Type 4 Laying Condition ([Standard Detail 511.02](#)). The minimum bedding depth shall be 3 to 4 inches under the pipe with an additional 1 inch depth of cushioning material added for each additional 2 feet of depth in excess of 16 feet up to a maximum of 12 inches of cushioning material.
 - 2) **Haunching DIP Gravity Pipe:** The remainder of bedding for DIP shall be brought up to a depth of 1/8 the OD of the pipe. However, when the foundation is determined by the City Engineer or his representative to be unsuitable, the pipe shall be bedded to the spring line of the pipe. See [Standard Detail 511.02](#), Type 4 laying condition.
 - 3) **Bedding and Haunching SDR 35 PVC and C900 PVC Gravity Pipe:** PVC pipe to have Type 5 laying condition ([Standard Detail 511.02](#)) with the remainder of bedding shall be brought to the top of pipe. The minimum bedding depth shall be 3 to 4 inches under the pipe with an additional 1 inch depth of cushioning material added for each additional 2 feet of depth in excess of 16 feet up to a maximum of 12 inches of cushioning material. See also [Standard Detail 731.01](#).
 - 4) **Minimum Bedding Allowed for DIP and C900 PVC Force Mains:** Bedding for DIP force mains shall be Type 1 Laying Condition with excavation of trench bottom for bells as shown on [Standard Detail 511.02](#). Bedding for C900 PVC force mains shall be Type 5 laying Condition as shown on [Standard Detail 511.02](#).

- 5) **Minimum Bedding Allowed for PVC Services:** Bedding for PVC services shall be Type 5 laying Condition as shown on **Standard Detail 511.02** except the total trench width may no less than 24 inches.
- D. **Bedding Water Pipe and Water Service Pipe:** Unless otherwise directed by the City Engineer, do not bed water pipe and water service pipe in stone. DIP water mains to be Type 1 Laying Condition with excavation of trench for bottom of bells as shown on **Standard Detail 511.02**. Bedding for C900 PVC water mains shall be Type 4 laying Condition as shown on **Standard Detail 511.02**.
- E. **Bedding in Rock:** For rock areas, bed pipe in accordance with paragraph [3.2.5 B Cushioning pipe in rock](#) and **Standard Detail C01.01**.
- F. **Bedding for Storm Drainage Pipe:** See [paragraph 3.2.7.B](#), above.
- G. **Bedding for Structures:** The bottom of manhole bases and other precast structures and appurtenances shall be excavated to minimum over depth of 6 inches, but no less than as indicated in the applicable standard details, below the bottom of the structure. The structures shall be placed on clean stone bedding that has been firmly consolidated. Bedding material shall be shaped, graded, and compacted so that the entire bottom of the structure rests level on the material for its entire area.

3.3.3 BEDDING MATERIAL PLACEMENT

- A. Unless otherwise specified, the bottom of the pipe trench for sanitary sewer (gravity and pressure), and where indicated by the City Engineer, storm drainage pipe shall be excavated to below the bottom of the pipe, to provide for the compacted bedding materials, except as specified in rock. Bedding material shall be placed, shaped, and compacted so that at least the bottom of the pipe rests uniformly upon the material for the entire length of the pipe. Bell holes and depressions required for the jointing of pipe shall be dug after the compacted bedding material has been graded and shaped and shall be only of the length, depth, and width required to make the joint properly. Care shall be taken to ensure bedding fills the voids beneath the pipe haunches, by poking with a shovel or tamper. See **Standard Details 511.01, 511.02, 631.01, and 731.01**, as applicable.

3.4 BACKFILLING (MATERIALS AND METHODS)

3.4.1 BACKFILLING

A. GENERAL:

- 1) **Materials:** See [paragraph 2.1.1 - Material Classification](#) for Select Earth Backfill and Common Trench Backfill classification. In areas of extensive rock excavation, where there is a shortage of suitable backfill, the contractor shall, at his own expense, haul suitable material in to be placed over the pipe.
- 2) Pipe and fittings shall be inspected before backfilling.

- 3) Except as otherwise specified or directed for special conditions, backfill trenches to the ground surface with [Common Trench Backfill](#) material approved by the City Engineer. After the pipe has been brought to grade on a proper foundation, earth fill shall be placed carefully about the pipe and tamped properly to hold the pipe in position. Exercise extreme care in backfilling operations to avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion. Repair damages, distortions, or misalignments to the full satisfaction of the City Engineer. Pipe shall be removed if broken or damaged during installation. Backfill shall closely follow the pipe installation. Unless otherwise directed or permitted by the City Engineer, all pipe laid shall be backfilled during the same day, and prior to the completion of the day's work, to provide a firm continuous support and covering for the pipe.
- 4) Reopen trenches that have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the City Engineer.
- 5) Do not allow or cause any of the work performed or installed to be covered up or enclosed by work prior to required inspections, tests, and approvals. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work and, after approvals have been given, refill and compact as specified, all at no additional cost to the City.
- 6) Observe specific pipe manufacturer's recommendations regarding methods of backfilling and compaction.
- 7) Ensure compaction of each lift to requirements stated in these specifications.
- 8) All pipe areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.
- 9) Heavy equipment shall not be operated over any pipe until it has been properly backfilled and compacted with a vibratory compaction device (i.e. Rammax walk behind or infrared remote controlled trench roller/compactor (24- to 33-inch drum), NOT A PLATE TAMP) and has a minimum cover as required by the plans. Pipe that is misaligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced at no cost to the City.
- 10) **Installation of Warning Tape:** See paragraph [3.17.2, Identification of Water Lines](#) for installation requirements. See paragraph [2.2.2 Warning Tape](#) for product specifications.

B. METHODS:

Provide backfill and compaction methods of following types:

- 1) **Carefully Compacted SELECT EARTH BACKFILL:** Furnish carefully compacted select earth backfill where indicated on drawings and specified for compacted backfill conditions up to 12 inches above top of

pipe. See paragraph 2.1 *Soil, Bedding, and Backfill* for definition of [Select Earth Backfill](#). Comply with the following:

Care shall be taken to prevent any disturbance of the pipe or damage to newly made joints. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that injurious side pressures do not occur such that the pipe could be displaced or dislodged. Do not backfill on muddy or frozen soil.

Sheeting and shoring generally should be removed only when the trench below it has become substantially filled, and every precaution shall be taken to prevent any slides of material from the sides of the trench onto or against the pipe.

- a. Unless otherwise approved by the City Engineer, place backfill in lifts not exceeding 6 inches (loose thickness).
 - b. Hand place, shovel slice, and hand tamp carefully compacted backfill solidly around pipe. Only hand tamping shall be used to compact earth around the pipeline. When the backfill has been brought to 12 inches above the top of the barrel, vibratory compaction devices (i.e. Rammax Trench Compactor walk behind or infrared remote controlled trench roller/compactor (24- to 33-inch drum), NOT A PLATE TAMP) shall be used to compact the remainder of the soil.
- 2) **COMMON TRENCH (FINAL) BACKFILL** Perform remaining backfill in accordance with drawings or as directed by the City Engineer. See paragraph 2.1 *Soil, Bedding, and Backfill* for definition of [Common Trench Backfill](#). Comply with the following:
- a. Unless otherwise specified or approved by the City Engineer, backfill the remainder of the trench, from 12 inches above the pipe to grade, with clean earth fill free of stones larger than 3 inches in diameter. Top 12 inches to be free of material greater than 1 inch. Material shall be free from all perishable and objectionable materials (organic). Before placing any backfill, all rubbish, forms, blocks, wires, or other unsuitable material shall be removed from excavation. The backfilling shall be placed in layers not over 6 inches thick in the street right of way and 12-inch layers outside of the street right of way. See [Table 2275.4](#). Final backfill shall be tamped with a vibratory compaction device (i.e. Rammax Trench Compactor walk behind or infrared remote controlled trench roller/compactor (24- to 33-inch drum), NOT A PLATE TAMP). See [Table 02275.3](#) below, for specific density requirements.
 - b. All areas within the limits designated on the drawings, including adjacent transition areas, shall be uniformly graded. The contractor shall finish surfaces within the specified tolerances with uniform levels or slopes between points where elevations or existing grades are shown.
 1. Finish subgrade areas that are to receive topsoil. Bring such areas to within 0.10 foot of required subgrade elevations.

2. Shape subgrade under sidewalks to line, grade, and cross-section. Subgrade is to be brought to within 0.10 foot of required subgrade elevations.
 3. Shape subgrade under pavement to line, grade, and cross-section. Bring to within ½ inch of required subgrade elevations.
- c. **Surface Protection – Traffic:** The contractor shall protect newly graded areas from traffic and erosion, repair, and re-establish grade in settled, eroded, or rutted areas. Where compacted areas are disturbed by subsequent construction or adverse weather, the contractor shall scarify the surface, reshape, and re-compact to the required density.

On City funded projects, should the contractor fail to maintain any trench within 2 days after notice from the City Engineer, the City may address/remediate the trench problem and the cost of such work may be retained from monies due the contractor. In case of emergency, the City Engineer may refill any dangerous trench failures or depressions without prior notice to the Contractor.

- 3) **Structure Backfill:** Backfill placed within 2 feet of manholes and other special structures shall be of the same quality as that specified for backfill around water, sewer or storm drainage lines. Take care to prevent wedging action of the backfill against structure by carrying the material uniformly around the structure so approximately the same elevation is maintained in each lift. If necessary to prevent damage to structure, provide temporary bracing of structure walls. Material shall be solidly tamped with a mechanical or pneumatic tamper in such a way as to avoid damaging the structures or producing unequal pressures. The Contractor shall refill all excavations as rapidly as practical after completion of the structural work therein, or after the excavations have served their purpose.

3.5 COMPACTION/DENSITY

Soil shall be compacted using equipment suitable for the material and the work area location. Power driven hand tampers shall be used for compacting materials adjacent to structures. Use hand tamper for recompaction over underground utilities.

A. Testing

Testing of backfill shall be performed by an independent laboratory approved by the City and the Contractor. The Contractor shall be responsible for excavation for testing.

Quality Assurance vs. Quality Control:

Quality Assurance (QA) testing, and the associated cost, is the responsibility of the City. Quality Assurance testing by the City is used to confirm that the Contractor is generally performing his/her work in compliance with these specifications.

Quality Control (QC) testing is the necessary and required testing that is to be performed by the Contractor to assure that he/she is meeting and complying with the requirements of these specifications. The associated cost for QC testing is the contractor's responsibility. The contractor is also responsible for "re-testing" costs incurred by the City when the City's test results (tests for Quality Assurance) results in a "failure."

Quality Control (QC) testing for City funded projects: The City shall pay for the cost of Quality Control by having the Contractor include the cost for testing in the unit cost of the project; not as a separate pay item. The Contractor shall pay for all costs associated with re-testing.

B. Quality Assurance (QA):

In the course of backfilling trenches for utility installations, the City Engineer may require "Field Density Determinations" or compaction tests. When compaction tests are called for, the City Engineer will determine the location of the tests and the City shall engage a qualified testing firm to perform the test. A representative of the City will observe tests and a copy of the test results and inspection report will be submitted by the testing firm directly to the City Engineer. When the tests indicate that the density failed to meet the requirements of [Table 2275.3](#), the Contractor shall comply with [paragraph 3.5 G, Failure of Compactive Efforts](#).

Payment for failed QA density tests: For City funded projects, payment for failed in-place density tests shall be made by the Contractor by deducting the testing cost from the forthcoming retainage. For other projects in which the City will ultimately assume ownership and maintenance, the testing costs for failed in-place density tests shall be billed directly to the Contractor.

C. Quality Control (QC): The Contractor shall perform in-field density tests in accordance with [Table 02275.2](#). Inspection reports shall be submitted by the testing firm directly to the City Engineer. See [paragraph 3.6 F, Passing Test](#).

- 1) All test results shall be provided to the City Engineer as they become available from the testing agency.
- 2) The Geotechnical testing firm is to perform laboratory tests (ASTM D698, standard Proctor) to establish a moisture-density relationship for all materials that are proposed to be used as fill.
- 3) Contractor shall give a 24-hour notice to Geotechnical testing firm for subgrade testing, subgrade confirmation, or inspections.

4) Minimum Compaction Testing Frequency:

The following testing frequency shall be employed on both City funded projects and projects proposed to be turned over to the City for maintenance and/or ownership.

Table 2275.2	
Testing Frequency	
Location	Frequency
Trench areas in road crossings	1 test group ^a per road crossing, and/or
Trench areas	1 test per 200 linear feet per two feet of fill thickness
Exception: Where additional tests are required to determine the extent of unacceptable compaction (having been determined by the initial QA/QC test). In this case, the costs for these additional tests are the responsibility of the Contractor.	

^aOne test group consists of a compaction test on each layer of backfill material in the trench segment.

- D. **Site access for testing:** Ensure the City, at all times, has immediate access to the site for the testing of all soils related work. Ensure excavations are in a safe condition for testing personnel.
- E. **Minimum Compaction Requirements:** Compaction percentages are percentages of maximum dry density as determined by indicated ASTM Standards. Unless noted otherwise on drawings or more stringently by other sections of these specifications, place and ensure degree of compaction of trench backfill and/or borrow material does not fall below the following percentages of the maximum density at optimum moisture content.

Table 2275.3		
Minimum Compaction Limits (Cohesive Soils)		
Location	Density	
Beneath and within 5 feet of buildings	100% of the maximum dry density by ASTM D698 (standard Proctor), AASHTO T-99.	
Areas under roadway pavement surfaces, curb and gutter, and sidewalks	Top 12 inches	100% of the maximum dry density by ASTM D698 (standard Proctor), AASHTO T-99.
	Up to within 12 inches	95% of the maximum dry density by ASTM D698 (standard Proctor), AASHTO T-99.
Roadway shoulders	95% of the maximum dry density by ASTM D698 (standard Proctor), AASHTO T-99.	
Under turf, sodded, planted, or seeded non-traffic areas	90% of the maximum dry density by ASTM D698 (standard Proctor), AASHTO T-99.	

- F. **Passing Test:** Average of 3 test results meeting the applicable provisions of [Table 2275.3](#) (above) with no one test failing by more than -3 percentage points. Moisture content tolerance is to be within +/- 3 percentage points of the optimum moisture content unless otherwise specified by the City Engineer or Geotechnical Engineer.

- G. **Failure of compactive efforts:** If compaction efforts should fail to provide a stable subgrade in accordance with the requirements in [paragraph 3.5 F, Passing Test](#) after subgrade materials have been shaped and brought to optimum moisture, such unstable materials shall be removed to the extent directed by the Geotechnical Engineer and/or the City Engineer and replaced and compacted using new material and must pass compaction test prior to proceeding to the next stage of construction and at no expense to the City.

The costs associated with excavation and re-compaction of areas that have failed will be the Contractors responsibility.

H. **Compaction Lifts:**

Table 2275.4	
Compaction Lift Thickness	
Lift Thickness (inches)	Location
6	Inside street rights-of-way
12	Outside street rights-of-way

- I. In-place testing of soils shall be tested based on the following:

Table 02275.5	
In-Place Density Tests	
Soil Type/Classification	Reference Standard
Crushed Rock	ASTM D2049 by percentage of relative density ASTM D1557 or D698 (standard Proctor)
GW, GP, SW and SP	ASTM D2049 by percentage of relative density ASTM D1557 or D698 (standard Proctor)
GM, GC, SM, SC, ML, CL	ASTM D2167, D1556, D2922, or D2937 by percentage of standard Proctor Density according to ASTM D698 or AASHTO T-99

3.6 SERVICE CUTS, DIRECTIONAL BORED OR PUNCHED SERVICES

- A. **Open trenches:** Sewer lateral and water service connections that cross paved streets shall be installed by saw cutting the pavement and opening the trench. The open trench width shall be no wider than 36 inches.

Lateral connection trenches in non-paved areas shall be buried as specified for gravity sewers and for water lines, as applicable. See [Table 2275.1](#).

Do not bed water service pipe, except when rock is encountered.

- B. **Directional Boring or Punching:** At the direction of the City Engineer, service pipes may be required to be “punched” or “directionally bored” beneath the pavement.

3.7 PAVEMENT REPAIR AND REPLACEMENT

- A. **General:** This work shall consist of replacing subbase stone, and bituminous material in the street in areas where it becomes necessary to remove the original

pavement for sewer, water main, and storm drainage trenches. Pavement repair shall be as shown on the drawings or as determined by the City Engineer. However, the pavement surface repair shall conform to the minimum requirements shown on **Standard Detail C01.03**. The pavement patch shall provide a uniform and smooth driving surface free of humps or depressions.

- B. **Construction in Public Rights of Way:** Water, sewer, and storm drainage lines installed in or across NCDOT roads shall be installed in accordance with, if applicable, the requirements stipulated in the approved encroachment permit and the latest requirements of both the NCDOT *Standard Specifications for Roads and Structures* and the *Roadway Standard Drawings*. All water, sewer and storm drainage lines installed in or across City streets shall be in accordance with these specifications and the applicable standard details.

When it is necessary to remove the existing pavements, prepared road surfaces, sidewalks, or curbing, it shall be the responsibility of the Contractor to replace these surfaces to original or better condition. The Contractor shall be responsible for contacting the City or the NCDOT, as applicable. Unless specified more stringently by the owner of the right of way, the backfill shall be compacted in accordance with [Table 2275.3](#).

Contractor shall replace pavement base such that there is a minimum of 36 inches of compacted stone screenings immediately below the proposed pavement surface compacted to 100% of the maximum dry density (ASTM D698). Pavement shall be S-9.5B and shall match the existing asphalt depth but may be no less than 2 inches in thickness. All patches greater than 2 inches in thickness shall be placed in appropriate lifts. See **Standard Detail C01.03**.

- C. When water, sewer and/or storm drainage lines are installed in or across roadways that have been macadamized or graveled, the Contractor shall save the gravel or stone, refill the upper 12 inches of the trench with the material, and supply sufficient new stone or gravel to return the roadway to the original grade. It shall be the Contractor's responsibility to maintain the original grade by adding gravel or ABC until the ditch is stable and the pipeline accepted by the City. Maintain area as outlined in paragraph [3.4.1 C - Surface Protection - Traffic](#).
- D. **Cutting Pavement:** See also **Standard Detail C01.03** and paragraph [3.1.3 B - Protection of Surface Features](#). Perform cutting operations prior to installation of line to avoid excessive removal of asphalt.
- E. **Protection of Pavement:** See paragraph [3.1.3 B - Protection of Surface Features](#).

3.8 BLASTING

3.8.1 GENERAL

- A. Blasting procedures shall conform to all applicable local, state, and federal laws and ordinances and shall be performed in accordance with OSHA *Standard 29 CFR Part 1910.109*, NCDOT Rules for Transporting Explosives, and local Fire Department Regulations. Prior to any blasting, a blasting permit shall be obtained. The approval of the City Engineer and Fire Marshall shall be obtained before any blasting takes place and the City Engineer may fix the hours of blasting if he/she deems it to be necessary. The use of explosives shall be in

accordance with approved methods that safeguard lives and property. Explosives shall only be handled, placed, and detonated by persons licensed in this work. It is the responsibility of the Contractor to provide proper notification to appropriate parties.

- B. **Rock Excavation:** See [paragraph 3.2.5 - Rock](#) for the definition of rock.
- C. The minimum insurance coverage for blasting shall be as specified by current NC Fire Prevention Code or more as determined by the City Engineer and Fire Marshall. The coverage shall include explosion and collapse. If blasting occurs within 200 feet of any underground structure or utility, underground coverage will be required. The owner and the property owners shall be named as “additional insured.”
- D. **Storage:** Store explosives in accordance with the Occupational Safety and Health Act and with other Federal, State and Local ordinances and regulations. The Contractor shall keep explosive materials that are on the job site in special constructed boxes provided with locks. These boxes shall be plainly identified as to their contents. Detonators shall be stored separately from explosives. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits.
- E. The City may prohibit blasting when the method of detonation or the means of protection provided is inadequate. Blasting conducted with or without direct supervision of the City will not relieve the Contractor of the responsibilities stipulated herein.
- F. Blasters shall not explode or attempt to explode blasting powder or high explosives unless it is performed with a suitable electric blasting machine. Electric current from batteries, telephone, or power lines shall not be used for detonation.
- G. A minimum of 3 minutes prior to the detonation, the blaster shall inform competent flagmen, equipped with red flags, stationed at reasonable distances from the blast area at every avenue of approach, to warn all persons.
- H. Immediately after the loading and tamping of the drill hole and before fixing the blast, the material to be blasted shall be covered on all exposed sides with blasting mats, or other approved protective material. After the protection has been applied, the blast shall be fired without unnecessary delay.

3.8.2 BLASTING PROCEDURE

- A. The Contractor shall provide a blast warning signal system. The blast warning signal system shall consist of one or more air horns located at the blast site. The air horn(s) shall be audible a minimum of 1 mile from the blast site. The signals shall be one long horn five minutes prior to the blast, one short horn 1 minute prior to the blast, and one long horn after the blast to signal all clear. The Contractor shall erect two clear and legible blast warning signal signs at locations determined by the City Engineer and Fire Marshall. The signs shall list the blast warning signal system, the Contractor Superintendent’s name and telephone number, and the City’s representative’s name and telephone number.

- B. The Contractor shall establish test pits at up to two representative locations along the alignment and up to three locations adjacent to the site proposed to be blasted to determine if the rock is “rippable” with a track backhoe Caterpillar No. 325 or equivalent and the feasibility of rock excavation by “hoe ramming” (see paragraph 1.4 P, above for definition of [rock excavation in open trenches and pits](#)). If these procedures do not offer reasonable production for rock excavation, then blasting will be allowed unless otherwise indicated.
- C. The Contractor shall notify in writing all property Owners within 250 feet of the proposed blast at least 1 week prior to the proposed blast and verbally on the day of the scheduled blast.
- D. Blasting shall be limited to mid-morning hours on days of clear-to-partly cloudy skies with increasing surface temperature and light wind. The Contractor shall provide monitoring equipment to monitor all blasting. A copy of monitor record shall be given to the City daily.
- E. The use of unconfined explosives shall be prohibited.
- F. Unless otherwise stipulated in Title 13 of the NC Administrative Code, chapter 7, the maximum allowable peak particle velocity shall be 1.25 inches per second for all structures located 0 to 300 feet from the blasting site. The maximum allowable peak particle velocity shall be 1.00 inch per second for all structures located 301 to 5,000 feet from the blasting site. The maximum allowable peak particle velocity shall be 0.75 inch per second for all structures located 5,001 feet and beyond from the blasting site.
- G. To minimize vibration, minimum scaled distance (SD) of 50 shall be used to determine maximum explosive weight per delay. A test blast shall be conducted to verify the scaled distance. The maximum explosive weight per delay shall not exceed the distance from the blast to the nearest structure divided by 50 squared. Maximum explosive weight per delay may be revised pending outcome of test blast. The recommendations indicated for blasting criteria in no way relieves the Contractor of his liability.
- H. The peak overpressure of air blast shall not exceed 0.015 pound per square inch or 138 decibels.
- I. Preblast meetings shall be scheduled with the City Engineer and Fire Marshall to document hole depths and spacing, charge weight per delay, shot scheduling, and weather conditions. The Contractor shall obtain accurate measured distances from structures to center of blast area prior to determining the safe maximum charge-weight per delay and loading blast holes.
- J. Preblast and post blast surveys shall be performed by the Contractor. The Contractor may review this data and supplement it as he sees fit or conduct separate survey after written permission is obtained from the property Owners. In this event, the written permission shall be submitted to the City Engineer and Fire Marshall prior to entering upon private property. The preblast and post blast surveys will include all occupied buildings within 250 feet of blasting areas. The Contractor is strongly encouraged to have a representative present during these surveys. The preblast and post blast surveys performed by the City or the property owner in no way relieve the Contractor of his liability.

- K. The City reserves the right to monitor production blasting. In this event, the Contractor shall provide the City Engineer and Fire Marshall ample notice of scheduled blasts (minimum of 24 hours) to allow set-up of monitoring equipment.

3.9 HIGHWAY CROSSING

- A. Pipeline crossing shall be installed in a steel casing pipe installed by the “dry bore and jacking” method. Length of steel pipe shall be welded to the preceding length installed. The carrier pipe shall be protected by spiders constructed as shown on **Standard Detail C07.03**. The ductile iron carrier pipe shall be as specified for sewer and water pipe and shall be mechanical joint ductile iron pipe. If, in the opinion of the Contractor, boring and jacking of the highway crossing is not possible due to rock, he shall test drill, in the presence of the City Engineer at the proposed crossing locations, at least 3 evenly spaced points in the placement along the crossing alignment. Upon verifying the presence of rock at a depth that would conflict with the boring and jacking operation, the Contractor shall make application to the City or the NCDOT, as applicable, to allow open cutting of the crossing. The Contractor shall be responsible for providing all data and shall pay any fees required for this application. If the trench is allowed to be open cut, casing pipe shall be provided and the trench shall be backfilled entirely with flowable fill concrete to the bottom of the pavement base course and the pavement restored within one day of placing the pipe.
- B. The steel casing pipe shall be of the thickness as specified in **Standard Detail C07.03**. Refer to specification *Division 02530, Sanitary Sewer* and *Section 02510, Water Distribution* for casing pipe specifications.
- C. Installation shall be in accordance with AREA.
- D. The jacking operation shall be carried on in such a manner that settlement of the ground or the highway above the pipeline will not occur. The use of water or other fluids in connection with the boring and jacking operation shall not be allowed. Excavation shall be made by auger or manual methods, at the Contractor’s option, to suit the conditions encountered. The contractor shall repair or replace, as directed by the City Engineer, at his own expense, casing pipe damaged during the jacking operation.
- E. After installation of the casing pipe, the carrier pipe, if required, shall be installed. The ends of the casing shall be plugged in accordance with **Standard Detail C07.03**.
- F. All operations of the Contractor shall be subordinate to the free and unobstructed use of the highway right of way for passage of traffic without delay or danger to life, equipment, or property. The contractor shall provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times.

3.10 RAILROAD CROSSING/TRACKS

Crossing of railroad tracks with water, sewer or storm drainage lines shall be by the method shown on the contract drawings and approved by the applicable Railroad Company. It is the responsibility of the Project Engineer and Contractor to contact the Railroad Company and to comply with all Railroad Company requirements for

specifications, drawings, permits, etc. All water, sewer, and storm drainage lines installed beneath railroad tracks shall be in accordance with the Railroad Company's policies, procedures, and permits requirements. The railroad right of way and track structure shall be fully restored to its original pre-existing condition and to the full satisfaction of the Railroad Company. The work shall not interrupt the use of the railroad tracks or in any way endanger the traffic on them.

3.11 UNDERGROUND RIVER OR CREEK CROSSINGS

In accordance with the contract drawings, underground river or creek crossings shall be made either by horizontal directional drilling (HDD) with HDPE pipe or constructed in the dry by providing a temporary cofferdam or bulkhead. River or creek crossings shall be in accordance with the requirements of the City Engineer, NCDENR, The US Army Corps of Engineers, and all other agencies having jurisdiction. Unless horizontal directional drilling is specified in the contract documents, river or creek crossings shall be made by providing a temporary cofferdam or bulkhead using ductile iron pipe for the crossing.

River or creek crossings shall be as near to perpendicular as possible to the stream.

- A. **Cofferdam Method:** The Contractor shall construct the river crossing in the "dry" by providing a temporary cofferdam or bulkhead of non-erodible material. The cofferdam shall not obstruct more than one-half of the water surface at any time and shall not extend more than 3 feet above the normal water surface. The Contractor shall not be allowed to operate construction equipment on the native stream bottom, except during removal of the cofferdam. The contractor shall be advised that the level in the river can fluctuate rapidly.
- 1) Non-erodible material shall be defined as heavy coarse aggregate as specified on the plans. An earth core for the cofferdam may be constructed over the propose excavations; however, the non-erodible materials shall be in place prior to the placement of the earth, so that the erodible earth does not come in contact with the flowing water.
 - 2) A bulkhead may be constructed in lieu of the cofferdam. The bulkhead shall be made of wood, steel or some like material suitable to withstand the hydraulic forces to permit construction in a dry trench.
 - 3) Construct the crossings as indicated. The Contractor shall then remove the cofferdam, bulkhead, or whatever equipment or material that was used to construct the crossing. The bottom of the river in the construction area shall be restored to its original cross section. All disturbed areas on the banks of the river shall be seeded and mulched in accordance with [paragraph 3.16 – Seeding and Groundcover](#).
 - 4) Comply with all terms and conditions of all permits issued by the US Army Corps of Engineers and/or NCDENR for this work.
 - 5) The pipe and joints of water or sewer main entering or crossing streams shall be tested in place and shall exhibit zero infiltration. This testing shall be done prior to encasing in concrete.
- B. **Horizontal Directional Drilling (HDD) Method:** HDPE pipe shall be installed by horizontal directional drilling using a surface mounted rig, first to drill a guided hole along a bore path consisting of a shall arc and then to pull a string of pipe

into the hole. Pull back is facilitated by a back-reamer, which enlarges the hole to approximately one and a half times the pipe diameter. Drilling fluids are injected into the bore hole to stabilize the hole and lubricate the pipe and drilling string. Tracking equipment is used to guide and direct the drilling. See [Division 02510, Water Distribution](#) for installation, testing and other requirements for horizontal directional drilling.

3.12 SURFACE/SUBSURFACE WATER CROSSINGS

Surface water crossings, with pipe above the water, shall be adequately supported by pipe support piers or beams. Subsurface water crossings, with pipe under the streambed, shall have the pipe encased in concrete or steel when the cover is less than 3 feet. For subsurface water main stream crossings, see [Standard Details C07.04 and C07.05](#) for additional limitations on cover and for other requirements relating to stream subsurface stream crossings.

3.13 CONCRETE COLLARS ON SEWER MAINS

Concrete collars shall be used on sewer lines with slopes 10% or greater. When concrete collars are specified or shown on the drawings, at least one concrete collar shall be placed before the bell of each joint of pipe. Additional collars may be required by the City.

3.14 PLACEMENT OF RIP RAP AND RIP RAP BEDDING

Placement of Rip Rap and fabric shall conform to Section 876 – *Rip Rap* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision.

3.15 CLEANUP AND RESTORATION OF SITE

- A. During the progress of the work, the Contractor shall keep the premises and the vicinity of the work clear from unsightly and disorderly piles of debris. Suitable locations shall be specified for the various construction materials and for debris. The materials shall be kept in their storage locations, except as needed for the work and debris shall be promptly and regularly collected and deposited in the specified location.
- B. Upon completion of section of pipeline and appurtenances, the Contractor shall fine grade the ground adjacent thereto, removing all surplus excavated material, leaving the area free from surface irregularities. He shall dispose of all surplus material, dirt, and rubbish from the site; and shall keep the site free of mud and dust to the satisfaction of the City Engineer. The contractor may be required to flush or sprinkle the street to prevent dust nuisance.
- C. When working on the shoulders of paved roads, the Contractor shall keep the pavement clean of all loose earth, dust, mud, gravel, etc., and shall restore road surfaces, shoulders, and ditches as required by either the NCDOT or the right-of-way owner.
- D. **Grading Easements:** Easements shall be graded to have cross slopes of 4% or less. The ground surfaces of easements shall be graded and cleared in such a way to promote proper drainage and allow mowing by vehicular equipment without damage to equipment from rock(s) and other debris.

- E. After all work is completed, the contractor shall remove all tools and other equipment, leaving the site free, clean, and in good condition.
- F. The contractor shall keep the surface over and along the trenches and other excavation in a safe and satisfactory condition during the progress of the work and for a period of one year after the work has been completed. He shall be held responsible for any accidents that may occur on the account of the defective condition of such surface.

3.16 SEEDING & GROUNDCOVER

Seeding and groundcover includes seedbed preparation, liming, fertilizing, seeding, and mulching of all disturbed areas. Areas inside or outside the limits of construction that are disturbed by the Contractor's operation and activity shall be seeded and mulched.

- A. Seeding, Sodding, and Groundcover shall comply with the applicable provisions and requirements of [Division 02920, Seeding, Sodding and Groundcover](#).
- B. Seeding and groundcover includes seedbed preparation, liming, fertilizing, seeding, and mulching of all disturbed areas. Areas inside or outside the limits of construction that are disturbed by the Contractor's operation and activity shall be seeded and mulched.

Unless called for otherwise on the Erosion and Sedimentation Control Plan, in areas where natural sod or vegetation has been disturbed, the area shall be seeded in accordance with [Standard Detail 350.01](#).

- C. Seeding and groundcover includes seedbed preparation, liming, fertilizing, seeding, and mulching of all disturbed areas. Areas inside or outside the limits of construction that are disturbed by the Contractor's operation and activity shall be seeded and mulched.

Unless called for otherwise on the Erosion and Sedimentation Control Plan, in areas where natural sod or vegetation has been disturbed, the area shall be seeded in accordance with [Standard Detail 350.01](#).

If the line is installed through a landscaped lawn, sod shall be placed to restore ground cover to the existing lawn.

- D. Seeding shall be carried out as soon as practical after the construction in any one area, and shall be maintained against erosion through the completion of the project. Seeding shall be accomplished as work progresses and shall be in accordance with Sediment and Erosion Control regulations.

The Contractor shall be responsible for proper care of the seeded area during the period that vegetation is being established. In the event of an erosive rain before an adequate stand of vegetation has been established, damaged areas shall be repaired, fertilized, seeded, and mulched at the Contractor's expense.

Seeding on rights of way of NCDOT maintained roads shall be in accordance with NCDOT specifications and the requirements of the approved encroachment permit.

- E. **Temporary Seeding:** Denuded areas to be graded during the construction phases that are not to be brought to final grade within 21 calendar days shall receive temporary seeding and mulching. Areas to be stabilized with permanent vegetation must be seeded or planted within 15 working days or 90 calendar days after final grade is reached, unless temporary stabilization is applied. Temporary seeding shall also be used to stabilize finished grade areas if the time of year is outside the specified permanent seeding periods.
- F. **Stockpile Area:** The contractor is responsible for securing a material lay down and stockpile storage area for this contract. As such, the contractor is responsible for the necessary erosion control measures, including but not necessarily limited to, a construction entrance, silt fence, protection of streams/buffers, clean up and restoration of site to the satisfaction of both the City of Wilson and the NCDENR, Department of Water Quality, Land Quality Section. Stockpile and/or waste areas must be maintained within the limits of the areas protected by the proposed measures and otherwise temporarily seeded if to be left stockpiled over 30 days.

3.17 MISCELLANEOUS

3.17.1 DUST CONTROL

The contractor shall be required to sprinkle with water or to apply dust allaying materials in the vicinity of dwellings, schools, churches, stores, or other places, where in the opinion of the City Engineer, it is necessary to ensure that dust is held to an absolute minimum. Dust control is considered incidental and shall be carried out at the Contractor's expense.

3.17.2 IDENTIFICATION OF NEW WATER LINES & FORCE MAINS

Underground Warning Tape

For all pipe, a metallic warning tape shall be placed 12 to 18 inches directly above the top of the pipe. See [Standard Detail 511.01](#).

The metallic warning tape shall be per [paragraph 2.2.2, Warning Tape](#) of this specification. No separate payment will be made for warning tape as it is considered to be incidental to the cost of construction of the line being installed.

3.17.3 FLOWABLE FILL CONCRETE BACKFILL

When directed by the City Engineer, the Contractor shall backfill trenches or undercut areas with flowable fill concrete plant mix. To allow for future re-excavation of filled area, concrete strength shall be liquid enough to flow, be self-leveling, and have an ultimate minimum strength 225 psi (this product is a combination of sand and Portland cement). Except for structural applications, traffic can be placed on mixture within an hour or two after placement. Final surfacing of pavements; however, should be delayed if possible at least 24 hours to allow for shrinkage and hydration of concrete. Depending on depth, a settlement of 2" to 3" is to be expected.

3.17.4 SALVAGE OF USEABLE MATERIALS

All materials such as paving blocks, brick, castings, and pipe etc., removed during excavation that is useable on this project shall only be reused after approval of its use by the City Engineer or the applicable owner of the street right-of-way. Such material shall be stockpiled on site. Unnecessary abuse and damage to these items shall be the Contractors responsibility for replacement at Contractors expense.

End of Section 02275

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