

SANITARY SEWER LINES: DETAILED SPECIFICATIONS FOR INSTALLATION

1. General Provisions
2. Scope of Work
3. Lines and Grades for Sanitary Sewer Lines
4. Clearing of Rights-of-Way
5. Excavation for Pipelines
6. Rock Excavation in Trenches
7. Pavement Cutting and Removal
8. Backfilling Trenches
9. Pipelines Crossing Gravel Drives
10. Pipe Laying - General Provisions
11. Pipe Laying - Vitrified Clay Pipe
12. Pipe Laying - PVC Sewer Pipe
13. Pipe Laying - Ductile Iron Pipe Sanitary Sewer Mains
14. Precast Concrete Manholes
15. Drop Manholes
16. Connections to Existing Sewage Collection System
17. Testing Sewer Lines and Force Mains
18. Setting Ductile Iron Fittings
19. Joint Restraint
20. Concrete Encasement
21. Cast Iron Soil Pipe Stacks
22. Pipelines Under State Highway Pavement
23. Pavement Replacement
24. Existing Pipes, Conduits, and Cables - Care of
25. Responsibility for Damages
26. Signs and Barricades
27. Cleanup
28. Erosion Control
29. Bonds and Permits Required by N. C. State Highway Commission
30. Guarantee
31. Manhole Testing
32. Video Inspection
33. Testing Notice
34. Damaged Piping

1. General Provisions. The following Specifications cover work which is to be furnished and installed under the document containing Sanitary Sewer Improvements.

2. Scope of Work. The work to be performed under this Contract includes the Sanitary Sewer Improvements shown on the Drawings, complete with all appurtenant items, as shown on the accompanying Plans and as described in these Specifications.

3. Lines and Grades for Sanitary Sewer Lines.

The Contractor shall furnish the following material, equipment, and services:

(a) All intermediate lines, grades, hubs, measurements, etc., required for the actual construction;

(b) Suitable laser equipment for installing the pipe at the indicated grade. Installation by batter boards will not be allowed;

(c) Both a transit and leveling instrument with appurtenances, all meeting the Engineer's approval, shall be kept on the construction site and a person skilled in their operation shall be employed or obtained whenever necessary to give or check elevations, levels, alignment, etc., in the work as the Contractor may need and as the Engineer may request;

(d) Two (2) copies of a daily record of the approximate lineal feet and depth of sewer trench opened per pipe size, the lineal feet of each size of pipe installed at the various incremental pay depths, the number and depth of manholes completed, and the completion of all other pay items. This daily record shall also record the time and location of any blasting. Locations of all work and blasting shown on the daily record shall be identified by station numbers;

4. Clearing of Rights-of-Way. The necessary rights-of-way for all lines crossing privately owned property will be secured by the owner. The permanent and temporary construction easements are of size and location as shown on the drawings. The entire width of the permanent right-of-way shall be cleared by the Contractor to its full width and will be left free of all stumps, brush, roots and rubbish. The temporary construction easement may be cleared in part to aid in the installation of the line.

All clearing operations conducted by the Contractor on the temporary construction easement shall be performed in exactly the same manner as that performed on the permanent easement.

Stumps, brush, roots and rubbish resulting from the clearing operation shall not be disposed of by placing on adjoining privately owned property unless the owner of the property in question approves of such disposal, and the Contractor furnishes the Engineer two (2) copies of a written instrument attesting to the said approval signed by the owner of the property.

5. Excavation for Pipelines. All trenches will be excavated in open cut from the surface, except as otherwise provided for herein, and in close conformity to the lines given by the Engineer.

In order that there be sufficient room for properly laying and jointing the pipe, trench widths shall be a minimum of 24" plus the outside pipe diameter. In order to safeguard the pipe, however, the maximum trench width shall not exceed 36" plus the outside pipe diameter unless approval to the contrary is given by the Engineer. Trench widths will be measured between faces of the cut at the top of the pipe.

Where no special bedding is required, trench bottoms may be machine excavated to slightly above grade and cut down to pipe grade by hand in the fine-grading operation. Should the trench bottom be inadvertently cut below grade, it shall be filled to grade with #67 washed stone tamped.

Length of trench open ahead of pipe laying shall be not more than 300 feet, and no less than 20 feet unless approval is obtained from the City and Engineer. Contractor shall open no more trench than can be covered by end of working day.

Wet trenches or those with unstable subgrade shall be stabilized by the use of No. 67 stone.

The Contractor shall keep all trenches free from water during excavation for pipelines. The water shall be pumped out of the ditch or dams built to keep it out of the ditch in such a manner as not to cause injury to the public health, private property, or the work in progress.

Portable bridges shall be erected across trenches, wherever the City deems them necessary to permit the passage of vehicular and/or pedestrian traffic.

The local Fire Department and 911 shall be notified at least 24 hours before any street is blocked by the opening of a trench. The Fire Department shall also be notified when the street is once again open to traffic. The contractor shall provide all temporary signage and barricades which may be required by the Fire Department or the Department of Transportation.

Sheeting or bracing shall be used wherever necessary to prevent caving of the trench banks. The removal of sheeting shall be done in such a manner as to minimize the loss of friction between the trench walls and the backfill. Sheeting shall be cut off and left in place where its removal will adversely affect the pipeline installation.

6. Rock Excavation in Trenches. Should rock be encountered in the trenches, the excavation shall be carried to a depth of 6" below the body of the pipe and the trench shall be brought back to grade with No. 67 Stone properly compacted. In rock excavation areas, the bedding must be #57 stone. Once bedded, pipe must have a minimum of 6" of #57 stone overtop of the pipe. Suitable backfill material shall be defined as stabilization stone, sand, or native material free from rocks of optimum moisture content in order to obtain a compaction of 95% standard proctor. The use of native material shall be subject to the sole approval of the Engineer or his representative.

Should rock be encountered in the trenches and blasting is required for its removal, then all blasting operations shall be conducted in strict accordance with existing ordinances and accepted safe practices relative to the storage and use of explosives.

No rock excavated from trenches larger than 3" diameter shall be used to backfill such trenches and no rock is allowed in the first 24" above the top of the pipe. The items named for the various sizes and classifications of pipe to be installed shall include the removal and disposal off site of such excavated rock material. The contractor shall secure, haul, and place in the trench sufficient suitable backfill material.

The use of native material shall be subject to the sole approval by the Engineer or his representative.

7. Pavement Cutting and Removal. Wherever it becomes necessary to cut pavement, the cuts shall be confined to a maximum width of the nominal pipe diameter plus 24". No pavement shall be cut wider than the Specifications without authorization from the City. All pavement to be

removed shall be marked for cutting by chalk line or other acceptable method. After marking, bituminous pavement shall be sawed to its full depth to a neat and true line along the mark. Concrete pavement shall be sawed to a minimum depth necessary for the smooth cut when broken out. All pavement cut shall be removed from the site of the work and shall not be used to backfill trenches.

8. Backfilling Trenches. Trenches shall be filled in layers six inches (6") deep and thoroughly compacted with mechanical compactors to attain 95% standard proctor. Dry material used in refilling shall be sufficiently moistened so that after compacting future settlement will be at a minimum. Flooring will not be permitted and excess water from any cause shall be removed from the ditch. Material left over from the trench shall be hauled away and no extra compensation will be allowed for such disposal. If native soils from the trench are unsuitable to attain a stable, unyielding trench; the contractor shall provide suitable backfill material as defined in paragraph 6. Compaction testing of the backfill shall be provided by a certified testing firm and paid by the contractor. See additional requirements as indicated under Section 10 and 27 of the Street and Site Improvements specifications.

The top twelve inches (12") of all trenches where pavement has been cut, and where directed by the City, shall be backfilled with crushed stone placed in layers six inches (6") deep and thoroughly compacted. This stone shall be Aggregate Base Course stone meeting the requirements of the N. C. State Highway Commission's "Standard Specifications for Roads and Structures", January 1, 2018 (as amended). It shall be the Contractor's responsibility to maintain all pavement cuts until paved or accepted by the Owner.

Wherever pipelines are laid in the shoulders of paved roads, backfilling shall be accomplished in the same manner as hereinbefore described for trenches in paved roads or streets except that the trench shall be filled to its full depth with earth.

9. Pipelines Crossing Gravel Drives. Wherever a sewer line crosses a gravel drive, it shall be backfilled as hereinbefore described in backfilling trenches for crossing paved roads, except the top six inches (6") shall be filled with thoroughly compacted ABC Aggregate. It shall be the Contractor's responsibility to maintain all drives until accepted by the City.

10. Pipe Laying - General Provisions. The Contractor shall be responsible for all material which may become a part of the finished work until it is finally in place, tested and accepted by the City, except as otherwise provided for herein, and shall remove from the lines any cracked or defective pipe or fittings.

Great care must be exercised by the Contractor in handling lined pipe so as not to injure the linings. A damaged lining in a piece of pipe or a fitting will be deemed sufficient reason for its rejection by the Engineer.

Should any pipe be cracked or defective, the City may allow the Contractor to cut off the cracked or defective portion and lay the remainder of the pipe if, in the City and Contractor's opinion, the cutting of the cracked or defective end will not injure the balance of the pipe. Permitting such cutting off of cracked or defective ends, however, will not absolve the Contractor from any of his responsibility toward the work. Cutting of pipe shall only be done at the end of the pipe unless special permission is given by the City.

Pipe must be of uniform material for gravity sewers between manholes. Change in material is only allowed at manholes.

All pipe shall be thoroughly cleaned of earth and rubbish before being placed in the trench and so kept until final completion and acceptance of the work. Every open end of the pipe shall be securely plugged when pipe laying is not in progress.

All pipe shall be thoroughly flushed and cleaned after installation but prior to acceptance. All connections to existing lines or manholes shall be plugged to prevent mud and water from entering the existing system during construction.

All pipe shall be laid on lines and grades as directed by the Engineer and as shown on the Drawings. All pipe shall be placed on a firm foundation so as to prevent subsequent settlement, and the trenches will be carefully excavated to the proper grade, except where rock excavation is encountered, so that it will be unnecessary to fill in under the pipe. Bell holes shall be provided for all pipe laying modes and special care shall be exercised in obtaining full barrel support.

Trace wire shall be installed on all gravity sewers, services, and force mains that are of material other than Ductile Iron. Trace wire shall be 12-gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Trace wire shall be installed along the entire length of the sewer, service, or force main and should terminate in manholes, cleanouts, valve boxes, and/or in test boxes. Trace wire shall be tested by the contractor and witnessed by the City after backfilling. Any areas that are not detectable shall be repaired at no cost to the City.

11. Pipe Laying – Vitrified Clay Pipe. Vitrified clay pipe may only be installed with special permission of the City. All materials for laying and jointing the pipe in the trench shall conform to the specifications for such materials hereinbefore given and will be furnished by the Contractor. Grade lines for aligning and grading the pipe in the trench will be established by the Engineer, and all material and labor required will be furnished by the Contractor.

Previous to being lowered into the trench, each pipe shall be inspected by the pipe foreman, and faulty pipe rejected and removed from the work. No pipe shall be laid in the trench until the Engineer has been notified of the intention of the Contractor to lay pipe, giving the Engineer sufficient time to check the lines and grades before pipe laying is begun. The Contractor shall notify the Engineer at least three days before work is to begin.

Extra strength Vitrified Clay Pipe, as hereinbefore specified, shall be used regardless of the depth of trench in which it is to be installed.

Class "B" Bedding shall be used in trench depths between 0 feet and 24 feet. All pipe installed in trenches greater than 24 feet shall be installed using Class "A" Bedding.

Upon completion of the work, all lines shall present a clean and unbroken barrel, true to line and grade, and any defective lines shall be repaired, and any deposits removed by the Contractor at his own expense.

12. Pipe Laying - PVC Sewer Pipe. PVC gravity sewer pipe shall be installed using a minimum Class "B" bedding as shown on the plans with a select backfill material to the springline of the pipe. Minimum cover over PVC sewer pipe shall be 3-feet to any subgrade elevation.

Select backfill material is defined as stabilization stone (Size No. 67)

PVC Sewer Pipe shall be installed in accordance with ASTM D221 - Standard Recommended Practice for Underground Installation for Flexible Thermoplastic Sewer Pipe. PVC Sewer Pipe shall be tested by the contractor for deflection. The pipe shall be mandrelled with a rigid device

sized to be cylindrical in shape and constructed with 9 to 10 evenly spaced arms. The mandrel shall be hand pulled by the contractor through all sewer lines. Any sections of sewer not passing the mandrel shall be uncovered and the contractor shall reround or replace the sewer and retest that section of line. The contractor shall submit mandrel drawings and testing schedule to the engineer for approval. The mandrel shall be sized for a 5% deflection allowance.

Previous to being lowered into the trench, each pipe shall be inspected by the pipe foreman, and faulty pipe rejected and removed from the work. No pipe shall be laid in the trench until the Engineer has been notified of the intention of the Contractor to lay pipe, giving the Engineer sufficient time to check the lines and grades before pipe laying is begun. The Contractor shall notify the Engineer at least three days before work is to begin.

All PVC sanitary sewer services shall be placed in stone bedding.

13. Pipe Laying - Ductile Iron Pipe Sanitary Sewer Mains. Wherever, in the laying of sanitary sewer lines, the pipe must be supported on piers, where the pipe crosses surface waters, under a highway that cannot be open cut, in shallow trenches where insufficient cover conditions exist, or in deep trenches with excess of 12-feet of cover, the Sanitary sewer lines shall be of ductile iron pipe. The material for laying and jointing the pipe shall conform to the specifications hereinbefore given for Ductile Iron Pipe. The ductile iron will be paid for at the unit price bid for the different sizes of pipe installed in the various pipe laying conditions. Force mains shall be of size and type as shown on the drawings and shall be installed in conformance to "Pipe Laying - General Provisions".

Previous to being lowered into the trench, each pipe shall be inspected by the pipe foreman, and faulty pipe rejected and removed from the work. No pipe shall be laid in the trench until the Engineer has been notified of the intention of the Contractor to lay pipe, giving the Engineer sufficient time to check the lines and grades before pipe laying is begun. The Contractor shall notify the Engineer at least three days before work is to begin.

All ductile iron pipe gravity sewer shall have a stone bedding placed under pipe.

14. Precast Concrete Manholes. Precast concrete manholes shall be built where shown on the plans or as directed by the Engineer. The inside diameter of the manholes shall be at least four feet (4'). Inverts will be built up to a depth of three-quarters (3/4) of the diameter of the pipeline as directed to properly take care of the flow through the manholes and to ease the drop from one pipe to the other. Benches shall be sloped for drainage, as shown of the Plans. Manholes shall be provided with flexible sleeves sealed with stainless steel bands at each pipe entering or exiting a manhole.

Joints between sections of the precast manhole shall be sealed with a Neophrene "O" Ring Gasket and bitumastic rope. Manholes shall be bedded on layer of crushed stone. The stone shall be the same as that specified for stabilizing ditches (Size No. 67) and shall be spread in a layer at least six inches (6") thick.

The manholes shall be capped with cast iron manhole frames and covers with the frames set in mortar with even bearing. The C.I. Frame shall be anchored to the manhole wall as shown on the plans. Manhole installed in asphalt will have 2' concrete collar surrounding cast-iron frame. After completion, all manholes will be cleaned out and left in a neat condition with all jointing material protruding from joints shall be removed. All riser joints shall be parged with non-shrink grout. Any infiltration into the manhole will not be allowed.

15. Drop Manholes. Drops in manholes greater than 6" but less than or equal to 30", indicate a concrete slide. If the drop exceeds 30" provide an outside drop manhole. The outside drop

manhole shall have a special drop pipe built into the manhole. This drop shall consist of a T-branch in the main sewer where it enters the manhole and a vertical drop pipe down the side of the manhole and supported therefrom and terminating at the bottom by a quarter bend into the manhole. All piping and fittings shall be of restrained joint ductile iron pipe with mega-lugs.

Drop pipe shall be Ductile Iron Pipe and fittings strapped to manhole wall with 1" stainless steel straps and masonry anchor bolts.

16. Connections to Existing Sewage Collection System. Connections to existing sewage collection systems shall be made where shown on the Plans or as directed by the Engineer. Where the connection is made at an existing manhole, it will be necessary to reconstruct the existing invert(s) to accommodate the new line.

In-line sewer connections are to be made with Romac saddles or approved equal.

No connection to existing manholes or sewer lines shall be made until remaining project construction has been completed and tested.

17. Testing Sewer Lines and Force Mains. All utilities (Water, Sanitary Sewer & Storm Sewer) need to be installed prior to testing. After the sewer lines are completed, but prior to their acceptance and before any sewage is permitted to enter, the following test shall be made by the Contractor to determine the watertightness of the lines, including the manholes. The Engineer will determine whether the test to be made shall be for infiltration or exfiltration. If ground conditions are such that an infiltration test would give no significant results, then an exfiltration test shall be made in the manner hereinafter described. The sewer line shall be filled with water to a level equal to the top of the lowest manhole in the section to be tested. At no point in the sewer line shall the head of the pipe reach more than 10 feet of water. The test will not be deemed conclusive, however, unless the head on the pipe reaches at least 3 feet of water at the upper end of the section being tested. Tests shall be run on the lines in separate sections so that the head on the pipe is at least 3 feet of water but does not exceed 10 feet.

Under the exfiltration method the line shall be tested for six hours (6) after filling and the leakage will be carefully measured. Allowable leakage shall be 100 gallons per inch of internal diameter per mile of pipe per 24 hours. If the leakage exceeds this limit the line shall be drained, repaired, and retested. The manholes shall be included in the test.

In the event the Engineer elects to test the sewer line by the infiltration method, the allowable infiltration shall be 10 gallons per inch of internal diameter per mile of pipe per 24 hours. If the infiltration exceeds this limit, the line shall be repaired and retested.

All sewer lines must pass the test requirements prior to their acceptance by the City. Excessive leakage or infiltration in any one section shall be corrected even though the total may come within the allowable limits.

Force mains shall be tested in the manner set forth in Section 13 of AWWA Standard C600, except the Contractor shall furnish his own gauges and perform the test at no cost to the Owner. Before final acceptance, the force main shall be filled with water, care being taken to expel all air.

A pressure test of 150 psi shall be applied to the line at the test pump and shall be maintained at that pressure for a minimum period of two consecutive hours.

All defective material found shall be replaced by the Contractor. All leaking joints shall be made tight. The pipe installation will not be accepted unless and until leakage, evaluated on the pressure test of 150 psi for 2 hours, does not exceed 10.0 gallons per day per mile of pipe per inch of nominal diameter. The contractor has the option of using an air test method in lieu of the exfiltration method in testing the sewer line. The following requirements apply.

Air Test:

Low-Pressure Air Test for Sanitary Sewers:

*Introduction - Numerous laboratory and field air tests have been devised over the years since the early 1960's. Much of the information contained in these tests was utilized by the American Society for Testing and Materials (ASTM) when preparing ASTM C828, a low-pressure air test for sanitary sewers.

Described below is the procedure for air testing sewer lines to demonstrate the integrity of the installed material and the construction methods.

*Summary of Method - The section of the sewer line to be tested is plugged. Low-pressure air is introduced into the plugged line. The amount and rate of air loss is used to determine the acceptability of the section being tested.

*Preparation of the Sewer Line - Flush and clean the sewer line prior to testing, thus serving to wet the pipe surface as well as clean out any debris. A wetted interior pipe surface will produce more consistent results. Plug all pipe outlets to resist the test pressure. Give special attention to stoppers and laterals. Testing to include all completed sewers including sewer services if included as a part of the work.

*Procedures - Determine the test duration for the section under test by computation from the applicable equations shown in ASTM C828, or from prepared air test tables. The pressure-holding time is based on an average holding pressure of 3 psi (21 kPa) gage or a drop from 3.5 psi (24 kPa) to 2.5 psi (17 kPa) gage.

Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi (28 kPa) gage. After an internal pressure of approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi (24 kPa) gage, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psig. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi (7 kPa) gage during the test period, the line is presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psig drop has not occurred.

*Safety - The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 lb. (1112N) is exerted on an 8-in. (203-mm) plug by an internal pipe pressure of 5 psi (34 kPa), it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

As a safety precaution, pressurizing equipment may include a regulator or relief valve set at perhaps 10 psi (69 kPa) to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

*Table - The air test table below has been prepared utilizing applicable equations from ASTM C828. It is based on an allowable air loss of 0.003 ft³/min·ft² of internal pipe surface, a maximum air loss per test section of 3.5 ft³/min and a minimum significant air loss per test section of 2.0 ft³/min. (Test sections of such length that an air loss of 3.5 ft³/min would be exceeded using the allowable loss of air per square foot of internal pipe surface may be tested in segments where total air loss would be between 2.0 and 3.5 ft³/min.). It applies when testing one pipe diameter only and for convenience ignores 4" and 6" lateral sewers, which in most instances create only insignificant differences in test time.

AIR TEST TABLE

Based on Equations from ASTM C828

SPECIFICATION TIME (min:sec) REQUIRED FOR PRESSURE DROP FROM 3-1/2 TO 2-1/2 PSIG

WHEN TESTING ONE PIPE DIAMETER ONLY

PIPE DIAMETER, INCHES

LENGTH OF LINE, FEET	4	6	8	10	12	15	18	21	24
25	0:04	0:10	0:18	0:28	0:40	1:02	1:20	2:01	2:38
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30	-	-
175	0:31	1:09	2:03	3:13	4:37	7:05	-	-	-
200	0:35	1:19	2:21	3:40	5:17	-	-	-	12:06
225	0:40	1:29	2:38	4:08	5:40	-	-	10:25	13:36
250	0:44	1:39	2:56	4:35	-	-	8:31	11:35	15:07
275	0:48	1:49	3:14	4:43	-	-	9:21	12:44	16:38
300	0:53	1:59	3:31	-	-	-	10:12	13:53	18:09
350	1:02	2:19	3:47	-	-	8:16	11:54	6:12	21:10
400	1:10	2:38	-	-	6:03	9:27	13:36	18:31	24:12
450	1:19	2:50	-	-	6:48	10:38	15:19	20:50	27:13
500	1:28	-	-	5:14	7:34	11:49	17:01	23:09	30:14

18. Setting Ductile Iron Fittings. Ductile iron fittings shall be set at locations shown in the Plans or as directed by the Engineer. The installation of fittings shall be made in accordance with Section 10 of AWWA C600. Special care shall be taken to properly bell-up the joints and to support the body of the fitting. All fittings shall be restrained using mega-lug mechanical joint restraints.

19. Joint Restraint. All cast iron or ductile iron fittings, valves, and other sewer main components subject to hydrostatic thrust shall be securely restrained by use of mega-lug mechanical joint restraints and appropriately sized concrete reaction blocking. Reaction blocking shall be 3,000 PSI ready mixed concrete. Sakrete type concrete is not allowed.

20. Concrete Encasement. Wherever in the laying of the sanitary sewer line the pipe is in a shallow trench where insufficient cover conditions exist, or where shown on the Drawings, or as directed by the Engineer, the pipe shall be completely encased in Class "C" concrete. This encasement shall conform to the typical section shown on the drawings. Delivery tickets on the concrete thus shall be turned in to the Engineer no later than the following working day after delivery was made.

21. Cast Iron Soil Pipe Stacks. The cast iron soil pipe stacks shall be installed where shown on the Drawings and to material specifications as hereinbefore specified.

The stack shall be installed as detailed on the Drawings. Care must be taken to properly tamp the earth around stack as the pipe is laid.

The concrete pad is to be poured on undisturbed soil under the 1/4 bend to size as detailed on the Drawings.

22. Pipelines Under State Highway Pavement. Where shown on the Plans, or as directed by the Engineer, ductile iron sewer mains shall be installed under State Highway pavement by encasing in a larger pipe. The carrier pipe shall be of restrained joint ductile iron and the encasement pipe shall be of steel.

The encasement pipe shall be installed true to line and grade and in conformance with the requirements of the N. C. State Highway Commission. The size of the encasement and carrier pipes shall be as shown on the Drawings.

Following the installation of the carrier pipe, the ends of the encasement pipe shall be suitably protected against the entrance of foreign material but shall not be tightly sealed. In general, this may be accomplished by the use of the same stone specified for trench stabilization. The ductile iron carrier pipe shall extend approximately 5.0 feet beyond each end of the encasement pipe.

Pipelines installed under this Section shall not be undertaken without the express approval of the appropriate N. C. State Highway Commission's Division Engineer.

23. Pavement Replacement. All pavement cut and removed from publicly maintained roads, streets or highways as authorized by the Engineer, shall be replaced by the Contractor. Pavement cuts shall be maintained by the Contractor until such time as the pavement has been replaced, but such replacement shall be done as promptly as weather permits. Pavement shall be replaced within 48 hours after being cut. No pavement cuts are allowed on Friday.

24. Existing Pipes, Conduits and Cables - Care of. Special care must be exercised by the Contractor, in the installation of the storm sewers, in passing under or over existing storm sewers, sanitary sewers, water lines, gas lines and telephone or power conduits or cables. All aforementioned structures broken or ruptured by the Contractor must be immediately repaired or replaced by him. It shall be the contractor's responsibility to verify the location of all underground lines before construction.

25. Responsibility for Damages. The Contractor shall be held responsible for all damages claimed, as a result of the installation of this project, to all utility poles, driveways, yards, shrubbery and planting, drain ditches and pipes, pavement, sidewalks, water lines, gas lines, telephone or power conduits or cables, buildings, fences, etc., and will be required to make satisfactory adjustment of all claims arising from the installation of the work contemplated in this contract prior to final settlement.

26. Signs and Barricades. The Contractor shall provide, erect, maintain and illuminate, where necessary, all barricades, warning signs and local detour signs required. The Contractor shall be held responsible for all damages to the project due to the failure of the signs and barricades to properly protect the work from traffic, pedestrians, animals, and from all other sources. Signs and barricades shall comply with Manual on Uniform Traffic Control Devices for Streets and Highways as amended by the N. C. Department of Transportation.

27. Cleanup. Upon installation of the specified improvements, the Contractor shall remove all excess materials, earth, debris, etc., along the line of his work and shall cleanup and leave, in its original or better condition, all affected property. The contractor shall clean up all work to the point of construction activity not less than weekly.

28. Erosion Control.

A. Reference to Other Documents. The General Conditions, Supplementary Conditions, Material Specifications, and Detailed Specifications for Installation contain requirements relevant to the work covered by this Section. Clearing and Grubbing, Site Grading, Clearing of rights of ways, excavating and backfilling, and Spoil Disposal will be subject to the applicable requirements of this Section.

B. General Requirements. Control of erosion and sedimentation resulting from land disturbing activities is subject to the requirements of the North Carolina Sedimentation Control Commission. Any authorized representative or agent of the commission shall be granted entry or access for purposes of inspection; he shall not be obstructed, hampered, or interfered with while he is in the process of carrying out his official duties. The requirements for erosion and sedimentation control apply to areas which are involved in borrow, waste disposal, and topsoil storage activities; and to areas which are directly involved with the construction of buildings, paving, curb, gutter, and to areas where storm drainage, water, and sewer lines and structures are installed. No Construction shall take place until erosion control permit is in hand and erosion control devices are installed.

Land disturbing activities shall be planned and carried out to achieve the following objectives:

- 1) Expose minimum sized areas at any one time
- 2) Limit exposures of areas to the shortest possible time
- 3) Control surface water run-off to reduce erosion and sediment loss
- 4) Hold off-site erosion and sedimentation damage to a minimum

With reference to requirement No. 2, portions of the site on which land disturbing activities have been undertaken, but upon which no further active construction takes place for a period of 15 working days, shall be planted or otherwise provided with a ground cover sufficient to restrain erosion.

The Contractor shall be responsible for maintaining all temporary and permanent erosion and sedimentation measures and facilities until the project is accepted by the City, or until removal of facilities and cessation of control measures is authorized by the Engineer.

C. Work Included. This Section includes the labor, materials, equipment, and related services required for the installation of berms, drainage structures, storm water drains, straw barriers, vegetative covers, and other devices or methods for control of erosion and sedimentation shown on the Drawings or specified herein.

D. Facilities and Measures for Erosion and Sedimentation Control.

1) Phased Construction. The installation of improvements shall be done in phases as specified on the construction drawings.

This phasing of construction will help limit erosion caused during the installation of the improvements and will act as an erosion control measure.

2) Clearing and Grubbing. The Contractor is to clear the entire width of the permanent easement of trees, stumps, shrubs, and brush. The natural vegetative cover is to remain intact until the installation of the line begins, except that which has to be removed during the clearing and grubbing operation. Stumps, brush, and rubbish resulting from the clearing operation shall not be disposed of by placing on adjoining privately owned property unless the Contractor has a written instrument from the property owner. All other spoil is expected to be trucked off to the sanitary landfill for disposal.

3) Rip Rap. Rip Rap shall be installed at locations as shown on plans or as directed by the Engineer per the NC DENR erosion control manual.

4) Berms. Drainage berms and ditches shall be installed as shown on the Drawings per the NC DENR erosion control manual.

5) Silt Fence. Silt fences shall be installed as shown on the Drawings or when directed by the Engineer per the NC DENR erosion control manual.

6) Excelsior Matting. Matting shall be installed at location shown on the Drawings and shall be in compliance with "Standards and Specifications for Soil Erosion and Sediment Control" by the Land Quality Section of NCDENR per the NC DENR erosion control manual.

7) Utility Line Installation. Soil resulting from trench excavation to be used as backfill material shall be placed on the uphill side of the trench. This will prohibit runoff directly into the creek. No excavation shall be placed in the creek or on the bank at any time. Rock encountered during excavation shall be removed from the site and shall not be disposed of by placing on adjoining privately owned property.

8) Permanent Vegetative Cover. Prepare seedbed by ripping, chiseling, harrowing or plowing to depth of six inches so as to produce a loose, friable surface. Remove all stones, boulders, stumps or debris from the surface which would prohibit germination or plant growth per the NC DENR erosion control manual.

Incorporated into the soil 800 to 1,000 pounds of 10-10-10 fertilizer plus 500 pounds of twenty percent (20%) Superphosphate per acre and two tons of dolomitic lime per acre unless soil tests indicate that a lower rate can be used.

Mulch after seeding with 2.0 tons of grain straw per acre and either crimp straw into soil or tack with liquid asphalt at 400 gallons per acre or emulsified asphalt at 300 gallons per acre.

PERMANENT SEEDINGS

<u>PLANTS & MIXTURE</u>	<u>PLANTING RATE/ACRE</u>	<u>PLANTING DATES</u>
TALL FESCUE (LOW MAINTENANCE)	100-150 LBS.	AUG. 15 - OCT. 15 FEB. 15 - MAY 1
TALL FESCUE WATERWAYS AND LAWNS (HIGH MAINTENANCE)	200-250 LBS.	AUG. 15 - OCT. 15 FEB. 15 - MAY 1
BLEND OF TWO TURF-TYPE TALL FESCUES (90%) AND TWO OR MORE IMPROVED KENTUCKY BLUEGRASS VARIETIES (10%) (HIGH MAINTENANCE)	200-250 LBS.	AUG. 15 - OCT. 15 FEB. 15 - MAY 1
TALL FESCUE AND KOBE OR KOREAN LESPEDEZA	100 LBS. & 20-25 LBS.	FEB. 15 - MAY 1 AUG. 15 - OCT. 15
TALL FESCUE AND SERICEA LESPEDEZA	50 LBS. 60 LBS./ACRE	NOV. 1 - FEB. 1 (UNSCARIFIED)
TALL FESCUE AND GERMAN MILLET OR SUNDANGRASS	70 LBS. AND 40 LBS.	JULY AND AUGUST
TALL FESCUE AND RYEGRAIN	70 LBS. AND 25 LBS.	NOV. 1 - JAN. 30
COMMON BERMUDAGRASS	8 LBS. (HULLED) 15-20 LBS. (UNHULLED)	APRIL 15 - JUNE 30 FEB. 1 - MARCH 30

Permanent Seeding Notes:

1. For spring seedlings, use scarified lespedeza seed. For late fall and winter seedings, use unscarified seed.
2. Annuals such as millet, sundangrass and ryegrain must be kept at 10-12" maximum height. The use of annual rye grass is not permitted.

The preceding permanent cover requirements pertain to all areas disturbed during the project construction including road shoulders, temporary access roads, spoil areas, building sites, rights-of-way, easements and line work.

29. Bonds and Permits Required by N. C. State Highway Commission. The Contractor, at his own expense, will secure from the N. C. State Highway Commission, the "Encroachment Agreement" required prior to the installation of that portion of this project that lies within the right of way of the said Commission. Any or all other bonds and/or permits required by the said Commission in connection with this project shall be provided and paid for by the Contractor. This relates especially to the "Permit to Open Pavement" and the performance bond.

30. Guarantee. The Contractor shall guarantee that if any materials, equipment or workmanship covered by these Specifications and the accompanying Drawings proves defective within one

year after final acceptance, such defects shall be made good by him. The Engineer shall provide a letter to the City indicating the start of the 12-month guarantee period. Provide State required certifications and “As Builts” with guarantee letter.

31. Manhole Testing. This section is to supplement the manhole specifications. All manholes shall be tested using either the exfiltration test or vacuum test as specified below. Manholes shall be tested by plugging the inlet and outlet lines with airtight plugs prior to performing the manhole test.

- a. Exfiltration: Fill the manhole to the rim with water and allow the level to equalize due to saturation.

Refill the manhole and mark the level to begin the test. The test shall last at least 2 hours and allowable leakage shall be 3 gallons per hour. Manholes that fail the test shall be repaired as necessary and retested until they pass.

- b. Vacuum Air: The manhole shall be sealed at the top of the rim with the test rig and shall have 10-inches of mercury applied through the rig. The time for the mercury to drop from 10-inches to 9-inches shall be measured. The minimum test time for the specified drop shall not be less than that shown in the following table. All manholes on the project shall be tested. If any manhole fails, it shall be repaired as necessary and retested until it passes.

<u>Manhole Depth</u>	<u>Diameter of Manhole</u>		
	48" Ø	60" Ø	72" Ø
≤ 10 ft.	60 sec.	75 sec.	90 sec.
> 10 ft. but < 15 ft.	75 sec.	90 sec.	105 sec.
> 15 ft.	90 sec.	105 sec.	120 sec.

32. Video Inspection. All sewers and sewer services shall be video inspected by the Contractor and a copy of such video delivered to the City in DVD format. Prior to the video of the sewers, all lines shall be pressured cleaned and flushed and the contractor shall pour 5 gallons of water down each service. All defects noted during the video inspection shall be corrected by the Contractor. The Contractor shall provide 48 hours’ notice to the City prior to the cleaning and/or video inspection in the event the City desires to witness the inspection.

33. Testing Notice. Notice to the City, for any testing related to sewer line work, will be required of the Contractor, 48 hours in advance of testing.

34. Damaged Piping. Should any piping be damaged prior to acceptance by the City, the whole joint will be replaced.