ADDENDUM NUMBER THREE

Lupton Mill Site Remediation

FOR THE CITY OF CHATTANOOGA, TENNESSEE

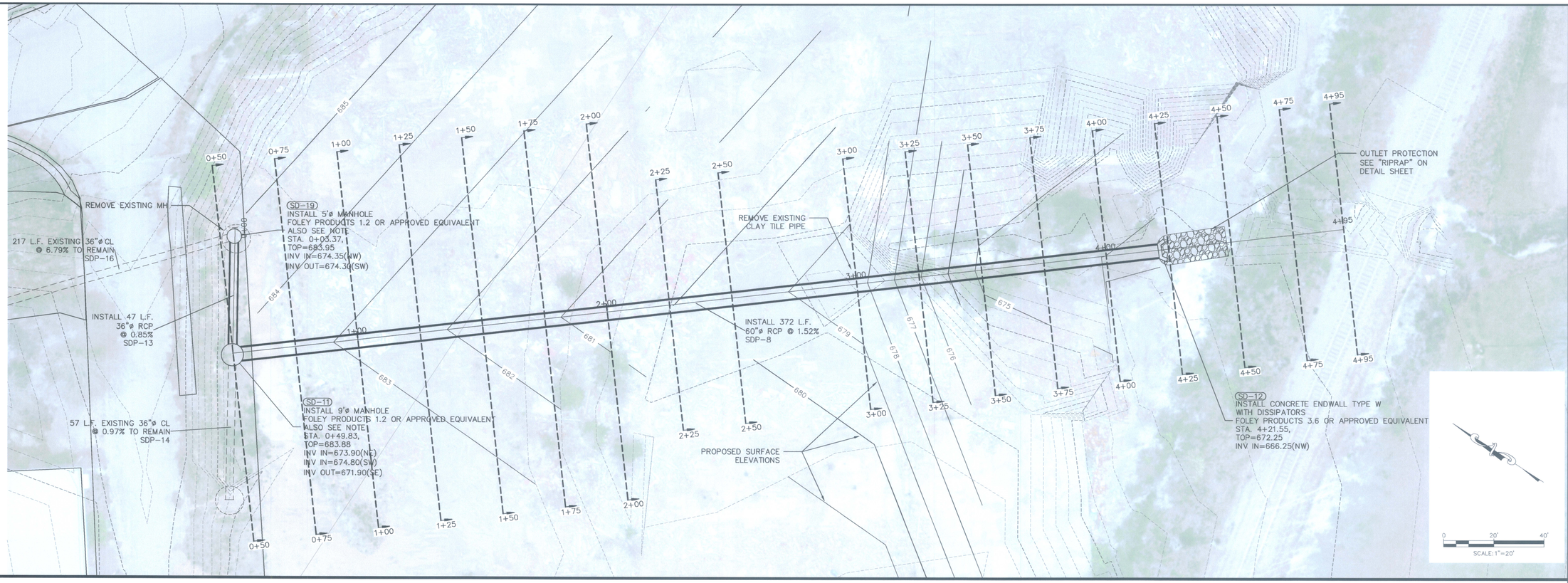
Contract Number E-16-006

The attached sheets ST-1 through ST-3 are added to the plan set. They were accidently omitted from the original plan set.

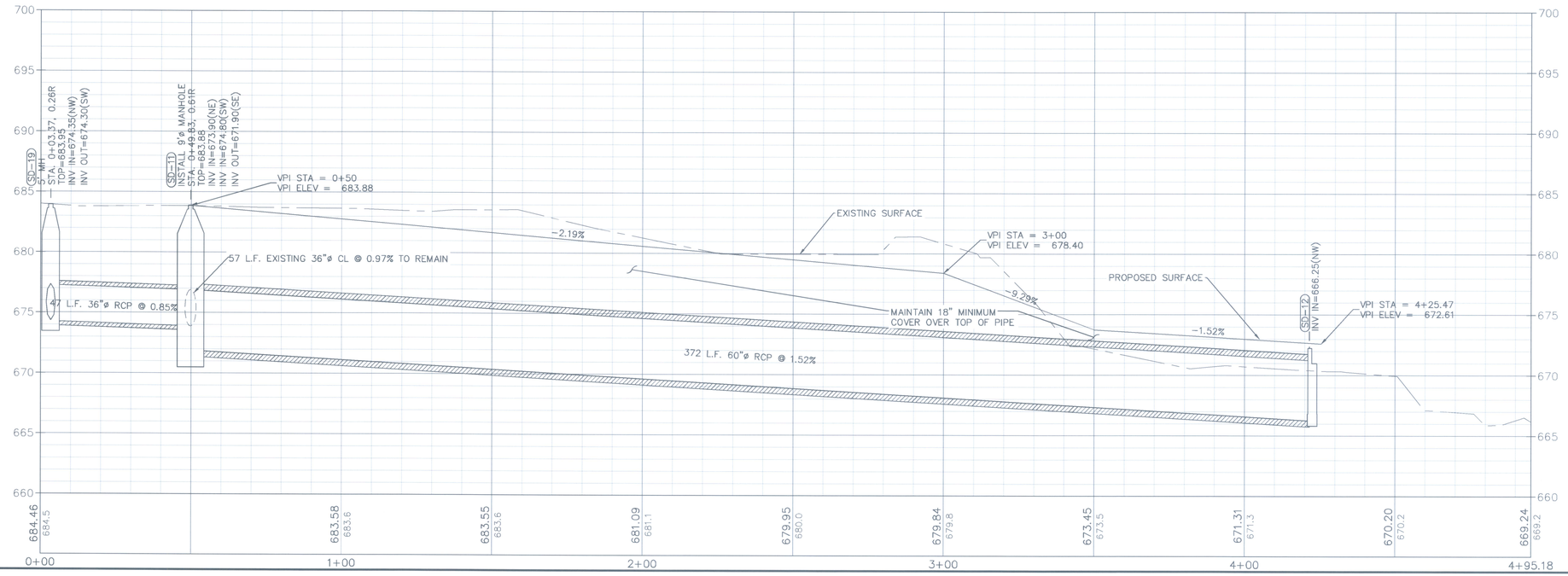
The attached specification sections 74 through 24100 are added to the written specifications. They were accidently omitted from the original specifications.

December 13, 2018

/s/ Justin C. Holland, Administrator
City of Chattanooga
Department of Public Works



NOTE:
FOR STORM STANDARD FRAME AND COVER SEE SD-301.03



SCALE:
1"=20' HORZ.
1"=5' VERT.

CITY OF CHATTANOOGA
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

ADMINISTRATOR: JUSTIN HOLLAND
CITY ENGINEER: WILLIAM C. PAYNE, P.E.

LUPTON DRIVE MILL PROPERTY
PLAN AND PROFILE
PROPOSED STORM SEWER

NO.	DATE	REVISION	SIG.
0	11/28/18	ORIGINAL	

CONTRACT#	E-16-006
SCALE:	AS SHOWN
DRAWN:	CBW
DESIGN:	SOC
CHECKED:	SOC

SANDRA LYNN O'CONNOR
REGISTERED ENGINEER
No. 119721
STATE OF TENNESSEE
TN REGISTRATION NO. 119721

SHEET: ST-1

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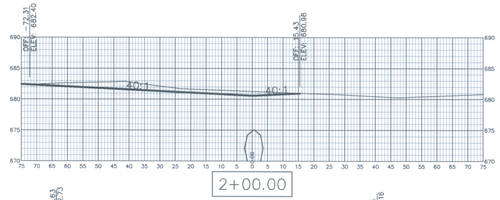

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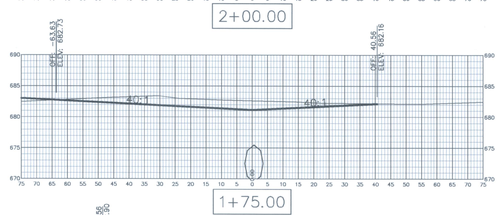

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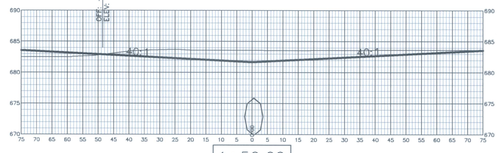

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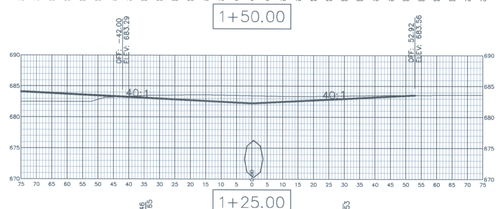

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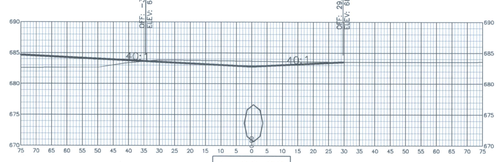

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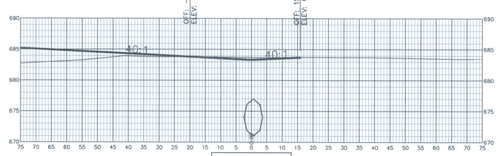

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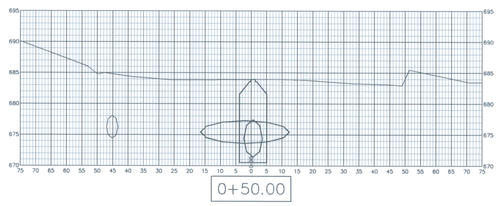

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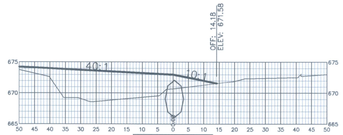

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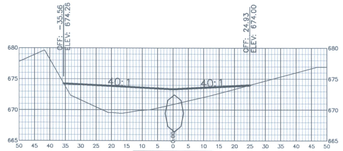

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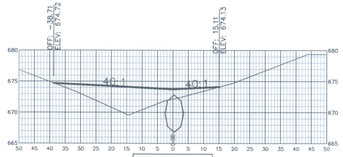

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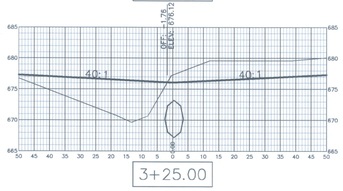

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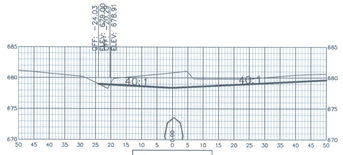

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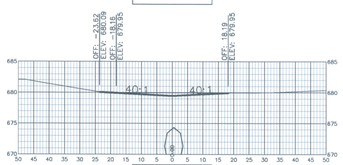

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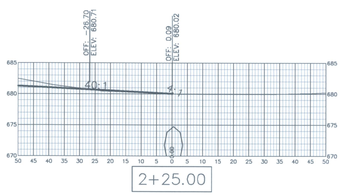

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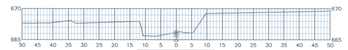

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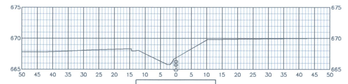

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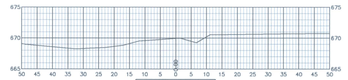

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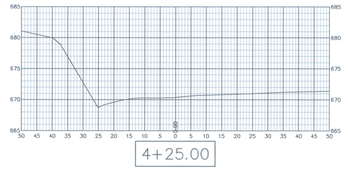

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CITY OF CHATTANOOGA
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

ADMINISTRATOR: JUSTIN HOLLAND
CITY ENGINEER: WILLIAM C. PAYNE, P.E.

LUPTON DRIVE MILL PROPERTY
CROSS-SECTIONS
PROPOSED STORM SEWER

NO.	DATE	REVISION	SIG.
0	11/28/18	ORIGINAL	

CONTRACT#	E-16-006
SCALE:	N.T.S.
DRAWN:	CBW
DESIGN:	SOC
CHECKED:	SOC

SANDRA LYNN O'CONNOR — REGISTERED ENGINEER — No. 118972 — STATE OF TENNESSEE
12-28-18
TN REGISTRATION NO. 118972

SHEET: ST-2

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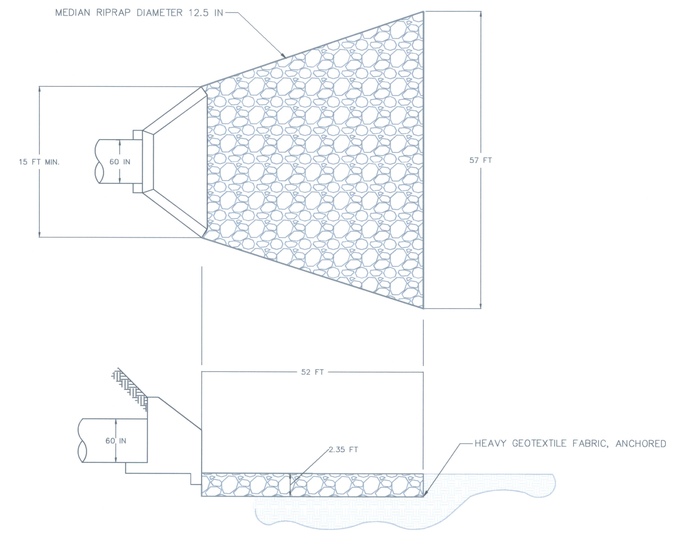
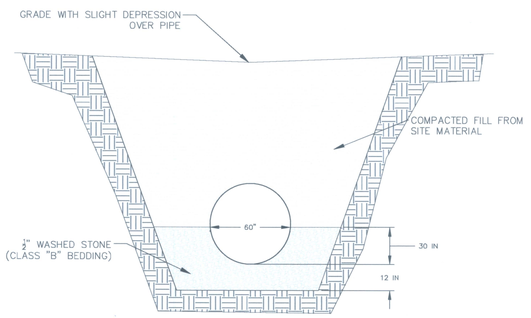


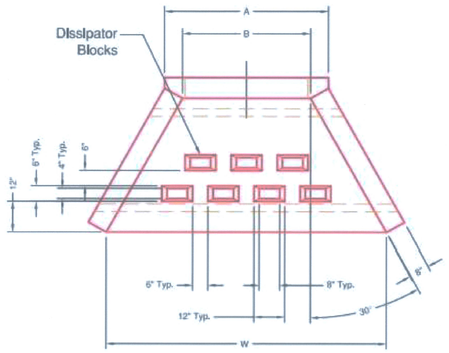
RIPRAP DETAIL
N.T.S.



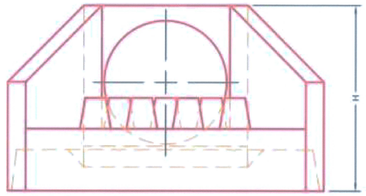
PIPE TRENCH DETAIL
N.T.S.

Pipe Size	Hole Size	"W"	"L"	"H"	"A"	"B"	"C"	"D"	"E"	"F"	"G"	Qty Of Dissipators	Weight
30" RCP 36" RCP	40" 48"	110"	60"	72"	64"	50"	48"	18"	13" 6"	145" 8"	5" 6"	7 (2 Rows)	9,979 Lbs.
42" RCP 48" RCP	54" 62"	146"	74"	87"	80"	70"	63"	27"	16" 8"	165" 8"	6" 7"	11 (2 Rows)	15,637 Lbs.
54" RCP	70"	172"	88"	98"	89"	80"	74"	33"	6"	9"	8"	24 (3 Rows)	21,676 Lbs.
60" RCP	76"												

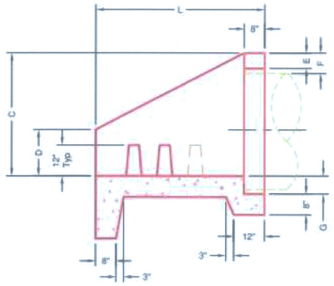
Hole Size For All Other Pipe Types Will Be Pipe O.D.+ 2"–4"



PLAN VIEW



FRONT VIEW



SECTION A-A

ENDWALL WITH ENERGY DISSIPATOR BLOCKS
N.T.S.

CITY OF CHATTANOOGA
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

ADMINISTRATOR: JUSTIN HOLLAND
CITY ENGINEER: WILLIAM C. PAYNE, P.E.

LUPTON DRIVE MILL PROPERTY
DETAIL SHEET
PROPOSED STORM SEWER

NO.	DATE	REVISION	SIG.
0	11/28/18	ORIGINAL	

CONTRACT#	E-16-006
SCALE:	N.T.S.
DRAWN:	CBW
DESIGN:	SOC
CHECKED:	SOC

SANDRA LYNN O'CONNOR REGISTERED ENGINEER XVI 118972 STATE OF TENNESSEE
Sandra Lynn O'Connor 12-3-18
TN REGISTRATION NO. 118972

SHEET: ST-3

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ITEM 74

MISCELLANEOUS MATERIALS

74.01 WATER

Water used in mixing concrete shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter, or other substances injurious to the finished product. Water will be tested in accordance with AASHTO, "Standard Method of Test for Quality of Water to be Used in Concrete," Serial Designation T 26. Water known to be of potable quality may be used without test. Where the source of water is relatively shallow, the intake shall be so enclosed as to exclude silt, mud, grass, or other foreign materials.

74.02 CALCIUM CHLORIDE

Calcium chloride shall conform to the requirements of AASHTO, "Standard Specification for Calcium Chloride," Serial Designation M 144, for the type specified.

74.03 SODIUM CHLORIDE

Sodium chloride shall conform to the requirements of ASTM, "Standard Specification for Sodium Chloride," Serial Designation D 632, for the type specified.

74.04 HYDRATED LIME

Hydrated lime shall conform to ASTM, "Standard Specification for Hydrated Lime for Masonry Purposes," Serial Designation C 207, Type N, except that Section 3 (b), 4, and 5 will not be applicable.

74.05 METAL CENTER STRIP

Metal center strip shall be of an approved type, shall not be lighter than sixteen gauge, and shall be painted or galvanized.

74.06 ASPHALT PLANT

Asphalt plant shall meet the requirements of AASHTO, "Standard Specification for Asphalt Plank," Serial Designation M 46, for the type specified.

74.7 PRECAST MANHOLE RISERS AND TOPS

These items shall conform to ASTM, "Standard Specification for Precast Reinforced Concrete Manhole Sections," Serial Designation C 478.

74.08 PRECAST REINFORCED CONCRETE CATTLE PASS UNITS

If these units are designed by the producer, completely detailed drawings and design computations shall be submitted to the Engineer for approval in advance of the start of manufacture. If the units are designed by the City, the applicable standard drawing sheet shall govern. Details of manufacture shall conform in all other respects to the applicable provisions of ASTM, "Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe," Serial Designation C 76. No strength tests will be required on the completed units, but the City reserves the right to conduct continuous inspection at the site of production, and to sample and test all component materials, including the concrete, for conformity of these Specifications.

74.09 CHEMICAL ADDITIVES

(a) For Portland Cement Concrete Mixtures

These additives shall conform to the requirements of AASHTO, "Standard Specification for Chemical Admixtures for Concrete," Serial Designation M 194, covering the following five types:

Type A	Water-Reducing Admixtures
Type B	Retarding Admixtures
Type C	Accelerating Admixtures
Type D	Water-Reducing and Retarding Admixtures
Type E	Water-Reducing and Accelerating Admixtures

Before any admixture is approved for use in Portland Cement concrete mixtures under these Specifications, the manufacturer of the admixture or the Contractor shall furnish the City documentary evidence that the material proposed for use has been tested in accordance with the methods of test specified in AASHTO, "Standard Specification for Chemical Admixtures for Concrete," Serial Designation M 194, and meets the requirements of that Specification. Documentary evidence shall be the results of tests conducted by a testing laboratory inspected at regular intervals by the Cement and Concrete Reference Laboratory of the National Bureau of Standards and approved by the City. The City may from time to time require a notarized certification from the manufacturer stating that the material is identical with that originally approved and has in no way been changed or altered.

(b) Asphalt To Be Used In Hot Bituminous Mixtures

Heat-stable asphalt anti-stripping additive shall contain no ingredient harmful to the bituminous material or to the operator and shall not appreciably alter the specified characteristics of the bituminous material when added in the recommended proportions.

The manufacturer shall recommend the percentage of his compound to be used, not to exceed 1.0 percent, but in no case shall the percentage of active agent added be less than 0.5 percent by weight of the asphalt cement.

The manufacturer shall furnish the City an affidavit stating the percentage by weight of active agent in the anti-stripping additive proposed for use.

The treated asphalt cement shall show no evidence of stripping when tested in accordance with Item 73.18.

74.10 MASONRY STONE

Masonry stone shall be sound, dense and durable, free from cracks, pyrite intrusions and other structural defects. Stone which will be used with mortar shall be free from dirt, oil, or other material that might prevent good adhesion with the mortar.

When tested by the Los Angeles Test Method, the percent of wear shall not exceed sixty.

When the crushed aggregate is subjected to five alternations of the sodium sulfate soundness test, the weighted percentage of loss shall be not more than fifteen.

74.11 WATERSTOPS

Waterstops shall be of the type, shape and dimensions shown on the Plans.

(a) Metallic

Metallic waterstops shall be sheet copper conforming to the requirements of Item 908.15 of the Tennessee Department of Transportation Specifications.

(b) Nonmetallic

Nonmetallic waterstops shall be manufactured from either natural rubber, synthetic rubber, or polyvinyl-chloride (PVC) at the option of the

Contractor. Waterstops shall be produced by such a process that, as supplied for use, they will be dense, homogeneous, and free from holes and other imperfections. The cross-section of the water stop shall be uniform along its length and transversely symmetrical so that the thickness at any given distance from either edge of the waterstop will be uniform.

(1) Rubber Waterstop

The waterstop shall be fabricated from a high grade thread-type compound. The basic polymer shall be natural rubber or a co-polymer of butadiene and styrene, or a blend of both. The compound shall contain not less than seventy percent by volume of the basic polymer, and the remainder shall consist of reinforcing carbon black, zinc oxide, accelerators, anti-oxidants, vulcanizing agents, and plasticizers, but shall contain no Factise.

Samples taken from the finished waterstop shall meet the following requirements when tested in accordance with the current specified ASTM method of test.

Title	ASTM Method Requirement of Test	
Tensile Strength (Die "C")	2500 psi, min.	D 412
Ultimate Elongation (Die "C")	450 percent min.	D 412
Shore Durometer Hardness	60-70	D 2240
Specific Gravity	1.5 +/- 0.03 (Sec. 17)	D 297
Water Absorption (% by Wt.)	5 percent	D 570
Tensile Strength after accelerated aging, oxygen-pressure method	80 percent min.	D 572

(2) Polyvinyl Chloride Waterstop

This waterstop shall be extruded from an elastomeric plastic material. The material shall be a plastic compound, the basic resin of which shall be polyvinyl chloride. The compound shall contain any additional resins, plasticizers, stabilizers, or other materials needed to insure that when the material is compounded it will meet the performance requirements of this Specification. No reclaimed polyvinyl chloride shall be used.

(3) Finished Waterstop

Samples taken from the finished waterstop shall meet the following requirements when tested in accordance with the current specified ASTM method of test.

Title	Requirement of Test	ASTM Method
Tensile Strength (Die "C")	2500 psi, min.	D 412
Ultimate Elongation (Die "C")	280 percent min.	D 412

(4) Sheet Material

Samples taken from the sheet material shall meet the following requirements when tested in accordance with the current specified ASTM method of test or the specified Civil Works Guide Specification CE 1402, "Metals, Miscellaneous Materials and Standard Articles."

Title	Requirement of Test	Method
Tensile Strength (Die "C")	1750 psi min.	ASTM D 412
Ultimate Elongation (Die "C")	350 percent min.	ASTM D 412
Stiffness in Flexure (1/4" span)	400 psi min.	ASTM D 747
Cracking or Chipping @ -35 F	Nil	ASTM D 746
Tensile Strength (Die "C")	1500 psi min.	Accelerated Extraction Test CE 1402
Ultimate Elongation (Die "C")	300 percent min.	Accelerated Extraction Test CE 1402
Change in Weight after 7 Days	0.00 to +0.25	Effect of percent Alkalies Test CE 1402
Change in Weight After 30 Days	0.00 to +0.40	Effect of percent Alkalies Test CE 1402
Change in Shore Durometer Hardness	+/- 5	Effect of Alkalies Test CE 1402
Change in Thickness After 30 Days	+/- 1 percent	Effect of Alkalies Test CE 1402

For polyvinyl chloride waterstops, the supplier shall submit a certificate stating that all of the performance requirements specified for the sheet material under polyvinyl chloride waterstops have been complied with. In addition, the supplier shall submit an affidavit to the effect that the sheet sample is of the same material in all respects as that to be used in the manufacture of the finished waterstop. The

supplier shall also specify the value of the specific gravity of the finished waterstop material to within plus or minus 0.02.

Waterstops shall be manufactured with an integral cross section which shall be uniform within plus or minus 1/8" in width, and the web thickness or bulb diameter within plus 1/16" and minus 1/32".

The Contractor shall furnish the City of Chattanooga at no cost to the City a certified test report from an approved laboratory covering each lot or unit of finished waterstops. These test reports shall contain the numerical laboratory test data of the required tests.

74.12 EPOXY RESIN SYSTEMS

Two-component epoxy resin systems for application to Portland Cement Concrete, bituminous concrete, and metals shall conform to the requirements of AASHTO, "Standard Specification and Recommended Practice for Epoxy Protective Coatings," Serial Designation M 200. These systems shall be supplied in one of the following types as designated;

Type A-A Polysulfide-modified system blended with mineral filler.

Type B-A Clear or light-colored amine or polymide-cured system.

Type C-A Coal-tar modified system

74.13 SELECT MATERIAL FOR SOIL-CEMENT BASE

Select material for soil-cement base shall be of such general character as to be classified as Group A-1 or A-2, AASHTO, "Recommended Practice for the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes," Serial Designation M 145. The material shall be of such size that all will pass the standard 1-1/2" sieve. Samples of the select material shall be tested in the laboratory before work is started for determination of cement content and optimum moisture content.

74.14 GRASS SEED

The seed shall meet the requirements of the Tennessee Department of Agriculture and no "Below Standard" seed will be accepted.

Grass seed furnished under these Specifications shall be packed in new bags or bags that are sound and not mended.

The vendor shall notify the City before shipments are made so that arrangements can be made for inspection and testing or stock.

The vendor shall furnish the City a certified laboratory report from an accredited commercial seed laboratory or from a State seed laboratory showing the analysis of the seed to be furnished. The commercial fertilizers as specified in Item 74.15 shall have a minimum of 3-1/2% nitrogen. The report from an accredited commercial seed laboratory shall be signed by a Senior Member of the Society of Commercial Seed Technologists. At the discretion of the City, samples of seed may be taken for check against the certified laboratory report. Sampling and testing will be in accordance with the requirements of the Tennessee Department of Agriculture.

When a seed group is used, the percentages forming the group shall be as follows, unless otherwise specified:

Name	Quantity Percent by Weight
Group "A"	
Lespedexa (Common or Korean)	20%
Sericea Lespedeza	15%
Ky. 31 Fescue	40%
English Rye	15%
White Dutch Clover	5%
Weeping Love Grass	5%
Group "B"	
Ky. 31 Fescue	55%
Redtop	15%
English Rye	20%
White Dutch Clover	5%
Weeping Love Grass	5%
Group "C"	
Sericea Lespedeza	50%
Ky. 31 Fescue	30%
English Rye	15%
White Dutch Clover	5%

In mixing or forming "Groups" of seed, they shall be uniformly mixed. "Group" seed shall not be mixed until after each type seed that is used to form the "Group" has been tested and inspected separately and approved for purity and germination by the City. Seed mixed before tests and inspection are made will not be accepted.

74.15 COMMERCIAL FERTILIZER

Manufactured fertilizer shall be a standard commercial fertilizer containing the specified percentages by weight of nitrogen (N), phosphoric acid (P O) and potash (K O).

The fertilizer shall be furnished in standard containers with the name, weight and guaranteed analysis of the contents clearly marked. The containers shall insure proper protection in handling and transporting the fertilizer.

All commercial fertilizer shall comply with local, state and federal fertilizer laws.

74.16 AMMONIUM NITRATE

Ammonium nitrate shall be a standard commercial product, shall conform to the requirements for other commercial fertilizers as specified in Item 74.15 and shall have a minimum of 33-1/2 percent nitrogen.

74.17 AGRICULTURAL LIMESTONE

Agricultural limestone shall contain not less than eighty-five percentof calcium carbonate and magnesium carbonate combined, and shall be crushed so that at least eighty-five percent will pass the No. 10 mesh sieve.

74.18 MULCH MATERIAL

All mulch materials shall be air dried and reasonably free of noxious weeds and weed seed, or other materials detrimental to plant growth.

Hay shall be stalks of approved grasses, sedges or legumes seasoned before baling or loading.

Straw shall be stalks of rye, oats, wheat or other approved grain crops.

Both hay and straw shall be suitable for spreading with standard mulch blower equipment.

74.19 JUTE MESH

Jute mesh shall be of a uniform, open, plain weave of single jute yarn. The yarn shall be of loosely twisted construction and shall not vary in thickness by more than one-half of

its normal diameter. Jute mesh shall be furnished in rolled strips and shall meet the following requirements.

Jute mesh shall be nontoxic to the growth of plants and germination of seeds, and shall be identified by tag. It shall have 58 wrap ends per yard, 41 weft ends per yard, and have an average weight of 0.9 pounds per square yard, with an allowable deficiency of not more than five percent.

All materials shall be new and unused, and the length shall be marked on each roll. Staples shall be machine made of No. 11 gauge new steel wire formed into a "U" shape.

74.20 LINSEED OIL PRESERVATIVE

Linseed oil preservative shall consist of fifty percent boiled linseed oil, and fifty percent petroleum spirits (mineral spirits), meeting the requirements of Item 604.28 of the Tennessee Department of Transportation Standard Specifications. The linseed oil and petroleum spirits shall be agitated and thoroughly mixed prior to application.

74.21 GROUT

Grout shall be mixed in small quantities as needed, and shall not be re-tempered or used after it has begun to set. Unless otherwise specified or directed, the grout shall consist of one part Portland Cement and three parts sand mixed with sufficient water to form a grout of proper consistency. When non-shrinking fast-setting grout is specified, it shall be formulated by the incorporation of an admixture, or a premixed grout may be used. The formulation and the admixture or the premixed grout used will be subject to the approval of the Engineer, and shall be mixed and used in accordance with the recommendations of the manufacturer. These special grouts will be classified as follows:

Type I - Non-shrinking grout
Type II - Non-shrinking, fast-setting grout

Portland Cement for grout shall conform to the requirements of Item 73.01. Sand for grout shall conform to the requirements of Item 73.02. Water for grout shall be approved by the Engineer.

74.22 MANHOLE STEPS

Steps used in manholes or catch basins shall be cast iron, aluminum or wrought iron, unless otherwise specified. The design of the steps shall be as shown on the Plans.

(a) Cast iron steps shall conform to the requirements of Item 908.07 of the Tennessee Department of Transportation Standard Specifications.

(b) Aluminum steps shall be fabricated from aluminum alloy 6060, T 60 with a minimum tensile strength of 3800 psi, a minimum yield strength of 3500 psi, and an elongation in two inches of not less than 10 percent.

74.23 RED IRON OXIDE

Red iron oxide for coloring concrete shall be a mineral product containing no organic coloring matter and shall conform to the following requirements:

Loss on ignition	4 percent, maximum
Iron Oxide, as F	80 percent, minimum
Passing 325 mesh sieve	97 percent, minimum

74.24 INOCULANTS FOR LEGUMES

Inoculants for treating legume seed shall be standard cultures of nitrogen-fixing bacteria that are adapted to the particular kind of seed to be treated. The inoculant shall be supplied in convenient containers of a size sufficient to treat the amount of seed to be planted. The label on the container shall indicate the specified legume seed to be inoculated and the date period to be used.

END OF DOCUMENT

ITEM 75 - COLD PLANING OF BITUMINOUS PLANT MIX PAVEMENTS

75.01-Description.

This work shall consist of cold planing an existing bituminous plant mix pavement in accordance with the requirements of these Specifications and in reasonably close conformity with the lines and grades shown on the Plans or established by the Engineer.

75.02-Equipment.

All equipment necessary for the satisfactory performance of this work shall be on hand and approved before work will be permitted to begin. The required equipment shall include a power broom, a water truck, and a planing machine. Equipment shall be furnished to remove the material planed from the pavement. The planing machine shall be a power operated, self-propelled milling machine or grinder capable of removing bituminous concrete to the required width, depth, profile, cross-slope and surface texture. The machine shall be capable of accurately establishing profile by referencing from either the existing pavement or from an independent grade control and shall have positive means for controlling cross-slope. The machine shall have a floating moldboard with sufficient down pressure to plane the milled surface. The machine shall have an effective means of removing cuttings from the pavement and for preventing dust from escaping into the air. When milling the Interstate or controlled access freeways, the planing machine shall be equipped with a cutter drum at least 12 feet wide and be capable of restoring pavement profile with either a contact or noncontact leveling system. A contact leveling system shall be a minimum of 40 feet in length and the non-contact leveling system shall have a minimum of 3 sensors dispersed the length of the machine.

The maximum spacing between teeth on the cutter drum shall not exceed 5/8 inch. Supplemental equipment shall be provided as necessary to remove material in areas that cannot be reached by the planing machine.

75.03-General Requirements.

The operations shall be so arranged that no vertical longitudinal faces exceed 1-1/4 inch in height in areas to be used by public traffic. Transverse faces shall be tapered in a manner approved by the Engineer to avoid creating a hazard for traffic. The Contractor shall be required to cold plane in the direction of traffic. The planing machine shall operate at a consistent forward speed to provide an acceptable surface texture. The maximum allowable forward speed shall be 60 ft/min when the teeth spacing is between ½ inch and 5/8 inch, and the maximum allowable forward speed shall be 80 feet/min when the teeth spacing is less than ½ inch.

After planing, the finished surface shall provide a smooth riding surface free from scallops, scabs, gouges, ridges, oil film, and other imperfections of workmanship, having a uniform texture, and true to the required grade and cross section. The elevation of the longitudinal edges of adjacent cuts shall not differ more than 1/8 inch.

Milling shall not commence unless the subsequent layer of pavement can be placed within limitation specified in **ITEM 12.09**.

The planed pavement shall be thoroughly swept immediately behind the machine and all materials swept up shall be loaded and hauled away. A water truck shall be furnished and used to control dust from the work, when deemed necessary by the Engineer.

Where sound pavement has been gouged, torn, or otherwise damaged during the milling operations, or damage is done to any other property of any kind including utility frames, grates, and covers, repairs shall be made by the Contractor at no cost to the Department. The Contractor shall take appropriate measures so that the cold planing operation does not trap water.

75.04-Surface Requirements.

Where the planed pavement is not to be resurfaced, the texture shall be uniform throughout the project and shall provide a satisfactory riding surface. The average texture depth shall be no less than 0.20 inch.

The finished surface shall be of uniform profile throughout, without any scabbing, scallops, gouges, ridges, or other imperfections resulting from worn cutter teeth, improper operating speeds, poor equipment maintenance, or other instances of poor workmanship. The cross-slope shall be as specified on the plans in the tangent, transition, and super-elevated curve sections. The finished surface after the final cut shall not show a deviation greater than 1/8 inch from a 10 ft. straightedge, and the crossslope shall not deviate more than 3/8 inch in 10 ft. All irregularities exceeding these limits shall be corrected. Approaches and tapers shall be acceptably textured when required by the Engineer. Length, width, and depth of cut on approaches and tapers will be as determined by the Engineer. The approaches and tapers shall match the finished cut on the main line and shall be transitioned to the existing surface to within ±1/8 inch.

When deemed necessary by the Engineer, private entrances shall be transitioned to provide a smooth approach to the roadway.

Unless otherwise specified on the plans, the cuttings shall become the property of the Contractor and be removed from the project.

75.05-Method of Measurement.

Cold Planing of Bituminous Pavement will be measured by the square yard of planed pavement. The method of measurement will depend upon the pay item designated in the proposal.

Unless otherwise specified, water used to control dust will not be measured for separate payment but will be considered incidental to the planing operation.

75.06-Basis of Payment.

The accepted quantity of Cold Planed Bituminous Pavement will be paid for at the contract unit price, which payment shall be full compensation for all labor, materials, equipment, hauling, and incidentals necessary to plane the pavement, control dust, and dispose of the cuttings.

END OF DOCUMENT

ITEM 98

SLOPE PROTECTION AND EROSION CONTROL

98.01 SCOPE

(a) This Section shall consist of temporary control measures as shown in the plans or directed by the Engineer during the life of the Contract to control erosion and water pollution, through the use of berms, dikes, dams, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other control devices.

(b) The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features, to assure economical, effective, and continuous erosion control throughout the construction and post-construction period.

98.02 TEMPORARY BERMS

(a) A temporary berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes or transverse to centerline on fills.These berms are used temporarily at the top of newly constructed slopes to
prevent excessive erosion until permanent controls are installed or slopes stabilized.

98.03 TEMPORARY SLOPE DRAINS

A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, sod or other material acceptable to the Engineer that may be used to carry water down slopes to reduce erosion.

98.04 SEDIMENT STRUCTURES

Sediment basins, ponds, and traps, are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from excessive siltation.

98.05 CHECK DAMS

(a) Check dams are barriers composed of logs and poles, large stones or other materials placed across a natural or constructed drainway.

(b) Stone check dams shall not be utilized where the drainage area exceeds fifty (50)

acres. Log and pole structures shall not be used where the drainage area exceeds five (5) acres.

98.06 TEMPORARY SEEDING AND MULCHING

Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes including waste sites and borrow pits shall be seeded when and where necessary to eliminate erosion.

98.07 BRUSH BARRIERS

(a) Brush barriers shall consist of brush, tree trimmings, shrubs, plants, and other approved refuse from the clearing and grubbing operation.
(b) Brush barriers are placed on natural ground at the bottom of fill slopes, where the most likely erodible areas are located to restrain sedimentation particles.

98.08 BALED HAY OR STRAW CHECKS (a) Baled hay or straw erosion checks are temporary measures to control erosion and prevent siltation. Bales shall be either hay or straw containing five (5) cubic feet or more of material.

(a) Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches, or other areas where siltation erosion or water run-off is a problem.

98.09 TEMPORARY SILT FENCES

Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the run-off water.

98.10 EROSION CONTROL FABRIC

Mulch on slopes exceeding 3 to 1 ratio shall be held in place by the use of an approved erosion control fabric, such as Curlex 1 as manufactured by American Excelsior Company, or an approved equal.

98.11 DITCH LINING FABRIC

(a) Mat

The mat shall be of three-dimensional structures of entangled nylon filaments (0.40 mm minimum diameter) bonded at their intersections. The filaments shall be coated with polyurethane binder to increase tensile strength between the filaments and to increase abrasion resistance. The mat shall be resistant to chemical and environmental degradation. The mat shall be 10 mm in thickness and promote and maintain the integrity of the grass root system. Enkamat Type 7020 soil reinforcement matting as manufactured by the American Enka Company or an approved equal shall be used.

(b) Ground Fasteners

Ground fasteners shall be one or a combination of the following:

1. T-Staple (wire)
2. Broad wire U-staple
3. Narrow wire U-staple
4. Wood Survey stake

All staples shall be 8- to 11-gauge wire with a minimum penetration of 8 inches. The wood survey stakes will be used when high velocity and/or large volumes of water are expected to occur.

98.12 PROJECT REVIEW

Prior to the preconstruction conference, the Contractor shall meet with the Engineer and go over in detail the expected problem areas in regard to the erosion control work. Different solutions should be discussed so that the best method might be determined. It is the basic responsibility of the Contractor to develop an erosion control plan acceptable to the Engineer.

98.13 PRECONSTRUCTION CONFERENCE

At the preconstruction conference the Contractor shall submit for acceptance his schedule for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing, grading, bridges and other structures at watercourse, construction, and paving. He shall also submit for acceptance his proposed method of erosion control on haul roads and borrow pits and his plan for disposal of waste materials. No work shall be started until the erosion control schedules and methods of operations have been accepted by the engineer.

98.14 CONSTRUCTION REQUIREMENTS

(a) The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface of erodible earth material exposed by excavation, borrow and fill operations and to direct the Contractor to provide

immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other water impoundment. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, seeding or other control devices or methods as necessary to control erosion. Cut and fill slopes shall be seeded and mulched as the excavation proceeds to the extent directed by the Engineer.

(b) The Contractor shall be required to incorporate all permanent erosion control features into project at the earliest practicable time as outlined in his accepted schedule. Temporary pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

(c) Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, erosion control measures may be required between successive construction stages. Under no conditions shall the surface area of erodible earth material exposed at one time by clearing and grubbing, exceed 750,000 square feet without approval by the Engineer.

(d) The Engineer will limit the area of excavation, borrow, and embankment o perations in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.

(e) Under no conditions shall the amount of surface area or erodible earth material exposed at one time by excavation or fill within the project area exceed 750,000 square feet without prior approval by the Engineer.

(f) The Engineer may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project conditions.

(g) In the event of conflict between these requirements and pollution control laws, rules, or regulations or other Federal or State or local agencies, the more restrictive laws, rules, or regulations shall apply.

98.15 CONSTRUCTION OF STRUCTURES

(a) Temporary Berms

A temporary berm shall be constructed of compacted soil, with a minimum width of 24 inches at the top and a minimum height of 12 inches with or without a shallow ditch, constructed at the top of fill slopes or transverse to centerline on fills. Temporary berms shall be graded so as to drain to a compacted outlet at a slope drain. The area adjacent to the temporary berm in the vicinity of the slope drain must be properly graded to enable this inlet to function efficiently and with minimum ponding

in this area. All transverse berms required on the downstream side of a slope drain shall extend across the grade to the highest point at approximately a 10-degree angle with a perpendicular to centerline. The top width of these berms may be wider and the side slope flatter on transverse berms to allow equipment to pass over these berms with minimal disruptions. When practical and until final roadway elevations are approached, embankments should be constructed with a gradual slope to one side of the embankment to permit the placement of temporary berms and slope drains on only one side of the embankment.

(b) Temporary Slope Drains

Temporary slope drains shall consist of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, flexible rubber, or other materials which can be used as temporary measures to carry water accumulating in the cuts and on the fills down the slopes prior to installation of permanent facilities or growth of adequate ground cover on the slopes.

1. Fiber matting and plastic sheeting shall not be used on slopes steeper than 4:1 except for short distances of 20 feet or less.

2. All temporary slope drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base for temporary slope drains shall be compacted and concavely formed to channel the water or hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain. Energy dissipaters, sediment basins, or other approved devices shall be constructed at the outlet end of the slope drains to reduce erosion downstream. An ideal dissipater would be dumped rock or a small sediment basin which would slow the water and collect sediment. All temporary slope drains shall be removed when they are no longer necessary and the site restored to match the surroundings.

(c) Sediment Structures

1. Sediment structures shall be utilized to control sediment at the foot of embankments at slope drain outlets, at the bottom and in the ditchlines atop waste sites, and in the ditchlines and/or borrow bits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long as they are wide.

2. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.

(d) Check Dams

1. Check dams shall be utilized to retard stream flow and catch small sediment loads. Materials utilized to construct check dams are varied and should be clearly illustrated or explained in the Contractor's erosion control plan.

2. All check dams shall be keyed into the sides and bottom of the channel a

minimum depth of 2 feet. A design is not needed for check dams, but some typical designs are shown in the standard plans.

3. Stone check dams should generally not be utilized where the drainage area exceeds fifty (50) acres. Long and pole structures should generally not be used where the drainage area exceeds five (5) acres.

(e) Temporary Seeding and Mulching

Seeding and mulching shall be performed in accordance with Item 35, entitled "Sodding and/or Seeding."

(f) Brush Barriers

Brush barriers shall consist of brush, tree trimmings, shrubs, plants and other approved refuse from the clearing and grubbing operation. The brush barriers shall be constructed approximately parallel to original ground contour. The brush barrier shall be compressed to an approximate height of 3 to 5 feet and approximate width of 5 to 10 feet. The embankment shall not be supported by the construction of brush barriers.

(g) Baled Hay or Straw Erosion Checks

Hay or straw erosion checks shall be embedded in the ground 4 to 6 inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales can remain in place until they rot, or be removed after they have served their purpose, as determined by the Engineer. The Contractor shall keep the checks in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.

(h) Temporary Silt Fences

1. Temporary silt fences shall be placed on the natural ground, at the bottom of fill slopes, in ditches, or other areas where siltation is a problem. Silt fences are constructed of wire mesh fence with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored into the soil.

2. The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Engineer. The silt accumulation at the fence may be left in place and seeded, removed, etc., as directed by the Engineer. The silt fence becomes the property of the Contractor whenever the fence is removed.

(i) Erosion Control Fabric

1. Fabric shall be installed immediately after seeding operations have been completed in work areas. Mulch shall not be used under the fabric.

2. Installation instructions shall be supplied by the manufacturer, and fabric shall be applied in accordance with the manufacturer's recommendation as directed by the specifier.

3. Fabric shall be unrolled and draped loosely, without stretching, so that continuous ground contact is maintained. In ditches, fabric shall be unrolled and applied parallel to the flow direction. On slopes, fabric shall be applied parallel to the slope direction unless the engineer approves an alternate application method.

4. In ditches and on slopes, each upslope and each downslope end of each piece of fabric shall be placed in a 4-inch trench, stapled on 9-inch centers, backfilled and tamped. Where one roll ends and a second roll starts, the upslope piece shall be brought over the end of the downslope roll so that there is a 12-inch overlap, placed in a 4-inch trench stapled on 9-inch centers, backfilled and tamped.

5. On slopes where two or more widths of fabric are applied, the two edges shall be overlapped according to manufacturer's installation instructions and stapled at 18 to 24-inch intervals along the exposed edge of the lap joint. The body of the fabric shall be stapled in a grid pattern with staples 3 feet maximum on center each way.

6. Where heavy concentrations of water or extremely erodible soil conditions exist, erosion checks shall be installed at intervals up to 50 feet as directed by the engineer. Erosion checks shall be a 4-inch deep trench perpendicular to the flow line across the width of the fabric. The fabric shall be stapled at 9-inch intervals along the bottom of the trench across the entire width of the fabric, backfilled and stamped.

(j) Ditch Lining Fabric

1. The ditch shall be shaped and dressed in accordance with the Specifications and Drawings at the location and grade shown on the plans or designated by the Engineer. Transverse check slots shall then be cut at the ends of the liner at 25-foot intervals along the ditch to a depth of 6 to 12 inches. Matting widths shall be as specified in the plans. Longitudinal shelves shall be cut 4 inches along the full length of the ditch for the mat edges to rest on.

2. Before the matting is placed, seeding operations shall be completed along the ditch line. Seeding operations shall conform to the requirements of Item 35, entitled, "Sodding and/or Seeding."

3. After seeding, the center strip of matting shall be rolled out starting at the upper end of the ditch. Then the side strips shall be rolled out, also starting at the upper end of the ditch, and overlapping the middle strip about 3 inches. The mat shall then be pinned down thoroughly and snugly in the transverse check slots and longitudinal shelves and at maximum intervals of 5 feet along the ditch. Where necessary, additional pins shall be used to hold the mat firmly in place, the transverse check slots and longitudinal shelves

shall be covered with soil and tamped. Additional grass seed shall be applied to any disturbed areas after dressing is complete.

98.16 MAINTENANCE

(a) The temporary erosion control features should be installed by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

(b) In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense.

(c) Where the work to be performed is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls and falls within the specifications for a work item that has a contract price, the units of work shall be paid for at the proper contract prices.

98.17 EROSION CONTROL OUTSIDE PROJECT AREA

Temporary pollution control shall include construction work outside the project area where such work is necessary as a result of construction such as borrow pit operations, haul roads and equipment storage sites. Bid price in such cases shall include all necessary clearing and grubbing, construction incidentals, maintenance, and site restoration when no longer needed.

END OF DOCUMENT

ITEM 717

MOBILIZATION OF FORCES, SUPPLIES, AND EQUIPMENT

717.01 Description

This work shall consist of the mobilizaton and demobilization of the prime Contractor's and all Subcontractors' work forces, supplies, equipment, and incidentals at the project site. It shall include all Contractor and Subcontractor costs associated with obtaining performance bonds, insurance required by railroads, and other preconstruction costs incurred after award of the contract which are necessary costs to the project and are of a general nature rather than directly attributable to other pay items. All necessary preconstruction costs not attributable to a specific pay item shall be included in the contract lump sum price for Mobilization and not in any other pay item.

717.2 Method of Measurement

Mobilization will be measured by the unit for the completion of the work as described above, and payment will be made on a lump sum basis.

717.3 Basis of Payment

Partial payment for mobilization will be determined as indicated below. Upon completion of all work on the project, payment will be made of any amount bid for mobilization in excess of the total limit for partial payment.

Partial Payment Schedule

Percent of Total Contract Amount of Progress Estimate Exclusive of Mobilization	Percent of Mobilization Allowed
Not Less Than	
2%	30%*
5%	50%*
10%	80%*
25%	100%*

* % of lump sum bid price for mobilization or of the total limit for partial payment whichever is less.

Payment for mobilization will be made in accordance with the provisions set out above, which price shall be full compensation for organizing and moving all forces, supplies, equipment, and incidentals to the project site, regardless of the number of times such moves are made and also for all preconstruction costs incurred after award of the contract.

END OF DOCUMENT

EMBANKMENT AND BACKFILLING

PART 1. GENERAL

1.1 This work shall consist of forming embankments, with materials from excavation or other approved sources and in conformance with the lines, grades and cross-section shown on the drawings.

1.2 Complete the clearing and grubbing of embankment areas.

1.3 Conduct all embankment operations in accordance with the requirements of the erosion control plan approved by the A/E.

1.4 RELATED SECTIONS

A. Item 1 – Common Excavation

B. Section 02260 – Finish Grading

PART 2. PRODUCTS

2.1 Use only acceptable materials in embankment formation. Place no frozen material, stumps, logs, roots or other perishable materials in any embankment. Place no stone or masonry fragment greater than 4 inches in any dimension within 12 inches of the finished subgrade elevation.

PART 3. EXECUTION

3.1 Remove topsoil from all areas to be backfilled to a depth of approximately 6 inches, or to a greater depth wherever the soils investigation report so indicates.

3.2 Form soil, soft shale, soft sandstone, weathered rock, bank gravel or creek gravel embankment by distributing the material in successive uniform horizontal layers no more than 12 inches thick (loose depth) to the full width of the cross-section. However, layers less than 12 inches in loose thickness will be required whenever necessary to obtain the specified density. Compact each layer as specified below. Shape the upper surface of the embankment so as to provide complete drainage of surface water at all times. The forming of ruts will not be permitted.

3.3 Compact all areas to the density specified below:

A. Trail areas shall be compacted to 95 percent of the maximum density as determined by ASTM D698 (Standard Proctor).

3.4 During compaction, embankment material that does not have enough moisture for proper compaction, shall have water added and thoroughly mixed as necessary to obtain proper compaction. Embankment material containing an excess of moisture shall be allowed to dry before compacting; manipulating as necessary to speed drying.

3.5 Perform construction operations so that simultaneous rolling and placing of material in the same lane or section is prevented. To avoid uneven compaction, see that hauling equipment traverses the full width of the cross-section as much as possible. Compact each layer as necessary before depositing material for the next layer.

3.6 The density requirements shall be the controlling factor in compaction. Use only such equipment as will satisfy the density requirements at all times.

END OF DOCUMENT

SECTION 02220
EARTHWORK

PART 1 - GENERAL

1.01 SCOPE

A. This specification section includes earthwork and related operations, including, but not limited to, clearing and grubbing the construction site, dewatering, excavating all classes of material encountered, pumping, draining and handling of water encountered in the excavations, handling, storage, transportation, and disposal of all excavated and unsuitable material, construction of fills and embankments, backfilling around structures and pipe, backfilling all trenches and pits, compacting, all sheeting, shoring and bracing, preparation of subgrades, surfacing and grading, and any other similar, incidental, or appurtenant earthwork operation which may be necessary to properly complete the work.

B. The Contractor shall provide all services, labor, materials and equipment required for all earthwork and related operations necessary or convenient to the Contractor for furnishing a complete work as shown on the Drawings or specified in these Contract Documents.

1.02 GENERAL

A. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonable, accurate information about the existing elevations. They are not precise, and the Contractor should satisfy himself as to the exact quantities of excavation and fill required.

B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.

C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material.

D. If soil borings are available for the area of this work, they will be on file at the Owner's address where they will be made available for review. This information is made available to the Contractor for such use as he may choose to make of it in the preparation of his Bid, but the Owner gives no guarantee, either expressed or implied, that it represents a true or complete cross-section of all of the material to be encountered performing the excavation and earthwork on this project.

E. Earthwork within the rights-of-way of the State Department of Transportation, the County Road Department, and the City shall be done in accordance with requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these Specifications.

F. The Contractor shall control grading in a manner to prevent water running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains, or temporary drains. Material for backfill or for protection of excavation in public roads from surface drainage shall be neatly placed and kept shaped so as to cause the least possible interference with public travel. Free access must be provided to all fire hydrants, watergates, meters, and private drives.

G. No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

H. Tests for compaction and density shall be conducted by the Engineer or by an independent testing laboratory selected by him. Costs of compaction tests performed by an independent testing laboratory shall be paid for directly by the Owner and not as a part of this Contract. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests. The cost of all retests made necessary by the failure of materials to conform to the requirements of these Contract Documents shall be paid by the Contractor.

I. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles Mechanized Equipment, and Marine Operations, and shall be conducted in a manner acceptable to the Engineer.

J. It is understood and agreed that the Contractor has made a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and flood plains, particularly in areas where construction activities may encounter water-bearing sands and gravels or limestone solution channels. The Contractor shall be responsible for providing all services, labor, equipment, and materials necessary or convenient to him for completing the work within the time specified in these Contract Documents.

PART 2 - EXECUTION

2.01 INITIAL SITE PREPARATION

A. Preparatory to beginning of construction operations, the Contractor shall remove from the site all vegetative growth, trees, brush, stumps, roots, debris, and any of other objectionable matter, including fences, buildings, and other structures shown on the Drawings in the construction areas which are designated for removal or which, if left in place, would interfere with the proper performance or completion of the contemplated work, would impair its subsequent use, or would form obstructions therein.

B. Stumps and roots shall be grubbed and removed to a depth noT less than 5 feet below grade. All holes or cavities which extend below the subgrade elevation of the proposed work shall be filled with compacted layers of crushed rock or earth backfill conforming to the requirements specified here for backfill. Organic material from clearing operations shall not be incorporated in excavation backfill or embankment material.

C. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, buildings, and other structures which are located in the construction area but not within designated clearing limits as shown on the Drawings or within the limits of embankments, excavations, or proposed structures. The Contractor shall be responsible for the repair and/or replacement of any of the aforementioned items damaged by his operation or construction activities.

D. The Contractor shall remove and dispose of all excess material resulting from clearing or site preparation operations. The Contractor shall dispose of such materials in a manner acceptable to the Engineer and at an approved location where such materials can be lawfully disposed.

2.02 DEWATERING

A. The Contractor shall provide and maintain at all times during construction ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the work. Dewatering shall be accomplished by methods which will ensure a dryexcavation and preservation of the final lines and grades of the bottoms of excavations. Methods of dewatering may include sump pumps, well points, deep wells, or other suitable methods which do not damage or weaken structures, foundations, or subgrades. Shallow excavations may be dewatered using open ditches provided such ditches are kept open and free-draining at all times. The actual dewatering methods used shall be acceptable to the Engineer.

B. Unless specifically authorized by the Engineer, no concrete or mortar shall be placed in water nor shall water be allowed to rise over newly-placed concrete or mortar for at least 24 hours after placement. No concrete structure shall be exposed to unequal hydrostatic forces until the concrete has reached its specified 28-day strength. Water shall not be allowed to rise above bedding during pipe laying operations. The Contractor shall exercise care to prevent damage to pipelines or structures resulting from flotation, undermining, or scour. Dewatering operations shall commence when ground or surface water is first encountered and shall be continuous until such times as water can safely be allowed to rise in accordance with the provisions of this section. Excavations shall be protected from the entrance of surface water to the extent possible by the use of dikes and/or covers.

C. Standby pumping equipment shall be on the job site. A minimum of one standby unit (a minimum of one for each ten in the event well points are used) shall be available for immediate installation should any pumping unit fail. The design and installation of well points or deep wells shall be suitable for the accomplishment of the work. Drawings or diagrams on proposed well point or deep well dewatering systems shall be submitted to the Engineer for review.

D. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with crushed rock at no cost to the Owner.

E. The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. Conveyance of the water shall be such as to not interfere with traffic flow or treatment facilities operation. No water shall be drained into work built or under construction without prior consent of the Engineer. The Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

F. Sedimentation and desilting basins shall be provided as necessary or when directed by the Engineer to prevent the entrance of excessive or injurious amounts of sand and silt from surface runoff or dewatering operations into storm drains or receiving waters. The system used for desanding or desilting the water shall be a baffled structure and shall provide not less han five minutes detention time and shall be designed to have a "flow-through" velocity not exceeding 0.2 feet per second at the anticipated peak flow. The method of desanding or desilting and the point of disposal shall be subject to the approval of the Engineer.

G. Water shall be disposed of in such a manner as not to be a menace to the public health and in accordance with applicable Environmental Protection Agency, Corps of Engineers, and State Water Quality Control Division standards and permits, and the Storm Water Division of the Department of Public Works, City of Chattanooga, Tennessee.

2.03 SHEETING, SHORING, AND BRACING

A. The sides of all excavations shall be sufficiently sheeted, shored, and braced as necessary to prevent slides, cave-ins, settlement or movement of the banks, to maintain the excavation clear of all obstructions, and to provide safe working conditions. Wood or steel sheeting of approved design and type shall be used in wet, saturated or flowing ground. All sheeting, shoring, and bracing shall have sufficient strength and rigidity to withstand the pressure exerted and to maintain shape and position under all circumstances.

B. The responsibility for correctly assessing the need for sheeting and analyzing the stresses induced shall be the total responsibility of the Contractor. Since the Engineer does not dictate or determine the Contractor's sequence or limits of excavation, the Engineer assumes no responsibility for sheeting and shoring. The Contractor must employ or otherwise provide for adequate professional structural and geotechnical engineering supervision to assess the need for sheeting and shoring and design same. Results of sheeting and shoring analysis and design shall be submitted to the Engineer on request.

C. Excavations adjacent to existing or proposed buildings and structures, or in paved streets or alleys shall be sheeted, shored, and braced adequately to prevent undermining beneath or subsequent settlement of such structures or pavements. Underpinning of adjacent structures shall be done when necessary to maintain structures in safe condition. Any damage to structures or pavements occurring through settlements, water or earth pressures, slides, caves, or other causes; due to failure or lack of sheeting or bracing, or due to improper bracing; or occurring through negligence or fault of the Contractor in any other manner shall be repaired by the Contractor at his own expense.

D. Sheeting, shoring, or bracing materials shall not be left in place unless otherwise specified or shown on the Drawings or ordered by the Engineer in writing. Such materials shall be removed in such manner that no danger or damage will occur to new or existing structures or property, public or private, and so that cave-ins or slides will not take place. Trench sheeting shall be left in place until backfill has been brought to a level 12 inches above the top of the pipe. It shall then be cut off and the upper portion removed. Sheeting for structures shall be left in place until backfill has been brought to a level of 12 inches above the top of the bottom footing. It shall then be cut off and the upper portion removed.

E. All holes and voids left in the work by the removal of sheeting, shoring, or bracing shall be filled and thoroughly compacted.

2.04 EXCAVATION

A. GENERAL

1. Excavation shall include the removal of all material from an area necessary for the construction of a pipeline, structure, basin, flume, or building. Excavations shall provide adequate working space and clearances for the work to be performed therein.

2. Except where otherwise shown on the Drawings, specified herein, or authorized by the Engineer, all material excavated below the bottom of concrete walls, footings, and foundations shall be replaced, by and at the expense of the Contractor, with Class B Concrete to the lines and grades shown on the Drawings.

3. Where quicksand, soft clay, spongy, swampy, or other materials unsuitable or subgrade or foundation purposes are encountered below the excavation limits, they shall be removed and disposed of to the level of suitable material. Areas so excavated shall be backfilled with Class B Concrete or with compacted layers of crushed rock, sand, or other approved material conforming to the requirements specified herein for backfill to the lines and grades shown on the Drawings.

4. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until the excavations are backfilled. All excavations shall be barricaded in such a manner to prevent persons from falling or walking into any excavation.

B. ROCK EXCAVATION

1. Rock encountered in the process of excavation for structures shall be uncovered and stripped of all loose materials over the entire limits of excavation. Rock encountered for removal in a trench section shall be uncovered for a distance of not less than 50 feet.

2. Rock and large boulders in trenches shall be excavated over the horizontal limits of excavation and to depths as shown on the Drawings.

3. The space below grade for pipe lines shall then be backfilled to the proper grade with compacted layers of crushed rock or sand conforming to the

requirements specified herein for backfill. Where pipe sewers are constructed on concrete cradles, rock shall be excavated to the bottom of the cradle as shown on the Drawings.

4. Rock under structures shall be excavated to lines and grades shown on the Drawings. Unless specified otherwise, where rock excavation has been carried below grade, the contractor shall backfill to grade with Class B concrete at his own expense.

5. Where rock foundation is obtained at grade for over 50 percent of the area of any one structure, the portion of the foundation that is not rock shall be excavated below grade to reach a satisfactory foundation of rock. The portion below grade shall be backfilled with Class B Concrete.

6. Where rock foundation is obtained at grade for less than 50 percent of any one structure and satisfactory rock cannot be found over the remaining area by reasonable additional excavation, the rock shall be removed for a depth of 12 inches below grade and the space below grade shall be backfilled to the proper grade with compacted layers of crushed rock conforming to the requirements specified herein for backfill.

7. Drilling and blasting operations shall be conducted with due regard for the safety of persons and property in the vicinity and in strict conformity with requirements of all ordinances, laws and regulations governing blasting and the use of explosives. Rock excavation near existing pipelines or other structures shall be conducted with the utmost care to avoid damage. Injury or damage to other structures and properties shall be promptly repaired to the satisfaction of the Owner by the Contractor at his own expense.

8. Rock excavation for all structures and adjacent trenches under this Contract and any other rock excavation directed by the Engineer shall be completed before the construction of any structure is started in the vicinity.

C. BORROW EXCAVATION

1. Wherever the backfill of excavated areas or the placement of embankments or other fills requires specified material not available at the site or material in excess of suitable material available from the authorized excavations, such material shall be obtained from other sources. This may require the opening of borrow pits at points not immediately accessible from the work. In such cases the Contractor shall make suitable arrangements with the property owner and shall pay all costs incident to the borrowed material including royalties, if any, for the use of the material. Before a borrow pit is opened, the quality and suitability of the material to be obtained there from shall be approved by the Engineer.

2. Borrow pits shall be cleared, grubbed and finish graded in accordance with the requirements specified herein.

D. ROADWAY EXCAVATION

Roadway excavation shall consist of excavation for roadways and parking areas in conformity with lines, grades, cross sections, and dimensions shown on the Drawings. After shaping to line, grade, and cross section, the subgrade shall be rolled until compacted to a depth of at least 6 inches to 100 percent of the maximum density at optimum water content as determined by AASHTO T 99, Method A. This operation shall include any reshaping and wetting required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.

E. TRENCH EXCAVATION

1. Trench excavation shall consist of the removal of materials necessary for the construction of water, sewer, and other pipelines and all appurtenant facilities including manholes, inlets, outlets, headwalls, collars, concrete saddles, piers and pipe protection called for on the Drawings.

2. Excavation for pipelines shall be made in open cut unless shown otherwise on the drawings. Trenches shall be cut true to the lines and grades shown on the Drawings or established by the Engineer on the ground. The banks of trenches shall be cut in vertical, parallel planes equidistant from the pipe centerline. From an elevation 12 inches above the top of the pipe to the bottom of the trench, the horizontal distance between vertical planes for different sizes of pipe shall not exceed those shown on the Drawings. When sheeting is used, the width of the trench shall be considered as the distance between the inside faces of the sheeting. The bottom of the trench shall be cut carefully to the required grade of the pipe except where bedding materials or cradles are shown, in which case the excavation shall extend to the bottom of the bedding or cradles as shown on the Drawings. Minimum pipe cover shall be as shown on the Drawings or specified in these Contract Documents.

3. The use of a motor-powered trenching machine will be permitted but full responsibility for the preservation, replacement, and/or repair of damage to any existing utility services and private property shall rest with the Contractor.

4. Bell holes for bell and spigot pipe and/or mechanical joint pipe shall be excavated at proper intervals so the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper installation of all joints in the pipe. Bell holes shall not be excavated more than 10joints ahead of pipe laying. No part of any bell or coupling shall

be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

5. Excavation for manholes, outlets, collars, saddles, piers, and other pipeline structures shall conform to the additional requirements specified herein for structural excavation.

6. Pipe trenches shall not be excavated more than 400 feet in advance of pipe laying and all work shall be performed to cause the least possible inconvenience to the public. Adequate temporary bridges or crossings shall be constructed and maintained where required to permit uninterrupted vehicular and pedestrian traffic.

7. Unless otherwise specified herein or shown on the Drawings, wherever pipe trenches are excavated below the elevation shown on the Drawings, the Contractor, at his own expense, shall fill the void thus made to the proper grade with Class B Concrete or with compacted layers of crushed rock or sand conforming to the requirements specified herein for backfill.

8. In all cases where materials are deposited along open trenches they shall be placed so that no damage will result to the work and/or adjacent property in case of rain or other surface wash.

F. STRUCTURAL EXCAVATION

1. Structural excavation shall consist of the removal of all materials necessary for the construction of structures, including tanks, foundations, footings, wetwells, dry wells, box culverts, flumes, channels, buildings, and other miscellaneous structures.

2. The bottom of structural excavations shall be true to the lines and grades shown on the Drawings. Faces of excavations shall not be undercut for extended footings.

Except as provided herein for excavation of unsuitable material or rock, where the excavation is carried below the grade elevation shown on the Drawings, the Contractor shall backfill the void thus made to the proper grade with Class B concrete at his own expense.

2.05 BACKFILLING

A. MATERIALS

Materials for backfilling shall conform to the following requirements:

1. SELECT EARTH BACKFILL

   Fine, sound, loose earth containing optimum moisture content for compaction to 90 percent of maximum density, free from all wood, vegetable matter, debris, and other objectionable material, and having scattered clods, stones, or broken concrete less than 2 inches in maximum dimension except that the maximum particle size shall be 3/4 inch when used with PVC, other flexible thermoplastic pipe, or extremely brittle pipe.

2. COMMON EARTH BACKFILL

   Sound, loose earth containing optimum moisture content for compaction to 90 percent of maximum density, free from all wood, vegetable matter, debris, and other objectionable material, and having scattered clods, stones, or broken concrete and pavement less than 6 inches in maximum dimension. Such backfill shall be placed a minimum of one foot above top of pipe.

3. SAND

   Natural or imported sand conforming to ASTM D1073.

4. CRUSHED ROCK

   Crushed rock conforming to Class A aggregate as specified in Section 903.05 and Section 903.22, Size 7 of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction.

5. CLASS B CONCRETE

   Class B concrete as specified in the Section entitled "Cast-In-Place Concrete" of these Specifications.

B. GENERAL

1. Unless otherwise specified herein, earth backfill shall be compacted to not less than 90 percent of the maximum density at optimum water content as determined by AASHTO T-99, Method A. Crushed stone and sand shall be compacted or consolidated to not less than 83 percent of the solid volume density as determined from the bulk specific gravity by AASHTO T-84 AND T-85 and the dry weight of the aggregate.

2. Material that is too dry for adequate compaction shall receive a prior admix of sufficient water to secure optimum moisture content. Material having excessive water content shall not be placed at any time.

3. Unless otherwise specified herein backfill material required to be compacted shall be placed in horizontal layers not to exceed 6 inches in thickness (before compaction) and compacted in place by ramming, tamping, or rolling. Compaction shall be accomplished by power driven tools and machinery wherever possible. Compaction and consolidation of sand and crushed rock backfill shall be accomplished using vibrating equipment in a manner acceptable to the Engineer.

C. BACKFILLING TRENCHES

1. The backfilling of sewer, water, and other pipeline trenches shall be started immediately after the construction of same has been inspected and approved by the Engineer. Select backfill or bedding material if specified shall be placed in the trench under and on each side of the pipe in 6-inch layers for the full width of the trench and thoroughly and uniformly compacted by ramming and/or tamping to a minimum of 90% of the maximum density determined as specified herein. Select earth backfilling shall start above the class of pipe bedding as specified or shown the Drawings. Sufficient select earth backfill shall be placed around the pipe and compacted to provide a cover of not less than 12 inches over the top of the pipe. Mechanical compactors or tampers shall not be used within 12 inches of pipe. Compaction in this area shall be accomplished by hand methods. Sand or specified crushed stone bedding material shall be substituted for select earth backfill when the pipe is bituminous coated steel pipe or wrapped steel pipe or when crushed stone trench backfill is required. Backfilling shall proceed simultaneously on both sides of the pipe to prevent lateral displacement.

2. Caution shall be used during backfill operations for PVC or other flexible thermoplastic pipe (non-pressure or sewer pipe) to prevent pipe deformation. PVC or other flexible thermoplastic pipe (sewer pipe) shall not be subjected to roller or wheel loads until a minimum of 36 inches of backfill has been placed over the top of the pipe and a hydrohammer shall NOT be used until a minimum depth of 48 inches backfill has been placed over the top of the pipe.

3. Backfilling of PVC pressure pipe or other flexible thermoplastic pipe (water pipe) shall be as described in Paragraph 1 above.

4. In streets, alleys, across sidewalks and driveways, paved areas, and at any other places subject to vehicular traffic

or other superimposed loads, crushed rock backfill shall be placed and compacted in 6-inch layers from the level of 12 inches above the top of the pipe upward for the full depth of the trench, except for the top 48 inches of backfill, which shall be compacted pugmill mix. Crushed rock shall be clean, uniform-sized stone placed in lifts of 6 inches maximum and compacted by use of a hydrohammer or approved vibratory compactor for the full depth of the trench, except for the top 48 inches of crushed rock backfill, which shall be compacted pugmill mix.

5. Trenches under concrete slabs and footings of structures shall be completely backfilled with compacted sand or crushed rock or filled with Class B concrete as shown on the Drawings.

6. In all other areas not affected by superimposed loads, common earth backfill may be placed from a level of 12 inches above the top of pipe upward for the full depth of the trench without compaction. At these places, backfill shall be neatly rounded over the trench to sufficient height to allow for settlement to grade after consolidation. In no event, however, will storm water be allowed to pond due to the backfilled trench.

7. All backfilling shall be done in such a manner that the pipe or structure over or against which it is being placed will not be disturbed or injured. Any pipe or structure injured, damaged, or moved from its proper line or grade during backfilling operations shall be removed and repaired to the satisfaction of the Engineer and then rebackfilled.

D. BACKFILLING AROUND STRUCTURES

1. Backfilling around structures shall consist of common earth backfill placed in 6-inch layers and compacted by tamping to a minimum of 90% of the maximum density determined as specified herein for the full depth of the excavation from the bottom to the finished grade. No backfill shall be placed against concrete structures until the concrete has reached its specified 28-day compressive strength. Where practical, compaction of structural backfill shall be accomplished by power-driven tamping equipment.

2. Where crushed rock mats under slabs and foundations are called for on the Drawings, the Contractor shall excavate below grade to the depth of the crushed rock mat as shown on the Drawings and shall install a compacted crushed rock bed. This shall be finished to a true line or plane and even with the subgrade of

the concrete foundations, piers, footings or slabs. Before placing any crushed rock, all loose earth or debris shall be removed. This crushed rock mat shall extend 12 inches beyond all slabs and foundations or to edges of sheet piling.

3. Crushed rock mats, 12 inches or less in thickness shall be constructed of compacted layers of crushed rock conforming to Section 903.22, Size Number 67 (3/4-inch to No. 4), of the Tennessee Department of Transportation, Standard Specifications for Road and Bridge Construction.

4. Crushed rock mats of thickness greater than 12 inches shall have the top 12 inches constructed of compacted layers of crushed rock as specified above. That portion below the top 12 inches shall be constructed of compacted layers of crushed rock conforming to Section 903.05, Class A, with a modified gradation of 6 inches to dust as received from the crusher.

5. Unless otherwise shown on the Drawings, the use of earth backfill to support footings, foundations, and structures shall not be permitted.

2.06 FILLS AND EMBANKMENTS

A. Fills and embankments shall consist of all earth fills except backfills in trenches or around structures. Unless special material is specified or shown on the Drawings, material for fills and embankments shall consist of excavated material from structures or of a mixture of such excavated materials and materials borrowed from other sources by the Contractor. All material used for fills and embankments shall be free from wood, vegetable matter, debris, soft or spongy earth or clay, large rock, or other objectionable material and shall be acceptable to the Engineer.

B. Material shall be placed in the fill or embankment in successive layers 6 inches or less in thickness before compaction, each layer being approximately horizontal and extending to the full limit of the required cross section and shall be compacted at optimum water content over the entire surface to not less than 95% of the maximum density as determined by AASHTO T-99, Method A. The process shall be repeated for each layer of material until the fill or embankment conforms to the plan lines, grades, and cross-sections. The degree of compaction and moisture content required, the method of tamping, and the equipment used shall be approved by the Engineer.

C. The area over which the fill or embankment is to be constructed shall first be cleared of all vegetation, debris, and other objectionable material and, if the ground is in a loose, uncompacted condition, it shall be compacted to a maximum density determined as specified herein.

D. No material shall be placed beyond the sloping lines of embankment unless so ordered by the Engineer. Material allowed to be placed beyond the lines of embankment shown on the Drawings will be compacted as required above unless otherwise authorized by the Engineer.

E. Material for embankments or roadway fills shall be placed in 6-inch maximum lifts and shall be compacted by rolling with power rollers weighing not less than 10 tons, with sheeps foot rollers, with vibrating rollers, or with pneumatic tire rollers, as required to accomplish the work. While and as each layer is deposited, water shall be applied in sufficient amount to ensure optimum moisture to secure the compaction specified.

F. The use of truck, carryalls, scrapers, tractors, or other heavy hauling equipment shall not be considered as rolling in lieu of rollers, but the traffic of such hauling equipment shall be distributed over the fill in such a manner as to make the use of the compaction afforded thereby as an addition to compaction by the use of rollers.

G. Wherever a trench passes through a fill or embankment, the fill or embankment material shall be placed and compacted to an elevation 12 inches above the top of the pipe before the excavation of the trench begins.

H. On subgrades for all roadbeds, the density for the top 6 inches of the finished subgrade shall be equal to not less than 100% of the maximum density as determine by AASHTO T-99, Method A. When field tests show failure to meet the density requirement, the subgrade shall be loosened by disking, harrowing or other approved methods to a depth of not less than 6 inches, then reshaped and recompacted as indicated in this paragraph.

2.07 DISPOSAL OF WASTE AND UNSUITABLE MATERIALS

A. All materials removed by excavation, which are suitable for the purpose, shall be used to the extent possible for backfilling pipe trenches, foundation, and footings and for making embankment fills or for such other purposes as may be shown on the Drawings. All materials not used for such purposes shall be considered as waste materials and the disposal thereof shall be made by the Contractor in a manner and at locations subject to the approval of the Engineer.

B. Waste materials shall be spread in uniform layers and neatly leveled and shaped. Spoil banks shall be provided with sufficient and adequate openings to permit surface drainage of adjacent lands.

C. Unsuitable materials, consisting of wood, vegetable matter, debris, soft or spongy clay, peat, and other objectionable material so designated by the Engineer shall be removed from the work site and disposed of by the Contractor in a

manner and at a location approved by the Engineer.

D. No unsuitable or waste material shall be dumped on private property unless written permission is furnished by the Owner of the property and unless a dumping permit is issued from the local jurisdiction.

2.08 FINAL GRADING

A. After other earthwork operations have been completed, the sites of all structures, roads, and embankments shall be graded within the limits and to the elevations shown on the Drawings. Grading operations shall be so conducted that materials shall not be removed or loosened beyond the required limits. The finished surfaces shall be left in smooth and uniform planes such as are normally obtainable from the use of hand tools. If the Contractor is able to obtain the required degree of evenness by means of mechanical equipment he will not be required to use hand labor methods. Slopes and ditches shall be neatly trimmed and finished to slopes shown on the Drawings unless otherwise approved by the Engineer.

B. Unless otherwise specified or shown on the Drawings, all finished ground surfaces shall be graded and dressed to present a surface varying not more than plus or minus 0.10 foot as regards local humps or depressions and shall be acceptable to the Engineer.

2.09 TOPSOIL

A. All areas to be sprigged or planted with trees, shrubs, or grass as shown on the plans shall be prepared by grading to a smooth, even surface to a level 4 inches or other specified depth below the elevation of the finished grade shown on the Drawings. It shall then be brought to a neat and finished grade by the addition of 4 inches or other specified depth of approved topsoil as specified or directed in Section 02485.

B. Topsoil removed from the construction area may be stockpiled and reused or topsoil may be obtained from approved borrow areas. If obtained from borrow areas, the Contractor shall make suitable arrangements with the property owner and shall pay all costs incident to the borrowed material including royalties.

2.10 SETTLEMENT

A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within one (1) year after final acceptance of the work by the Owner.

B. The Contractor shall make, or cause to be made, all repairs or replacement made necessary by settlement within 30 days after receipt of written notice from the Engineer or Owner.

2.11 PREVENTION OF BLASTING DAMAGE

A. GENERAL

The Contractor shall be responsible for all property damage and personal injury caused by blasting for excavation work on this project. This includes events in which flying debris, air blast, or ground vibrations cause personal injury or property damage.

B. PREVENTING DAMAGE BY FLY-ROCK

A qualified Explosive Engineer and experienced Powder Foreman shall be available to direct and supervise the design of the blasting work. This shall consist of selecting the correct burden, spacing and stemming dimensions for the explosives used and the rock being blasted. This includes, but is not limited to, controlling water in the blast hole and using the proper stemming. The objective is to select the optimum blast dimensions which ensure that just enough explosive is available to break the rock, and that there is no excess explosive to propel the rock fragments beyond safe limits.

Blasting mats and/or backfill materials shall be used for each "shot" to help confine the limits of fly-rock in populated areas.

Traffic and access to blasting areas shall be closed off and blasting signals audible for 2,000 feet shall be sounded in time for all workers and nearby residents to get under cover. Also, residents immediately adjacent to a blast should be notified personally before any blast occurs.

C. PREVENTING DAMAGE BY AIR BLAST

Design measures shall be taken to reduce or control air blast to levels below which actual damage will not occur. Microphones to which a metering device is attached to record over pressure levels shall be used to monitor air results of all blasts. These records shall be filed and maintained throughout the construction of the project.

The use of detonating cord on the surface shall be avoided.

The use of sufficient burden, spacing and stemming to prevent the premature release of explosive gases shall be required for all blasting in closely populated areas.

The specific gravity of stemming material shall always be equal to or greater than that of the rock, and its length equal to 0.7 of the burden. The shape of the stemming material shall be coarse and angular.

There should be no top priming of any holes.

Decking shall be used to bridge limestone cavities or other weak areas in any hole.

In closely populated areas, all blast shall be designed to limit the peak particle velocity to less than two (2) inches per second.

D. PREVENTING DAMAGE BY GROUND VIBRATIONS

The Explosive Engineer and Powder Foreman shall design each "shot" to obtain the desired fragmentation without providing extra explosives which could be used to produce ground vibrations. In closely populated areas where old residential or auxiliary structures in poor condition exists, the two (2) inches per second peak particle velocity limit shall be lowered. Monitoring of these structures with seismographs shall be required and the data filed and maintained for the duration of the project.

Delay intervals such as millisecond caps or millisecond connectors shall be used to reduce the vibration effects of large blasts to the range of smaller charges at reduced peak particle velocity.

Tight confined shots that require increased powder charges shall not be attempted.

Excessive sub-drilling shall not be permitted.

In decking charges where small weights of powder are used, the inert material between decks shall be one (1) to two (2) feet thick.

The use of sensitive explosives such as straight dynamite shall not be permitted.

In drilling blast holes with cavities, the driller shall measure the depth and size of each cavity encountered. This log shall be used by the Powder Foreman in loading the explosive in the rock parts and filling with the stemming material in cavity parts.

Delay pattern shall be designed to provide maximum amount of free faces which reduces the amount of energy-transfer in ground vibrations.

Where potential settlement of a structure is involved, a pre-split line shall be required to help reduce the peak particle velocity beneath the structure to be protected.

SECTION 02242

CLAY OR FLOWABLE MORTAR FILL FOR CUTOFF WALLS

PART 1 - GENERAL

1.01 SCOPE

The work covered by this section includes furnishing all labor, equipment, and materials to forma cutoff consisting of flowable mortar fill or clay material at the location shown on the Drawings or as directed by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS FOR FLOWABLE MORTAR FILL

A. Materials used in this construction shall meet the following requirements:

Material	Specification
Portland Cement Type 1	AASHTO M 85
Fly Ash, Class C or Class F	AASHTO M 295
Water Potable	
Chemical Additives	AASHTO M 194

B. Fine aggregate shall be well graded from coarse to fine and when tested by means of laboratory sieves, shall conform to the following requirements:

Sieve Size	Total Percent Passing by Weight
3/4-inch	100
No. 4	95-100
No. 16	50-90
No. 50	10-30
No. 200	0-10

2.02 PROPORTIONING FOR FLOWABLE MORTAR FILL

A. Flowable mortar shall be proportioned as follows:

Material	Per Cubic Yard
Portland Cement, Type 1	100 lbs. (maximum)
Fly Ash, Class C or F	250 lbs. (minimum)
Fine Aggregate	2,800 lbs.
Water	60 gals. (approximate)

B. The above proportions may be adjusted by the Engineer to obtain the consistency required for satisfactory flow. Consistency shall be determined as follows:

Place an open-ended cylinder (pipe) 3 inches in diameter by 6 inches in heights in an upright position on a smooth, level surface. Fill the cylinder with a representative sample of the flowable mortar proposed for use. Remove the cylinder by lifting it straight up thus allowing the sample to diffuse on the smooth, level surface. the flowable mortar should diffuse into a circular shape having an approximate diameter of not less than 8 inches.

2.03 FOR CLAY CUTOFF WALL

A. Clay material shall have no organic material.

B. Clay material shall be compacted to 95 percent Standard Proctor.

PART 3 - EXECUTION

3.01 GENERAL

A. Flowable mortar shall be used where cutoffs are required and the area is in streets, alleys, across sidewalk and driveways, and at any other place subject to vehicular traffic or other superimposed loads.

B. Installation of cutoffs shall be according to "Backfilling Trenches" in Section 0220, "Earthwork."

C. The flowable mortar shall be covered or otherwise protected while in the plastic state. Backfill shall not be placed on the flowable mortar prior to final set or hardening as determined by the Engineer.

D. Cutoff material shall be placed from bottom of trench to top of ground.

END OF DOCUMENT

FINISH GRADING

PART 1. GENERAL

1.1 The work called for by this section shall include, but not necessarily be limited to, finish grading and the spreading and shaping of topsoil to the finished contour elevations indicated by the drawings.

1.2 Refer to other sections for work related to that specified under this heading. Coordinate this work with that specified by other sections for timely execution.

PART 2. PRODUCTS

2.1 Topsoil: Use stripped topsoil that has been stockpiled as specified elsewhere. If the quantity of topsoil on the job is inadequate, furnish enough additional topsoil. Topsoil furnished shall be natural, fertile, friable soil possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well-drained areas. It shall not be excessively acid or alkaline nor contain toxic substances that may be harmful to plant growth. Topsoil shall be without admixture of subsoil and shall be cleaned and reasonably free from clay lumps, stones, stumps, roots, or similar substances 2 inches or more in diameter, debris, or other objects that are a hindrance to planting operations. Such material shall be subject to testing.

PART 3. EXECUTION

3.1 Do not begin work until the earth is dry enough to be tillable.

3.2 Inspect sub-grades to see that they generally conform to the standards called for elsewhere in these specifications, particularly with regard to the approximate depths required for the work. After work is completed, inspect it to ensure that all finish grading complies with design requirements.

3.3 Place finished grade stakes wherever necessary to bring the work accurately to the elevations required by the drawings.

3.4 Finish grade all areas outside the building line to the depths required for the work as follows:

A. Grade uniformly with rounded surfaces at the tops and bottom of abrupt changes of planes.

1. Hand grade steep slopes and areas that are inaccessible for machine work.
2. Protect grades areas from undue erosion, and repair and re-grade areas where erosion does occur.
3. Refill areas where noticeable settlement has occurred.
4. Finish grade areas that are to receive topsoil up to 4 inches below the finished contour elevations called for by the drawings or, over rock, to 12 inches below these elevations.

B. Place topsoil uniformly over disturbed areas that do not receive other work as follows:

1. Obtain approval of the finish grading from the A/E before starting to place topsoil.
2. Scarify sub-grade to a depth of 3 inches.
3. Place the topsoil to a depth of 4 inches when lightly rolled or, on rock, to a depth of 12 inches.
4. Level the topsoil so that it slopes uniformly and has no water pockets.
5. Carefully rake the topsoil by hand to remove all clods, roots, sticks, stones over 1 inch in diameter, and other foreign materials from the surface.

C. Dispose of excess excavated materials and debris away from the site.

END OF DOCUMENT

SECTION 02270

SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.01 SCOPE

A. This section shall consist of temporary control measures as shown in the plans or directed by the ENGINEER during the life of the Contract to control erosion and water pollution, through the use of berms, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other control devices.

B. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features, to assure economical, effective, and continuous erosion control throughout the construction and post-construction period.

C. The City of Chattanooga, Department of Public Works, Storm Management Division guidelines, "General Criteria for Controlling Erosion and Sediment from Land Disturbing Activities." 1988 edition shall be included in these specifications by references.

PART 2 - PRODUCTS

2.01 SEDIMENT STRUCTURES

Sediment basins, ponds, and traps, are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from siltation.

2.02 TEMPORARY SEEDING AND MULCHING

Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes including waste sites and borrow pits shall be seeded when and where necessary to eliminate erosion. See Section 02485.

2.03 BALED HAY OR STRAW CHECKS

A. Baled hay or straw erosion checks are temporary measure to control erosion and prevent siltation. Bales shall be either hay or straw containing five (5) cubic feet or more of material.

B. Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment, along the toe of slopes, in ditches, or other areas where siltation erosion or water run-off is a problem.

2.04 TEMPORARY SILT FENCES

Silt fences are temporary measure utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the run-off water.

2.05 EROSION CONTROL FABRIC

Erosion control fabric shall be Hold/Gro Erosion Control Fabric as manufactured by Gulf States Paper Corporation, or approved equal, and shall consist of strips of biodegradable paper, interwoven with yarn that is subject to degradation by ultraviolet light.

PART 3 - EXECUTION

3.01 PROJECT REVIEW

Prior to the preconstruction conference, the Contractor shall meet with the ENGINEER and go over in detail the expected problem areas in regard to the erosion control work. Different solutions should be discussed so that the best method might be determined. It is the basic responsibility of the Contractor to develop an erosion control plan acceptable to the ENGINEER.

3.02 PRECONSTRUCTION CONFERENCE

At the preconstruction conference, the Contractor shall submit for acceptance his schedule for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing, grading, bridges and other structures at watercourses, construction, and paving. He shall also submit for acceptance his proposed method of erosion control on haul roads and borrow pits and his plan for disposal of waste materials. No work shall be started until the erosion control schedules and methods of operations have been accepted by the ENGINEER.

3.03 CONSTRUCTION REQUIREMENTS

A. The ENGINEER has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, and borrow and fill operations, and the authority to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other water impoundment. Such work may involve the construction of sediment basins, and use of temporary mulches, mats, seeding or other control devices or methods as necessary to control erosion. Cut and fill slopes shall be seeded and mulched as the excavation proceeds to the extent directed by the ENGINEER.

B. The Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in his accepted schedule. Temporary pollution control measures shall be used to correct conditions

that develop during construction that were not foreseen during the design stage that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

C. Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise erosion control measures may be required between successive construction stages. Under no conditions shall the surface area of erodible earth material exposed at one time by clearing and grubbing, exceed 15,000 square feet without approval by the ENGINEER.

D. The ENGINEER will limit the area of excavation, borrow, and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.

E. Under no conditions shall the amount of surface area or erodible earth material exposed at one time by excavation or fill within the project area exceed 15,000 square feet without prior approval by the ENGINEER.

F. The ENGINEER may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project conditions.

G. In the event of conflict between these requirements and Federal or State or local agencies, the more restrictive laws, rules, or regulations shall apply.

3.04 CONSTRUCTION OF STRUCTURES

A. SEDIMENT STRUCTURES

1. Sediment structures shall be utilized to control sediment at the foot of embankments where slope drains outlet; at the bottom as well as in the ditch lines atop waste sites; in the ditch lines or borrow pits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long as they are wide.

2. When use of temporary sediment structures are to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.

B. TEMPORARY SEEDING AND MULCHING

Seeding and mulching shall be performed in accordance with the section entitled "Seeding and Mulching."

C. BALED HAY OR STRAW EROSION CHECKS

Hay or straw erosion checks shall be embedded in the ground 4 to 6 inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales can remain in place until they rot, or be removed after they have served their purpose, as determined by the ENGINEER. The Contractor shall keep the checks in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.

D. TEMPORARY SILT FENCES

1. Temporary silt fences shall be placed on the natural ground, at the bottom of fill slopes, in ditches, or other areas where siltation is a problem. Silt fences are constructed of wire mesh with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored into the soil.

2. The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the ENGINEER. The silt fence becomes the property of the Contractor whenever the fence is removed.

E. EROSION CONTROL FABRIC

1. Fabric shall be installed immediately after seeding operations have been completed in work areas. Mulch shall not be used under the fabric.

2. Installation instructions shall be supplied by the manufacturer, and fabric shall be applied in accordance with the manufacturer's recommendation as directed by the specifier.

3. Fabric shall be unrolled and draped loosely, without stretching, so that continuous ground contact is maintained. In ditches, fabric shall be unrolled and applied parallel to the flow direction. On slopes, fabric shall be applied parallel to the slope direction unless the ENGINEER approves an alternate application method.

4. In ditches and on slopes, each upslope and each downslope end of each piece of fabric shall be placed in a 4-inch trench, stapled on 9-inch centers, backfilled and tamped. Where one roll ends and a second roll starts, the upslope piece shall be brought over the end of the downslope roll so that there is a 12-inch overlap, placed in a 4-inch trench, stapled on 9-inch centers, backfilled and tamped.

5. On slopes where two or more widths of fabric are applied, the two edges shall be overlapped according to manufacturer's installation instructions and stapled at 18-inch to 24-inch intervals along the exposed edge of the lap joint. The body of the fabric shall be stapled in a grid pattern with staples 3 feet maximum on center each way.

6. Where heavy concentrations of water or extremely erodible soil conditions exist, erosion checks shall be installed at intervals up to 50 feet as directed by the ENGINEER. Erosion checks shall be a 4-inch deep trench perpendicular to the flow line across the width of the fabric. The fabric shall be stapled at 9-inch intervals along the bottom of the trench across the entire width of the fabric, backfilled and stamped.

3.05 MAINTENANCE

A. The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

B. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of work as scheduled, and are ordered by the ENGINEER, such work shall be performed by the Contractor at his own expense.

C. Where the work to be performed is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls and falls within the specifications for a work item that has a contract price, the units of work shall be paid for at the proper contract prices.

3.06 EROSION CONTROL OUTSIDE PROJECT AREA

Temporary pollution control shall not include construction work outside the project area where such work is necessary as a result of construction such as: borrow pit operations, haul roads and equipment storage sites. Bid Price in such cases shall not include all necessary clearing and grubbing, construction incidentals, maintenance, and site restoration when no longer needed. This will be the responsibility of the Contractor.

END OF DOCUMENT

SECTION 02485
SEEDING AND MULCHING

PART 1 - GENERAL

1.01 SCOPE

A. The Work covered by this Section consists of furnishing all labor, equipment, and material required to place topsoil, seed, commercial fertilizer, agricultural limestone, and mulch material, including seedbed preparation, harrowing, compacting, and other placement operations on graded earthen areas as described herein and/or shown on the Drawings. In general, seeding operations shall be conducted on all newly graded earthen areas not covered by structures, pavement, or sidewalks; all cleared or grubbed areas which are to remain as finish grade surfaces; and on all existing turf areas which are disturbed by construction operations and which are to remain as finish grade surfaces. Areas disturbed by borrow activities shall also be seeded according to these Specifications.

B. The Work shall include temporary seeding operations to stabilize earthen surfaces during construction or inclement weather and to minimize stream siltation and erosion.

1.02 QUALITY ASSURANCE

A. Prior to seeding operations, the CONTRACTOR shall furnish to the ENGINEER labels or certified laboratory reports from an accredited commercial seed laboratory or a state seed laboratory showing the analysis and germination of the seed to be furnished. Acceptance of the seed test reports shall not relieve the CONTRACTOR of any responsibility or liability for furnishing seed meeting the requirements of this section.

B. Prior to topsoil operations, the Contractor shall obtain representative samples and furnish soil test certificates including textural, pH, and organic ignition analysis from the State University Agricultural Extension Service or other certified testing laboratory.

C. All existing lawns encountered shall be replaced with topsoil and seeding of the same type and quality as that existing prior to construction and shall be restored to original condition or better.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. The CONTRACTOR shall place a minimum of 4 inches of topsoil over all graded earthen areas and over any other areas to be seeded. Sources of topsoil shall be approved by the ENGINEER prior to disturbance.

B. Topsoil shall be a friable loam containing a large amount of humus and shall be original surface soil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2 inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips, or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and perennial weed seeds, and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life.

C. Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, sandy loam, or a combination thereof. The pH shall range from 5.5 to 7.0. Topsoil shall contain not less than 5 percent nor more than 20 percent, by weight, of organic matter as determined by loss on ignition of oven-dried samples to 65 degrees C. The ignition test shall be performed on samples which have been thoroughly oven-dried to constant weight at a temperature of 221 degrees F.

2.02 SEED

A. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the U.S. Department of Agriculture Federal Seed Act.

B. All seed shall be from the last crop available at time of purchase and shall not be moldy, wet, or otherwise damaged in transit or storage.

C. Seed shall bear the growers analysis testing to 98% for purity and 90% for germination. At the discretion of the ENGINEER, samples of seed may be taken for check against the growers analysis.

D. Species, rate of seeding, fertilization, and other requirements are shown in the Seeding Requirements Table.

2.03 FERTILIZER AND LIMING MATERIALS

A. Fertilizer and liming materials shall comply with applicable state, local, and federal laws concerned with their production and use.

B. Commercial fertilizer shall be a ready mixed material and shall be equivalent to the grade or grades specified in the Seeding Requirements Table. Container bags shall have the name and address of the manufacturer, the brand name, net weight, and chemical composition.

Seeding Requirements Table

Area	Sowing Season	Species	Seed	Fertilizer	Limestone
Flat to rolling Terrain with slopes less than 3:1	3/1-6/1	Kentucky 31			

C. Agricultural limestone shall be a pulverized limestone having a calcium carbonate content on not less than 85% by weight. Agricultural limestone shall be crushed so that at least 85% of the material will pass a No. 10 mesh screen and 50% will pass a No. 40 mesh screen.

2.04 MULCH MATERIAL

A. All mulch materials shall be air dried and reasonably free of noxious weeds and weed seeds or other materials detrimental to plant growth.

B. Mulch shall be composed of wood cellulose fiber, straw, or stalks, as specified herein. Mulch shall be suitable for spreading with standard mulch blowing equipment.

C. Wood-cellulose fiber mulch shall be as manufactured by Weyer-Hauser Company, Conway Corporation, or equal.

D. Straw mulch shall be partially decomposed stalks of wheat, rye, oats, or other approved grain crops.

E. Stalks shall be the partially decomposed, shredded residue of corn, cane, sorghum, or other approved standing field crops.

2.05 MULCH BINDER

A. Mulch on slopes exceeding 3 to 1 ratio shall be held in place by the use of an approved mulch binder. The mulch binder shall be non-toxic to plant life and shall be acceptable to the ENGINEER.

B. Emulsified asphalt binder shall be Grade SS-1, ASTM D 977. Cut-back asphalt binder shall be Grade RC 70 or RC 250.

2.06 INNOCULANTS FOR LEGUMES

All leguminous seed shall be inoculated prior to seeding with a standard culture of nitrogen-fixing bacteria that is adapted to the particular seed involved.

2.07 WATER

Water shall be clean, clear water free from any objectionable or harmful chemical qualities or organisms and shall be furnished by the CONTRACTOR.

PART 3 - EXECUTION

3.01 SECURING AND PLACING TOPSOIL

A. Topsoil shall be secured from areas from which topsoil has not been previously removed, either by erosion or mechanical methods. Topsoil shall not be removed to a depth in excess of the depth approved by the ENGINEER.

B. The area or areas from which topsoil is secured shall possess such uniformity of soil depth, color, texture, drainage, and other characteristics as to offer assurance that, when removed the product will be homogeneous in nature and will conform to the requirements of these Specifications.

C. All areas from which topsoil is to be secured, shall be cleaned of all sticks, boards, stones, lime, cement, ashes, cinders, slag, concrete, bitumen, or its residue, and any other refuse which will hinder or prevent growth.

D. In securing topsoil from a designated pit or elsewhere, should strata or seams of material occur which do not come under the requirements for topsoil, such material shall be removed from the topsoil, or if required by the ENGINEER, the pit shall be abandoned.

E. Before placing or depositing topsoil upon any areas, all improvement within the area shall be completed, unless otherwise approved by the ENGINEER.

3.02 SEEDBED PREPARATION

A. Before fertilizing and seeding, the topsoil surfaces shall be trimmed and worked to true line free from unsightly variation, bumps, ridges and depressions, and all detrimental materials, roots, and stones larger than 1 inch in any dimension shall be removed from the soil.

B. Not earlier than 24 hours before the seed is to be sown, the soil surface to be seeded shall be thoroughly cultivated to a depth of not less than 2 inches with a weighted disc, tiller, pulvimixer, or other equipment, until the surface is smooth and in a condition acceptable to the ENGINEER.

C. If the prepared surface becomes eroded as a result of rain or for any other reason, or becomes crusted before the seed is sown, the surface shall again be placed in a condition suitable for seeding.

D. Ground preparation operations shall be performed only when the ground is in a tillable and workable condition.

3.03 FERTILIZATION AND LIMING

A. Following seedbed preparation, fertilizer shall be applied to all areas to be seeded so as to achieve the application rates shown in the Seeding Requirements Table. Copies of all weight tickets shall be furnished to the ENGINEER.

B. Fertilizer shall be spread evenly over the seedbed and shall be lightly harrowed, raked, or otherwise incorporated into the soil for a depth of 1/2 inch.

C. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. The seed shall not remain in water containing fertilizer for more than 30 minutes when a hydraulic seeder is used.

D. Agricultural limestone shall be thoroughly mixed into the soil according to the rates in the Seeding Requirements Table. The specified rate of application of limestone may be reduced by the ENGINEER if pH tests indicate this to be desirable. It is the responsibility of the CONTRACTOR to obtain such tests and submit the results to the ENGINEER for adjustment in rates.

E. It is the responsibility of the Contractor to make one application of maintenance fertilizer according to the recommendations listed in the Seeding Requirements Table.

3.04 SEEDING

A. Seed of the specified group shall be sown as soon as preparation of the seedbed has been completed. No seed shall be sown during high winds, nor until the surface is suitable for working and is in a proper condition. Seeding shall be performed during the dates shown in the Seeding Requirements Table unless otherwise approved by the ENGINEER. Seed mixtures may be sown together provided they are kept in a thoroughly mixed condition during the seeding operation. Copies of all weight tickets shall be furnished to the ENGINEER.

B. Seeds shall be uniformly sown by any approved mechanical method to suite the slope and size of the areas to be seeded, preferably with a broadcast type seeder, windmill hand seeder, or approved mechanical power drawn seed drills. Hydro-seeding and hydro-mulching may be used on steep embankments, provided full coverage is obtained. Care shall be taken to adjust the seeder for seedings at the proper rate before seeding operations are started and to maintain their adjustment during seeding. Seed in hoppers shall be agitated to prevent segregation of the various seeds in a seeding mixture.

C. Immediately after sowing, the seeds shall be covered and compacted to a depth of 1/8 to 3/8 inch by a cultipacker or suitable roller.

D. Leguminous seeds shall be inoculated prior to seeding with an approved and compatible nitrogen-fixing inoculated in accordance with the manufacturer's mixing instructions.

3.05 MULCHING

A. All seeded areas shall be uniformly mulched in a continuous blanket immediately after seeding. The mulch shall be applied so as to permit some sunlight to penetrate and the air to circulate and at the same time shade the ground, reduce erosion, and conserve soil moisture. Approximately 25 percent of the ground shall be visible through the mulch blanket.

B. One of the following mulches shall be spread evenly over the seeded areas at the following application rates:

1. Wood Cellulose Fiber	1,400 lbs./acre
2. Straw	4,000 lbs./acre
3. Stalks	4,000 lbs./acre

These rates may be adjusted at the discretion of the ENGINEER at no additional cost to the OWNER, depending on the texture and condition of the mulch material and the characteristics of the seeded area.

C. Mulch on slopes greater than 3 to 1 ratio shall be held in place by the use of an approved mulch binder. Binder shall be thoroughly mixed and applied with the mulch. Emulsified asphalt or cutback asphalt shall be applied at the approximate rate of 5 gallons per 1,000 square feet as required to hold the mulch in place.

D. The CONTRACTOR shall cover structures, poles, fence, and appurtenances if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.

E. Mulch and binder shall be applied by suitable blowing equipment at closely controlled application rates.

3.06 WATERING

A. CONTRACTOR shall be responsible for maintaining the proper moisture content of the soil to insure adequate plant growth until a satisfactory stand is obtaincd. If necessary, watering shall be performed to maintain an adequate water content in the soil.

B. Watering shall be accomplished by hoses, tank trucks, sprinklers in such a way to prevent erosion, excessive runoff, and overwatered spots.

3.07 MAINTENANCE

A. Upon completion of seeding operations, the CONTRACTOR shall clear the area of all equipment, debris, and excess material and the premises shall be left in a neat and orderly condition.

B. The CONTRACTOR shall maintain all seeded areas without additional payment

until final acceptance of the work by the Owner. Seeding work shall be repeated on defective areas until a satisfactory uniform stand is accomplished. Damage resulting from erosion, gullies, washouts, or other causes shall be repaired by filling with topsoil, compacting, and repeating the seeding work at contractor's expense.

SECTION 02560
MANHOLES

PART 1 - GENERAL

1.01 SCOPE

The work covered by this Section includes furnishing all labor, equipment and materials required to install cast-in-place, and/or precast concrete manholes, and concrete junction chambers as described herein and/or shown on the Drawings.

1.02 DESIGN CRITERIA

A. Manholes shall be constructed of specified materials to the sizes, shapes, and dimensions and at the locations shown on the Drawings or as otherwise directed by the ENGINEER. The height or depth of the manhole will vary with the location, but unless shown otherwise on the Drawings shall be such that the top of the manhole frame will be at the finished grade of the pavement or ground surface and the invert will be at the designed elevations.

B. Where the difference in the invert elevation of a sewer 18 inches in diameter or smaller and any other sewer intersecting in one manhole is 18 inches or more, a dropmanhole shall be constructed as shown on the Drawings. They shall be similar in construction to the standard manhole except that a drop connection of pipe and fittings of the proper size and material shall be constructed outside the manhole and be supported by Class B Concrete.

1.03 QUALITY ASSURANCE

A. Prior to delivery all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the ENGINEER, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials which fail to conform to these specifications shall be rejected.

B. After delivery to the site, any materials which have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site.

1.04 SHOP DRAWINGS AND ENGINEERING DATA

Complete shop drawings and engineering data on frames, covers, steps, and precast manhole sections shall be submitted to the ENGINEER in accordance with the requirements of the section entitled "Submittals" of these Specifications.

1.05 GUARANTEE

Provide a guarantee against defective materials and workmanship in accordance with the requirements of the Section entitled "Guarantees and Warranties" of these Specifications.

PART 2 - PRODUCTS

2.01 CONCRETE AND REINFORCEMENT

A. Concrete used in manhole and junction chamber construction shall be Class A concrete conforming to the requirements of the Section entitled "Cast-In-Place Concrete" of these Specifications.

B. Steel reinforcement shall conform to the requirements of the Section entitled "Cast-In-Place Concrete Reinforcement" of these Specifications.

2.02 MORTAR

A. Mortar for manhole construction shall be sand cement mortar composed of one part Portland Cement to two parts clean sand conforming to ASTM C 144. Twenty pounds of hydrated lime per sack of cement may be added. No retempered mortar shall be used.

B. Non-shrink mortar shall be pre-mixed, Master Builders "Masterflow 713", Sonneborn "Ferrolith G-D.S. Redi-Mixed", or equal.

2.03 PRECAST CONCRETE MANHOLES

A. Precast concrete manholes shall consist of precast reinforced concrete sections, a conical or flat slab top section, and a base section conforming with the typical manhole details as shown on the Drawings.

B. Precast manhole sections shall be manufactured, tested, and marked in accordance with the latest provision of ASTM C 478.

C. The minimum compressive strength of the concrete for all sections shall be 4,000 psi.

D. The maximum allowable absorption of the concrete shall not exceed eight (8%) percent of the dry weight.

E. The circumferential reinforcement in the riser sections, conical top sections, and base wall sections shall consist of one line of steel and shall be not less than 0.12 square inches per lineal foot.

F. The ends of each reinforced concrete manhole riser section and the bottom end of the manhole top section shall be so formed that when the manhole risers and the top are assembled, they will make a continuous and uniform manhole.

G. Joints of the manhole sections shall be tongue and groove. Sections shall be joined using either an O-ring gasket or a mastic sealant consisting of bitumen and inert mineral fibers. The sealant shall be applied in accordance with the manhole manufacturer's requirements. A sufficient amount of sealant should be used to fill the annular joint space with some squeeze out.

H. Each section of the precast manhole shall have not more than two (2) holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with rubber stoppers or mortar after installation.

I. Cast iron or reinforced plastic manhole steps shall be installed in each section of the manhole in accordance with the details on the Drawings.

2.04 FRAMES, COVERS, AND STEPS

A. Cast iron manhole steps, toe pockets, frames, and covers shall be cast iron conforming to the minimum requirements of Federal Specifications WW-1-652 or to ASTM A 48, "Gray Iron Castings," for Class 35B. All castings shall be made accurately to the required dimensions, fully interchangeable, sound, smooth, clean, and free from blisters and/or other defects. All regular manhole frames and covers shall be the City's Standard as manufactured by Acheson Foundry A2024-81C weight of 350 pounds as shown on the drawings.

Defective castings which have been plugged or otherwise treated shall not be used. All castings shall be thoroughly cleaned and painted or coated with a bituminous paint.

B. Reinforced plastic manhole steps shall conform to the minimum requirements of ASTM 2146-68 under Type II, Grade 16906 and ASTM C-478, Paragraph 11. The reinforcing bar shall be a Grade 60, deformed 1/2-inch reinforcing bar conforming to all the requirements of ASTM A-615.

C. All manhole frames and covers shall be of the size and weight shown on the Drawings. All regular manhole frames and covers shall be the City's Standard as manufactured by Acheson Foundry A2024-81C weight of 350 pounds as shown on the drawings.

D. Watertight manhole covers shall be furnished with a rubber gasket, stainless steel tightening bolt, machined bearing surfaces, channel iron locking bar, and concealed watertight pick hole, and shall weigh not less than 590 pounds, and shall be of the size and dimensions shown on the Drawings. Watertight manhole covers shall be equivalent to A2624-71C as manufactured by Acheson Foundry of Chattanooga, Tennessee.

E. The contact surfaces of all manhole covers and the corresponding supporting rings in the frames shall be machined to provide full perimeter contact.

F. All sanitary sewer manhole covers shall have the words "CITY OF CHATTANOOGA" and "SEWER" as designated by the Engineer cast on the top in letters two (2) inches high or other as directed.

G. An adjusting ring equal to R1979 as manufactured by Neenah Foundry Company of Neenah, Wisconsin, shall be provided for each manhole in a street. Adjusting rings shall provide a minimum inside clear opening of 24 inches and shall be made to be capable of being bolted to the manhole frame.

PART 3 - EXECUTION

3.01 GENERAL MANHOLE CONSTRUCTION

A. All manhole bases, including curved manhole bases, and inverts shall be constructed of Class A concrete in accordance with details on the Drawings and inverts shall be smooth and accurately shaped and have the same cross section as the invert of the sewers which they connect.

The manhole base and invert shall be carefully formed to the required size and grade by gradual and even changes in sections, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit.

B. Pipe of all diameters shall be connected to manholes using an integrally cast A-lock elastomeric ring, a Kor-N-Seal rubber boot, or approved equal flexible connector and shall be installed as recommended by the manufacturer. Connections using mortar or other rigid materials will not be acceptable. Connections to existing manholes shall be cored. "Hammer taps" will not be acceptable.

C. The manhole steps shall be inserted into the wall of the manhole at the proper locations and elevations and shall be securely embedded in the wall.

D. Any adjustment necessary for manhole frame elevation shall be made with concrete "donut" sections. A maximum of three (3) sections shall be permitted.

E. The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the masonry. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted to conform to the exact slope, crown, and grade of the existing adjacent pavement.

F. Masonry work shall be allowed to set for a period of not less than 24 hours. Outside forms, if any, shall then be removed and the manhole backfilled and compacted in the manner provided in the Section entitled "Earthwork" of these Specifications. All loose or waste material shall be removed from the interior of the manhole. The manhole cover then shall be placed and the surface in the vicinity of the work cleaned off and left in a neat and orderly condition.

G. After backfilling has been completed, the excavated area if located in a street, alley, or sidewalk, shall be provided with a temporary surface, as directed by the ENGINEER.

3.02 CONSTRUCTION OF CAST-IN-PLACE CONCRETE MANHOLES

A. Cast-in-place manholes, excluding curved manhole bases, shall be constructed in place with the base, barrel and conical section all monolithically cast using removable forms of a material and design approved by the ENGINEER

B. The vertical forms, vertical and horizontal wall spacers steps and placing cone must be carefully positioned and firmly clamped in place before any placement is made. The wall spacers must be located 90 degrees from each other. The forms shall be firmly supported with bottom of forms at the proper elevation to permit the base to be deposited through the vertical forms.

C. The manhole base shall be deposited down through the wall forms onto undisturbed earth or rock bearing. It shall be evenly distributed around the wall and vibrated both inside and outside the forms until there is a minimum slope of 60 degrees from the bottom of the forms to the bearing surface both inside and outside of the manhole. When this is complete and before additional concrete is added, the concrete must be carefully vibrated on each side of each sewer pipe.

D. The base shall be concentric with the manhole and have a minimum diameter of 16 inches greater than the outside diameter of the manhole, and 10-inch minimum thickness under the lowest pipe. Minimum wall thickness shall be six (6) inches.

E. Additional concrete must be deposited in evenly distributed layers of approximately 18 inches with each layer vibrated to bond it to the preceding layer. The wall spacers must be raised as the placements are made. The concrete in the area from which the spacer is withdrawn shall be carefully vibrated. Excessive vibration shall be avoided.

F. Adjustment rings shall be provided between the conical section and the manhole frame. The rings shall be cast-in-place using building felt between pours to create a weakened joint or as directed by the ENGINEER. If adjustment of the lid elevation is called for, concrete "donut" sections shall be used.

G. The invert and flow channel shall be constructed in accordance with the applicable requirements of Part 3.01 of this Section and shall be formed during or immediately after the placing of the concrete and brush-finished as soon as the concrete has sufficiently set.

H. Form marks and offsets shall not exceed one (1) inch on the outside surface of the manhole. Form marks and offsets shall not exceed 1/2 inch inside of the manhole. All offsets on the inside surface of the manhole shall be smoothed and rubbed so there is no projection or irregularity capable of scratching a worker or catching and holding water or solid materials. Honeycombed areas shall be completely removed immediately upon removal of the forms and replaced with Class A concrete.

I. Should circumstances make a cold joint necessary, a formed groove or reinforcing dowels shall be required in the top of the first placement for shear protection. Immediately before the second placement is made, the surface of the cold joint shall be thoroughly cleaned and wetted with a layer of mortar being deposited on the surface.

J. Concrete setting time, backfilling, masonry work, setting frame and cover, temporary paving, etc., shall be in accordance with the applicable requirement of Part 3.01 of this Section.

3.03 CONSTRUCTION OF PRECAST CONCRETE MANHOLES

A. The base and invert shall be constructed in accordance with the applicable requirements of Part 3.01 of this Section.

B. After the base section has been allowed to set for a period of not less than 24 hours, the precast manhole sections shall be placed thereon, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations.

C. Manhole sections shall be set so that the manhole steps align vertically.

D. Masonry work required to complete the precast concrete manhole shall be done in accordance with the provisions of Part 3.01 of this Section.

E. Fill all joints, lifting holes, and other imperfections inside and outside with non-shrink mortar, overlapping the seam 2" on both sides, to form a neat, smooth finish. Manholes shall be completely waterproof.

F. Concrete setting time, backfilling, setting frame and cover, temporary paving, etc., shall be in accordance with the applicable requirements of Part 3.01 of this section.

3.04 CONSTRUCTION OF PRECAST CONCRETE "TEE" MANHOLE BASES

A. Precast concrete tee manhole bases and elbows shall conform to the requirements of the Section entitled "Concrete Pipe Sewers" of these Specifications. Class of pipe used shall be the same as that used in the line adjacent to the manhole and elbow. The tee section shall be carefully formed to the required size. The inside of the base shall be left smooth with no rough edges or protrusions.

B. Elbows where required shall be fabricated to a true angle as shown on the drawings. Elbows shall be made smooth by hand troweling and the finished surface shall be equal to that in the rest of the pipe.

C. All fabrication work on the manhole base and elbows shall be done by the manhole or pipe manufacturer at the plant. No field fabrication will be permitted without specific authorization of the ENGINEER.

D. After the base section has been installed, the precast manhole sections shall be placed thereon.

E. Masonry work required to complete the precast concrete manhole shall be done in accordance with the provisions in Part 3.01 of this Section.

F. Concrete setting time, backfill, masonry work, setting frame and cover, temporary paving, etc., shall be in accordance with the applicable requirements of Part 3.01 of this Section.

3.05 CONSTRUCTION OF JUNCTION CHAMBERS

A. Junction chamber toe pockets shall conform to the applicable requirements of Part 2.04 of this section and shall be placed as shown on the Drawings.

B. The concrete shall be constructed in strict accordance with the Drawings and other applicable specifications and all lines inside the chamber shall be finished smooth with no protrusions to obstruct flow, all subject to the approval of the ENGINEER.

C. During construction of the junction chambers, the existing sewage flow shall be maintained in a manner acceptable to the ENGINEER. Bypassing of sewage into streams or storm water drainage facilities will not be permitted. If the junction chamber is to be built on an existing sewer, the section of sewer within the junction chamber shall be removed before the base of the junction chamber is poured unless shown otherwise on the Drawings.

D. All ground areas that are disturbed during construction of the junction chamber shall be prepared and grassed as called for elsewhere in these Specifications.

3.07 TESTING

Manholes installed in this contract shall be tested prior to backfilling for compliance with the infiltration limits specified for pipe used in this contract. The methoused shall be a vacuum test in which manholes are plugged, pumped to 5 psi vacuum, and held for a minimum of one (1) minute. The manhole shall be approved when it losesless than one (1) psi vacuum pressure during the 1 minute test period.

END OF SECTION

SECTION 2810

LANDSCAPING

PART 1 - GENERAL

1.01 REQUIREMENT, CODES

A. All applicable portions of the site work and general conditions, specifications and requirements are to be considered as included with this section.

B. The following are minimum requirements and shall govern except that all local, state and/or federal codes and ordinances shall govern when their requirements are in excess hereof.

C. The landscaping shall be installed by a licensed Landscape Contractor.

1.02 SCOPE

A. Provide all labor, materials, equipment and services necessary and incidental to the completion of all landscaping where shown or indicated on the drawings and specified herein.

B. Work included consists of, but is not limited to, the following:

LAWN INSTALLATION:

Fertilizer and lime application.
Final soil preparation.
Seeding of new lawn areas.
Placement of slope ground cover.
Mulch application.
Maintenance of seeded areas.
Replanting of unsatisfactory or damaged turf.

PLANT MATERIAL INSTALLATION:

Furnishing, delivering, and unloading of plant materials at site.

Preparation of planting pits and beds and related excavation, backfilling, and disposal of surplus and unsuitable excavated material.

Planting of trees, including fertilizing, mulching, and if necessary pruning, guying and/or staking.

Guarantee and replacement of plant material.

Maintenance of lawns and trees, as specified in Section 2820, Landscape Maintenance.

1.03 OTHER DOCUMENTS INCLUDED OR RELATED TO THIS CONTRACT

A. Annual Maintenance Manual - Section 2820

B. Landscape Plan and Details - Sheets C-1 through C-13.

1.04 SUBMITTALS

A. CERTIFICATION OF QUALIFICATION: Prior to bid acceptance, submit certification of insulator's experience identifying a minimum of four (4) projects to the Owner's representative. Include the following information for each project: Owner, Landscape Architect, project location, type and size of contract.

B. WORK SCHEDULE:

1. Submit a proposed work schedule to City of Chattanooga's Construction Representative at least 30 days prior to start of work under this Section. After approval, no modification shall be made to this schedule without written authorization by City of Chattanooga's Construction Representative.

2. All landscape work must be completed by _____, 2001.

3. Complete erosion control and turf establishment must be completed by _____, 2001.

4. The Landscape Contractor shall carefully correlate his work with that of other site Contractors.

1.05 INSPECTION OF CONDITIONS

A. EXAMINATION OF SITE: This subcontractor will have examined the site personally to ascertain the state thereof and to understand the complexities of the work. This subcontractor will be held to have satisfied himself as to the condition of the premises, the actual elevation, existing obstructions, areas of work, and other conditions that would affect the completion of the work.

1. The bidder must acknowledge that he has examined the site, plans and specifications, and the submission of a quotation shall be considered evidence that examinations have been made.

2. The bidder shall verify availability of stockpiled topsoil prior to submittal to bid.

3. The Contractor shall verify the accuracy of all finish grades within the work area.

B. FIELD CONDITIONS: The Contractor shall verify drawing dimensions with

actual field conditions and inspect related work and adjacent surfaces. The Contractor shall report to the City of Chattanooga's Construction Representative all conditions which prevent proper execution of this work.

C. The exact location of all existing utilities, structures, and underground utilities, which may not be indicated on the drawings, shall be determined by the Contractor, and he shall conduct his work so as to prevent interruption of service or damage to them. The Contractor shall protect existing structures and utility services and be responsible for their replacement if damaged by him. Any required removal, repair, or replacement of this work caused by unsuitable conditions shall be done at no additional cost to the City of Chattanooga or Owner.

1.06 PRECONSTRUCTION CONFERENCE

Schedule a preconstruction conference with City of Chattanooga's Construction Representative at least 7 days before beginning work under this Section. The purpose of this conference is to review any questions Contractor may have regarding the work, administrative procedures during construction and project work schedule.

1.07 SUBSTITUTIONS

A. Specific reference to manufacturers' name and products specified in this Section are used as standards, but this implies no right to substitute other material or method without written approval of the City of Chattanooga's Construction Representative.

B. Installation of any approved substitution is Contractor's responsibility. Any changes required for installation of any approved substitution must be made to the satisfaction of the City of Chattanooga's Construction Representative and without additional cost to the City of Chattanooga.

1.08 WARRANTY

A. All Plant material, lawns, and related work and material shall be warranted for a period of not less than one year from the date of acceptance of the landscape installation. See Section 3.07, completion and acceptance.

B. All replacement stock shall be subject to the same warranty requirements as the original stock. Any damage due to replacement operations shall be repaired by the Landscape Contractor at no expense to the City of Chattanooga or Owner.

1. During the last month of the Guarantee Period, the City of Chattanooga's Construction Representative will inspect the planting to determine the number and type of plants to be replaced. A count and description of the dead plants shall be made and submitted to the Contractor in writing. The Contractor shall replace these during the first thirty (30) days of the next earliest planting season.

2. Plants which have lost over 33 percent (33%) of their branches shall be

considered dead and shall be replaced. When replacements have been made and installed in compliance with these specifications, the requirements for planting under this contract shall be considered fulfilled.

3. All replacements under the guarantee shall be plants of the same kind, size, and quality as specified in the Plant List. They shall be furnished, planted, and mulched as specified herein.

1.09 FINAL ACCEPTANCE

Work under this Section will be accepted by the City of Chattanooga's Construction Representative upon satisfactory completion of all work. Upon Final Acceptance, and after one year maintenance period, City of Chattanooga will assume responsibility for the maintenance of the work. Said assumption does not relieve Contractor of obligations under Warranty.

1.10 APPROVAL

Wherever the terms "approve," "approval," "approved" are used in the Specification, they mean approval of the City of Chattanooga's Construction Representative, in writing.

PART 2 - PRODUCTS

2.01 STANDARDS

Comply with the provisions of the latest editions of the following specifications and standards, except as otherwise shown or specified herein.

A. AMERICAN STANDARD FOR NURSERY STOCK, 1986 Edition, American Association of nurserymen (ANSI.1-1986)

B. PLANT HARDINESS ZONE MAP, 1965 Edition, Miscellaneous Publication No. 814 Agricultural Research Service, U. S. Department of Agriculture.

C. U.S.D.A. TRIANGULAR SOIL TEXTURE CHART, Bureau of Plant Industries, Soils and Agricultural Engineering, U. S. Department of Agriculture.

2.02 TOPSOIL

A. Topsoil shall be fertile, natural topsoil, typical of the locality, obtained from well-drained areas. Stockpiled topsoil may be used. It shall be without admixture of subsoil or slag and shall be free of stones, lumps, sticks, plants or their roots, toxic substance or other extraneous matter that would be harmful to plant growth or would interfere with future maintenance. Topsoil pH range shall be 5.3 to 6.0.

B. If the supply of stockpiled topsoil is insufficient, the Landscape Contractor shall supply additional topsoil to meet all landscaping needs.

C. SOIL TESTING: The Contractor shall be responsible for having topsoil tested. Topsoil shall be tested by the local county extension office. The Contractor shall furnish one (1) copy of the soil analysis and recommended amendments prepared (to meet the desired pH, nutritional and organic levels determined to be adequate for the area) by the county extension agent, to the City of Chattanooga's Construction Representative's satisfaction prior to application of any amendments or fertilizer.

2.03 SOIL CONDITIONERS AND AMENDMENTS

A. Agricultural limestone shall contain not less than 95 percent calcium carbonate equivalent and shall be ground to such a fineness that at least 98 percent will pass a 20-mesh sieve and at least 50 percent will pass a 100-mesh sieve. Other liming material shall have a minimum calcium carbonate equivalent of 80 percent and shall be crushed to such a fineness that 98 percent will pass a 20-mesh sieve and at least 50 percent will pass a 100-mesh sieve.

B. Aluminum sulfate shall be horticultural grade.

C. Peat shall be a natural product of sphagnum moss peat (peat moss), derived from a freshwater site conforming to ASTM D2607 except as otherwise specified. Peat shall be shredded and granulated to pass a 1/2 inch mesh screen and conditioned in storage piles for at least 6 months after excavation. Peat shall be measured in a dry condition, containing not more than 35% moisture by weight.

D. Sand shall be clean and free of toxic materials.

E. Vermiculite shall be horticultural grade and free of any toxic materials.

F. Manure shall be well-rotted, unbleached stable or cattle manure not less than 8 months or more than 2 years old, containing not more than 25 percent by volume of straw, sawdust, or other bedding materials, and containing no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds.

G. Rotted sawdust shall have 7.5 pounds of nitrogen added uniformly to each cubic yard and shall be free of chips, stones, sticks, soil, and toxic substances.

H. Gypsum shall be 90 percent pure, free of any toxic materials, and at least 95 percent by weight shall pass a 4-mesh sieve.

I. Other amendments as recommended by the county extension agent.

2.04 SEED

A. Seed shall be the best blend of certified lawn grass and/or ground cover. Plant seeds common to the site location. Provide fresh, clean, new-crop seed complying with established to tolerances for germination and purity in accordance with the U. S. Department of Agriculture Rules and Regulations under the latest edition of the Federal Seed Act. Seed shall be mixed by the dealer and shall be delivered to the site in sealed containers which shall bear the dealer's guaranteed analysis. Seed mixture and seeding rate shall be specified on the drawings and on the following table:

	MIN% Purity/Germination	WT %	RATE/AC
1. WARM SEASON, TEMPORARY BLEND (See Plan For applicability)			
Tall Fescue Grass (Festuca Arundinacea)	98%/85%	100%	40 lbs./ac.
Annual Ryegrass (Lolium Multiflorum)	98%/85%	100%	15 lbs./ac.
2. WARM SEASON, PERMANENT BLEND (See plan for applicability)			
Bermuda Grass "Tifton 419" (Cynodon Dactylon "Tifton 419")	98%/85%	100%	40 lbs./ac.
3. STEEP BANK GROUND COVER BLEND (See plan for applicability)			
Tall Fescue Grass (Festuca Arundinacea)	98%/85%	100%	40 lbs./ac.
Sericea Lespedeza (Lespedeza Cuneta Var. Sericia)	98%/85%	100%	70 lbs./ac.

2.05 FERTILIZER

A. All fertilizers shall be complete formula fertilizers and shall conform to the applicable State Fertilizer Laws. All fertilizers shall be uniform in composition, free-flowing and suitable for application with approved equipment. Fertilizers shall be delivered to the site in the manufacturer's original unopened containers, fully labeled according to the applicable State Fertilizer Laws and shall bear the name, trade name, trademark, and warranty of the producer.

B. PLANT STOCK: Fertilizer shall be "Agriform" slow release fertilizer tablets.

C. LAWN AREAS: Shall be high phosphorus starter fertilizer. Fertilizer formula

and application rate shall be as recommended by the County Extension Agent based on soil test results.

2.06 PLANTING MIXTURE

Planting mixture shall consist of a uniform mixture of the following materials in respective proportions: three parts topsoil, one part peat moss, and one part manure. The mixture must be thoroughly ground up and mixed so that there is no visible segregation of material.

2.07 HERBICIDES

A. Herbicides must comply with all applicable State and Federal Laws and be registered with the U. S. Environmental Protection Agency.

1. HERBICIDE CONTROL SHALL BE:

a. Pre-emergence application of "Treflan 5% Granules" or equivalent, applied according to manufacturer's recommendations and incorporated into soil as specified.

b. Post-emergency application of "Roundup" or equivalent, applied as specified by manufacturer. Spray with extreme care to avoid contact with landscape plants and lawns to remain.

2.8 Water shall not contain elements toxic to plant life. It shall be obtained from on-site water source.

2.09 TREE PROTECTANTS

A. Trees shall not be staked.

2.10 MULCHES

A. MULCHES FOR PLANT STOCK: Shredded hardwood bark mulch common to the locality shall be specified. Bark shall be of a relative uniform particle size with a median size of one and one-half inches (1-1/2") and shall be free of sticks, stones, leaves and any other debris.

B. MULCHES FOR LAWN AREAS:

1. SEEDED AREAS 3:1 OR LESS: shall be clean, dry, weed-free straw suitable for placing with mulch blower equipment or by hand.

2. SEEDED AREAS OVER 3.1: Hay or straw as specified above with binder and wood cellulose fiber.

a. MULCH BINDER: RMB Plus by Reinco Mulch Binder Corporation (800) 526-7687, applied per manufacturer's specifications.

b. WOOD CELLULOSE: Wood cellulose fiber for use with hydraulic application of grass and seed and fertilizer shall consist of commercially prepared natural wood cellulose fiber or wood pulp processed to contain no growth or germination-inhibiting factors and dyed any appropriate color to facilitate visual metering of the application. On an air-dry weight basis, the wood cellulose fiber shall contain a maximum of 12 percent moisture, plus or minus 3 percent at the time of manufacture. The pH range shall be from 3.5 to 5.0. The wood cellulose fiber shall be manufactured so that the fibers disperse readily and uniformly as a homogeneous slurry, so that when hydraulically sprayed on the ground, the material will form blotter like cover impregnated uniformly with grass seed, and so that moisture and rainfall will absorb and percolate the underlying soil.

2.11 TREE ROOT CONTROL SYSTEMS

A. TYPAR BIOBARRIER

DowElanco, 9002 Purdue Road, Indianapolis, Indiana, 46268-1189, Phone 1-800-352-6776.

Typar biobarrier is a multi-year root control system, consisting of herbicidal time release nodules permanently attached to a permeable geotextile fabric, which will inhibit plant root encroachment.

B. DEEP ROOT

Deep Root Corporation, 15040 Golder West Circle, Westminster, California, 92683, Phone 1-714-898-0563.
Deep Root products are a multi-year root control system, consisting of a rigid plastic barrier which will direct the growth of root systems down, away from surface rooting.

C. Any substitution must be approved in writing and must be equal to the above mentioned products.

Refer to Section 1.07, Substitutions.

2.12 PLANT STOCK

A. The Contractor shall notify the City of Chattanooga's Construction Representative of the source of his materials and the inspection certificates required for their transporttation to the job site, prior to tagging plant materials.

B. Plant sources are subject to approval by the City of Chattanooga's Construction Representative.

C. Plant Material shall be first quality stock and shall conform to the code of standards set forth in the current edition of the American Standards for Nursery Stock sponsored by the American Association for Nurserymen, Inc.

D. Species and variety as specified on the drawings and delivered to the site shall be certified true to their genus, species and variety as specified on the drawings and as defined within the current edition of International Code of Nomenclature for Cultivated Plants, issued by the International Union of Biological Sciences.

E. Planting stock shall be well branched and well formed, sound, vigorous, healthy, free from disease, sun-scale, windburn, abrasion, and harmful insects or insect eggs, and shall have healthy, normal unbroken root systems. Deciduous trees and shrubs shall be symmetrically developed, or uniform habit of growth, with straight trunks or stems, and free from objectionable disfigurements. All trees shall be branched as street trees.

F. Plant materials shall be provided in the quantity, size and species as shown and/or scheduled under this contract. All stock shall be balled and burlapped or container grown stock. Bareroot stock of any kind is unacceptable.

G. Plant material shall be nursery grown in accordance with good horticultural practices and shall have been grown for at least two years in the same plant hardiness climate zone as the planting site, under climatic conditions similar to those in the locality of the project. Plant materials shall be typical of their species and variety and shall have been grown under proper cultivation with appropriate wide spacing of the plants to produce healthy, balanced and sturdily developed branches and densely foliated plants.

H. Plant materials shall be freshly dug and vigorous plants. No heel-in plants or plants from cold storage will be accepted.

I. Plants shall conform to measurements as shown on the drawings and/or specified in schedules except that plants larger than specified may be used if approved by the City of Chattanooga's Construction Representative prior to planting. Use of such plants shall not increase the contract price. If larger plants are approved, the root ball and planting pits shall be increased in proportion to the size of the plant.

J. All plant material measurements, i.e., caliper, height, branching, level, number of canes, ball sixes, etc., shall be in strict accordance with the latest edition of the American Standard for Nursery Stock. Minimum acceptable sizes are:

Trees 2 – ½" to 3"

K. Plant materials shall be measured when branches are in their normal position. Height and spread dimensions, when specified, refer to the main body of the plant and not from branch tip to branch tip.

L. Trees shall be labeled with a durable waterproof label and weather-resistant ink. Labels shall state the correct plant name and size as specified in the plant list of required plants. Labels shall be securely attached to plants and shall be legible for 60 days after delivery to the planting site. Wire identification tags shall not be used.

M. Caliper measurements shall be taken at a point on the trunk, six inches (6") above natural ground for trees up to and including four inch (4") caliper size material and at a point twelve inches (12") above the natural ground line for larger trees.

N. Where a range of sizes is specified in the schedule, no plant shall be less than the minimum size, and not less than 50 percent of the plants shall be as large as the average size specified.

O. All plants shall be free from disease, insect infestations, defects and physical damage that would prevent the plant from thriving with the desired quality, appearance and growth characteristics.

P. All plant materials shall be matched specimens from a single block source.

Q. Plants shall not be pruned before delivery. Trees which have a damaged or crooked leader, or multiple leaders, unless specifically requested, will be rejected. Damaged trees such as trees with abrasions of the bark, sun-scald, disfiguring knots, or cuts of limbs over 1/4 inch which have not completely callused, will be rejected.

R. No change in quality, quantity, species, variety, or sex of plants from those specified will be permitted without the written approval of the City of Chattanooga's Construction Representative. The Contractor may suggest alternative available plants which conform to the requirements of the contract as to size, type, and function. In no case shall the price for the substitution exceed the bid price of those replaced.

PART 3 - EXECUTION

3.01 GENERAL

A. Prior to beginning the work of this section, verify that site grading and preparation have been properly completed. At this point, rough grades should be 6" below the finish grade levels for all landscape and turf areas.

C. The Landscape Contractor shall proceed with the installation work as soon portion of the site becomes available.

C. UNDERGROUND OBSTRUCTIONS TO PLANTING: If underground utilities, construction or solid rock ledges are encountered, other locations for planting may be selected by the City of Chattanooga's Construction Representative. Damage to utility lines shall be repaired at the Contractor's expense at no additional cost to the City of Chattanooga or Owner.

D. PROTECTION OF EXISTING VEGETATION: If lawns have been established prior to planting operations, the surrounding turf shall be covered in a manner that will protect turf areas before excavations begin.

E. MATERIALS STORAGE AND CLEANUP: The Contractor shall keep the premises free from rubbish and all debris at all times and shall arrange his material storage so as not to interfere with the operation of the project. All unused materials, rubbish, and debris shall be removed from the site.

3.02 APPLICATION OF TOPSOIL

A. The Landscape Contractor shall place a six-inch (6") compacted layer of topsoil over all areas to be established in turf, shrubs or groundcover, except planter islands as specified below. The topsoil layer shall bring all landscape areas to finish grade.

B. PREPARATION OF PLANTER ISLANDS

1. The Landscape Contractor is to remove 36" of sub-grade from all planter islands and backfill with topsoil.

2. Planter islands shall be bermed to a high point of six inches (6") above adjacent curb, or higher as necessary to ensure positive drainage (a minimum of 2% slope). (See Detail Sheet).

C. Prior to topsoil placement, areas to receive topsoil shall be cleared of all debris. Clearing shall consist of the satisfactory removal and disposal of brush and rubbish occurring within all lawn and planting areas. Any collected debris shall be removed from the site.

D. Topsoil shall be tested and evaluated by the local county extension office. See Item 2.02, Paragraph C of this section.

E. Fertilizer and soil amendments as recommended shall be thoroughly tilled in before placing into planter areas. To assure that soil, organic matter and fertilizer are properly blended, several passes with the tiller in opposite directions shall be made.

F. After soil amendments have been thoroughly tilled in to soil, all areas are to be rolled with a hand roller weighing not more than 100 pounds per foot of width. (Compact at 85% Standard Proctor). During the rolling, all depressions caused by settlement of rolling shall be filled with additional topsoil and the surface shall be re-graded and rolled until presenting a smooth and even finish to the required finish grade.

G. Finish grading shall be done just prior to seeding or sodding. The entire area shall be carefully raked to a smooth surface free of all clods, roots or stones 1/2" or larger.

H. Final grades shall drain and conform to finish grades and contours indicated on site drawings. Grades shall not vary more than one-tenth of a foot from true surface grade when tested with a 12 foot straight edge.

I. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

3.03 SEEDING

A. Topsoil, fertilizer, lime and seed shall be applied to all areas to be seeded as specified herein and in accordance with standard horticultural practices.

B. Any undulations or irregularities in the surface resulting from fertilizing, liming, tilling, or other causes shall be smoothed prior to application of seed. The final grade shall be reasonably firm but friable.

C. CLEANUP: Prior to seed application, the surface shall be raked of all trash, debris and stones larger than 1 inch in diameter, and of all roots, brush, wire, grade stakes and other objects that would interfere with planting or maintenance operations.

D. SEEDING DATES: The normal seasonal dates for permanent seeding shall be May 1 to September 1 and from the time the soil is workable in the Spring to May 1. Seeding of a specified grass variety at times other than the normal seasonal dates must be approved by the City of Chattanooga's Construction Representative. Seeding shall not be done during windy weather or when the ground is excessively wet, frozen or otherwise un-tillable.

E. Seeding may be applied with a mechanical hand seeder or by hydroseeding as specified below:

a. SEEDING: Seed shall be spread in two (2) successive sowings with the second perpendicular to the first. The rate of each sowing shall be one-half of the total seed rate specified. Immediately after seeding, all areas shall be lightly rolled. If, due to slope conditions, rolling cannot be done, seed shall be raked unto top ¼" of soil. Mulch as specified below shall be applied immediately after seed has been sown.
b. MULCHING: All seeded areas shall be mulched immediately after seeding. Mulch may be either dry straw or wood cellulose fiber. Straw shall be applied at a rate of 100 pounds per 1,000 square feet. Straw shall be stabilized with specified mulch binders. Mulch binder shall be applied per manufacturer's specifications.

F. All areas which do not show a satisfactory catch of grass shall be reseeded at intervals of 21 days until a dense lawn of permanent grasses, free from any bare spots, areas of washout or erosion damage has been established.

G. WATERING: Seeded areas shall be watered daily to ensure good germination. Once seeds have germinated, irrigation may be decreased, but the seedlings must never be allowed to dry out completely. Frequent watering should be continued for approximately there (3) weeks after germination or until grass has become sufficiently established to warrant watering on an "as needed" basis.

H. Seeded areas shall be maintained by the Landscape Contractor for the specified maintenance period (a minimum of one year) or longer if necessary to establish a dense cover as specified above (Paragraph F). See Section 2820 for complete maintenance requirements.

I. The Contractor shall be responsible for repair of damage to turf areas until all work is accepted.

3.04 PLANTING OF TREES

A. All planting shall be performed by personnel familiar with the accepted procedure of planting and under the constant supervision of a qualified planting foreman.

B. All planting is to be done as shown on drawings or as specified herein and in strict accordance with standard horticultural practices.

C. The Contractor shall label for shipment and planting operations all trees and shrubs in each group of a similar species. Plant materials labels shall be durable, legible labels stating the correct plant name (botanical and common name from the contract documents) and size in weather resistant ink or embossed by a process capable of remaining readable at least two years. They shall be labels which can be tied securely to all plants in a manner that normal growth will not be restricted.

D. No material shall be dug or transported after the leaf buds are open unless special conditions exist which may warrant a variance, subject to approval by the City of Chattanooga's Construction Representative.

E. Trees may be planted in accordance with the time schedule outlined in these specifications, and in keeping with good horticultural practice.

F. No digging or planting operations shall be conducted when the soil or plants are excessively wet, muddy, or in a frozen condition.

G. When considered advisable and in keeping with proper horticultural procedures, the Contractor may request in writing permission to plant and transplant out of season. The City of Chattanooga's Construction Representative shall take under advisement the needs and requirements of the City of Chattanooga, weather factors, planting conditions and other factors to alter the planting seasons. Holes may be dug prior to these planting seasons as approved by the City of Chattanooga's Construction Representative.

H. Location of trees shall be staked in the ground by the Contractor and approved by the City of Chattanooga's Construction Representative prior to beginning and planting work. The Contractor may accompany the City of Chattanooga's Construction Representative to review and approve all plant staking. Adjustments in locations and outlines shall be made as directed by the City of Chattanooga's Construction Representative.

I. OBSTRUCTIONS:

1. The Contractor may secure from the utility companies at his own expense all information and assistance needed and copies of layout drawings to identify the location of all utilities, electrical conduits, steam conduits, water lines, irrigation lines, sewer and gas lines, etc. Care shall be taken when excavating plant pits and placing stakes and

anchors in the proximity of such utilities to avoid damaging them and to adjust the planting in harmony with work performed by other tradesmen.

2. In the event obstructions are encountered, the Contractor shall at once notify the City of Chattanooga's Construction Representative so that arrangements may be made to change locations of such planting. The Contractor shall assume the responsibility of repairing all utilities damaged in the performance of his work.

3. In the event that rock, tree stumps or underground construction work or other obstructions are encountered in any plant pit excavation work to be done under this contract, alternate locations shall be approved by the City of Chattanooga's Construction Representative. Where locations cannot be changed, the obstructions shall be removed to a depth of not less than 3 feet below grade and no less than 24 inches from the edges of the plant pit.

J. Existing plants remaining on the site (as shown on the plans), shall be protected from soil compaction and other damages during the planting operations. Care will be taken by the Contractor to work in and from open areas to avoid contract with the existing trees and root feeding areas. The Contractor is responsible to repair all damages and in the case of extreme damages shall replace the plant with a specimen nursery grown plant as similar in size as possible to the destroyed plant. Compaction of soils caused by planting operations within root feeding areas will be loosened.

K. EXCAVATION OF PLANTING PITS:

1. Planting pits shall be excavated to produce vertical sides and flat bottoms. Scarify side walls to alleviate glazing and loosen any hard subsoil in the bottom of pit.

2. Dispose of subsoil (off-site) removed from planting excavations. Do not mix with planting soil or use as backfill.

3. If plant pits are prepared and backfilled with the planting mixture to grade prior to planting, their location shall be marked and recorded on the plans and marked clearly on the site so that when planting proceeds they can easily be located.

2. The Contractor shall not leave any hole unattended when an unsafe condition exists without proper protection, signals, barriers, etc., or when in any manner it presents a hazard to pedestrians or vehicles on the site.

3. Planting pits may be dug with a motorized augur provided the sides and bottom of the pits are cut at least 2 inches larger with a hand spade. This cutting shall be deep enough and of a method to assure natural subsurface water circulation after planting.

6. Mechanical "Tree Spade" transplanting equipment may be used to dig and install plants. Provisions shall be made to assure natural subsurface water circulation and

surface water circulation and surface water absorption, the sides of the plant pits shall be cut at least 2 inches deep at 4 to 6 inch intervals with a hand spade to pierce the compacted wall surface of the tree pit.

L. DRAINAGE TESTING/DRAINAGE CHANNEL REQUIREMENTS:

Prior to planting, all pits selected for testing shall be tested in the following manner:

1. All material removed from the drainage channel shall be discarded.

4. When backfilling planting pits with planting mixture, care must be taken to keep the consistency of the soil mix and the same throughout the planting pit and drainage channel.

Note: Refer to vertical drain notes on the plans.

M. SETTING AND BACKFILLING:

1. Planting pit shall be filled with water and allowed to drain before backfilling.

2. Balled and burlapped and container-grown plants shall be handled and moved only the ball or container. Plants shall be set plumb and held in position until sufficient soil has been placed around roots or ball. Plants shall be set in relation to surrounding grade so that they are even with the depth as which they were grown in the nursery, collecting fields, or container.

5. All plants shall be planted in soil mixture as specified and backfilled in 6 inch layers to eliminate voids and air pockets. When planting pit is approximately two-thirds full, fertilize as specified below, and thoroughly water again before placing remainder of backfill. Soils which are in a frozen or muddy condition shall not be used for backfilling plant pits.

4. Balled and stock shall be backfilled with planting soil mixture to approximately half the depth of the ball and then tamped and watered. Burlap and tying materials shall be carefully removed or opened and folded back from top one-third of root ball. The remainder of backfill or planting soil mixture shall be tamped and watered.

5. Container-grown stock shall be removed from containers without damaging plant or root system. Planting shall be completed as specified for balled or burlapped plants.

6. A root ball cracked or broken before or during planting operations shall be cause for rejection of the plant material.

7. Fertilizer as specified herein shall be added at the time of backfilling. Delay addition of fertilizer if planting mixture will not be used within two (2) days.

N. PLANT TABLET INSTALLATION:

1. The rate of application of planting tablets shall be according to the manufacturer's instructions and as follows:

a. For balled and burlapped plant material use two 21-gram tablets per each 1/2 inch caliper.

2. Placement of the planting tablets shall be as follows:

Position the ball in the plant pit. Place the recommended number of tablets evenly around the perimeter of, and adjacent to, the root ball at a depth which is in the upper one-third of the settled backfill around the root area and in accordance with planting details.

3. Plant tablets shall be placed only during the Spring growing season.

O. MULCHING AND WEED REMOVAL:

1. See Section 2: "Products" for the type of mulch to be used.

2. Mulch shall be applied after plants have been watered, backfilled, and allowed to settle, and shall be installed within 48 hours after planting.

3. Mulch for planting beds shall be installed to a minimum depth of four inches (4") in all areas specified on the drawings.

8. Mulch shall be kept out of the crowns of shrubs and off buildings, sidewalks, light standards, and other structures.

5. The top of all areas of mulch shall be 1" below the top of adjacent curb, walk or edge of pavement.

6. The mulched bed outline shall be continuous and cut vertically. Vegetation within bed outline shall be removed a minimum of 1 inch in depth to prevent re-growth. Planting beds shall be mulched as detailed on the drawings. The basin shall be maintained, as specified, within the plant beds.

7. Prior to the installation of mulch, all areas to be covered shall be weed free and shall be treated with a pre-emergent herbicide. Herbicide shall be used only on bedding plants which spread by rhizomes. DO NOT treat beds which contain surface rooting plants. The pre-emergent herbicide shall be evenly applied to the surface of all plant beds AFTER the mulch has been applied and firmed in place. All weeds and grasses existing within the beds and saucers shall be removed, after which the soil and mulch

shall be smoothed and firmed in place. The pre-emergent shall be applied in accordance with the manufacturer's recommendation. The planting bed shall then be thoroughly watered.

P. PRUNING:

1. Plant materials shall be pruned following planting operations to remove broken or damaged branches and roots.

2. Pruning shall be performed by experienced plantsmen by using clean and sharp tools, after the plants have been inspected by the City of Chattanooga's Construction Representative.

3. Damaged or pruned tree leaders and otherwise excessively damaged and improperly pruned plants shall be cause for rejection.

3.05 ADJUST AND CLEAN

A. Constant care should be exercised by the Contractor to maintain a safe and clean condition of the site for safe movement of pedestrians and vehicles. The ground shall be cleared of all debris and superfluous materials and all equipment shall be entirely removed from the public traffic-ways when not being used to the satisfaction of the City of Chattanooga's Construction Representative.

B. At the completion of the work in an area or areas, or when work is stopped for a period of time due to weather conditions, etc., the work areas shall be cleaned of all superfluous soils, materials and equipment, in order to maintain a neat, clean and safe condition, to the satisfaction of the City of Chattanooga's Construction Representative.

C. The Contractor shall be responsible for the repair of any damage to lawns, paved areas, roads, walks, curbs, or underground utilities which may result from his work. Such repairs shall be made swiftly in a thorough and workmanlike manner, with minimum inconvenience and at no cost to the City of Chattanooga.

D. LAWN AREA: Where lawn areas have been damaged, the damaged lawn areas, ruts and/or depressions shall be cultivated, filled with topsoil and settled to proper grades, and replanted to the satisfaction of the City of Chattanooga's Construction Representative.

3.06 COMPLETION AND ACCEPTANCE

A. The completion of the contract will be accepted and Notice of Completion recorded only when the entire contract is completed to the satisfaction of the City of Chattanooga's Construction Representative.

B. Work under this section will be accepted by the City of Chattanooga's Construction Representative upon satisfactory completion of all work including "punch list" items.

C. Acceptance of plant material by the City of Chattanooga's Construction Representative shall be for general conformance to the specifications, including size and character, and shall not relieve the Contractor of responsibility for full conformance to the contract documents including maintenance.

D. The Contractor shall replace, without cost to the City of Chattanooga, and as soon as weather conditions permit within the next 30 days or within the first month of the next earliest planting season, whichever occurs first, all plants and all plants not in a vigorous thriving condition, as determined by the City of Chattanooga's Construction representative. The plants shall be free of dead or dying branches and branch tips, and shall bear foliage of normal density, size and color. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification.

E. Upon completion of repairs and replacements by the Contractor, the City of Chattanooga's Construction Representative shall certify as to the completion for the initial acceptance of the project and recommendation for beginning the Guarantee Period.

END OF DOCUMENT

SECTION 2820

LANDSCAPING MAINTENANCE

PART 1 - GENERAL

1.01 MAINTENANCE PERIOD

Upon completion of installation, the landscape Contractor shall maintain his work on a regular basis throughout one full growing season following planting. In no case shall the maintenance period be less than one (1) year from the date of completion, (example: growing season April through October. Stock planted in June shall be maintained through October of the following year - a total of 16 months). At the end of the above specified maintenance period, the Landscape Contractor shall furnish, in writing, two (2) copies of the annual Landscape Maintenance Schedule to the City of Chattanooga.

1.01 AREA TO BE MAINTAINED

This contract includes all areas within the property lines, and adjacent street right-of ways, with he following exceptions:

A. Any paved areas, unless damage or otherwise affected by the Landscape Contractor.

B. Outlet properties where development has occurred, or is in progress.

C. Undisturbed or "Naturalized" wooded areas.

1.03 INSPECTIONS

A. The Contractor will inspect the site a minimum of once a week to determine the work to be done and materials needed.

B. The City of Chattanooga's Construction Representative will inspect the site at any time, and will report any damage or unsatisfactory work to the Contractor. The Contractor shall remedy the situation within a minimum of forty eight (48) hours after notification by the City of Chattanooga's Construction Representative.

1.04 COOPERATION AND COORDINATION

A. The Contractor shall cooperate with and communicate with other Contractors serving this property and, with them, ensure careful maintenance of the property.

B. The Contractor shall report any vandalism or damage to landscape areas immediately to the property manager.

1.05 ADDITIONAL WORK

A. No claim for extra work or change of plans shall be made by the Contractor except upon a signed, written change order from authorized representative of the City of Chattanooga. Such agreement must be signed in advance of any work. Failure to do so will result in the Contractor assuming liability for the total cost.

B. Additional work, when authorized by the City of Chattanooga, will be done at a cost mutually agreed upon by the City of Chattanooga, Owner, and Contractor, in writing.

PART 2 - SCOPE OF WORK

2.01 WATERING

A. It is the Landscape Contractor's responsibility to determine water application rates and timer cycling. The Irrigation Contractor will instruct the Landscape Contractor on the operation and programming of the Controller.

B. The Landscape Contractor shall report any problems or damage to the irrigation system to the Irrigation Contractor and the City of Chattanooga's Construction Representative immediately.

C. Any supplemental or hand watering shall be performed by the Landscape Contractor, as required for healthy plant growth.

2.02 TURF MAINTENANCE

A. MOWABLE AREAS (Slopes 3:1 or less) shall be maintained at the recommended height for individual species. No more than 1/3 of the total height of the leaf blade shall be removed at any one mowing.

B. SOIL TESTS AND AMENDMENTS

Soil tests will be made prior to the topsoil being backfilled to monitor the actual fertility and pH levels. Soil amendments will be applied as necessary to ensure that the soil has the correct pH and nutrient level.

C. EDGING

Curbs, walks, and beds will be edged as specified in the maintenance schedule. Apply a custom-blended fertilizer with controlled-released nitrogen in the Spring, and a balance fertilizer with micro-nutrients in the Fall. Further nitrogen applications will be made throughout the growing season, as needed to maintain a thick, healthy, green turf.

D. WEED CONTROL

1. Lawn areas and planting beds will be treated with a pre-emergent herbicide in early Spring. The herbicide used must break down in time for over-seeding. Another application shall be made in the late fall, after the new grass seed has become established.

2. Hand weeding and spot treatment shall be done on an "as needed" basis.

F. INSECT AND DISEASE CONTROL

Treat insect and disease problems with approved chemicals on an "as needed" basis. These chemicals to be applied in a safe and lawful manner, by licensed personnel.

G. LAWN RENOVATION

1. Lawns will be detached by vertical mowing at the time specified in the maintenance schedule. The depth of penetration of the vertical mower's blade should be adjusted so the blade will completely penetrate through the thatch layer and into the soil under the thatch.

2. Over-seeding will be done once a year at the time best suited for the individual species.

2.03 PLANT MATERIAL MAINTENANCE

A. FERTILIZATION

Shrubs and trees will be fertilized with a balanced fertilizer containing micro-nutrients in early Spring and Fall to promote deep green color, vigor and Winter hardiness.

B. WEED CONTROL

Treat shrub beds and other mulched areas with a pre-emergent herbicide in early Spring to control annual grasses and broadleaf weeds. Post emergent herbicides will be done in areas where it is not feasible to use herbicides.

C. INSECT AND DISEASE CONTROL

Insect and disease problems will be treated with approved chemicals, as needed. Chemicals to be applied in a lawful manner by licensed applicators.

D. MULCHING

A full four inches (4") of Mulch will be applied to planting beds inthe Spring.

E. PRUNING

Shrubs and small trees (Under 15') will be pruned during the growing season as needed to promote healthy growth and a neat appearance. Remove dead branches immediately. Dispose of all clipping off-site.

END OF DOCUMENT

ITEM 70
RIPRAP

PART 1 – GENERAL

1.1 SCOPE

A. The work covered by this section includes furnishing all labor materials, and equipment required to furnish, place, and set rock riprap, concrete block riprap, and sacked sand-cement riprap as shown on the Drawings and/or specified herein.

B. Riprap shall be placed on slopes of embankments or other surfaces or around structures as protection against the erosive action of water.

C. Where shown on the Drawings, a filter blanket course of crushed rock, or sand and gravel, or an approved filter fabric shall be placed under the riprap.

1.2 SUBMITTALS

A. The CONTRACTOR shall provide the ENGINEER with written evidence in the form of mill test reports from a qualified testing laboratory that all sands, cements, and filter blanket materials used conform to the applicable requirements of this Specification section.

B. When requested by the ENGINEER, the CONTRACTOR shall furnish representative samples of rock riprap material for classification, gradation, or other tests as the ENGINEER may direct.

PART 2 – PRODUCTS

2.1 ROCK RIPRAP

A. Rock riprap shall be constructed using sound, dense, durable stones, or rock fragments, free from crack, pyrite intrusions and other structural defects. Stones which will be used with mortar shall be free from dirt, oil, or other material that might prevent good adhesion with the mortar. Stones with a laminated structure shall be avoided. Field stones shall not be used as a source of rock for riprap. Only rock that has been approved by the ENGINEER shall be used for riprap.

B. When the crushed aggregate is subjected to five (5) alternations of the sodium Sulfate soundness test, the weighted percentage of loss shall be not more than 12 percent.

C. Shape of the stones shall be generally rectangular or cubic. Flat or elongated stones having a small dimension less than 1/3 of the large dimension shall not be used.

D. At least 50 percent of the stones or rock fragments for plain rock riprap shall Weigh 150 pounds or more. The sizes of the stones shall be well graded from the smaller to the larger.

E. At least 90 percent of the stones or rock fragments for hand placed rock riprap shall weigh 100 pounds or more and shall be not less than 12 inches long, 12 inches deep, and 8 inches wide.

2.2 CONCRETE BLOCK RIPRAP

Concrete blocks for riprap shall be of the size as shown on the Drawings and shall be composed of non-reinforced Class A concrete conforming to the requirements of the section entitled "Cast-In-Place Concrete" of these Specifications..

2.3 SACKED SAND-CEMENT RIPRAP

A. Sand-cement for sacked sand-cement riprap shall be composed of a dry mixture of one bag (94 pounds) of cement to 5 cubic feet of dry sand.

B. Sacks shall be either cotton or jute, standard grade of cloth, which will hold the sand-cement mixture without leakage during handling and tamping. They shall be strong and shall be sized to hold approximately 1 cubic foot.

C. Cement shall be Type I Portland Cement conforming to ASTM C 150.

D. Sand shall be manufactured of natural siliceous river sand conforming to ASTM D 1073. The sand shall meet the following gradation requirements.

Sieve Size	Total Percent Passing by Weight
4	100
8	95-100
30	50-80
50	30-60
100	8-25
200	2-10

D. Sand shall be clean, hard, and free from excessive organic matter.

2.4 GROUT

A. Grout for grouted rock riprap shall be sand cement grout composed of one part Cement to four parts sand, measured by volume, mixed thoroughly with sufficient water to make a grout of such consistency that it will flow into and completely fill the voids.

B. Cement shall be Type I Portland Cement conforming to ASTM C 150.

C. Sand shall be cleaned, hard, natural siliceous sand conforming to the requirements of ASTM C 33 and the section entitled "Cast-In-Place Concrete" of these Specifications.

D. Water shall be fresh, clean, portable water free from injurious amounts of oil, acid, alkali, or organic matter.

2.5 FILTER BLANKET MATERIAL

A. Filter blanket material shall consist of fragments of sound, durable stone or crushed rock, free from disintegrated stone, alkali, salt, vegetable matter, or adherent coating. Aggregate shall be reasonably free from thin or elongated pieces. The percentage of wear of the aggregate as outlined AASHTO Test No. T-96 shall not exceed 7 percent.

B. Aggregate shall have the following gradation:

Sieve Size	Total Percent Passing by Weight
1-1/4"	100
1"	95-100
¾"	70-100
3/8"	50-85
No. 4	33-65
No. 10	20-45
No. 40	8-25
No. 200	0-10

C. The material finer than the No. 10 sieve shall be of such characteristics and gradation that will prevent the mass from setting up or becoming cemented together. Stone or crushed rock meeting the requirements of the section entitled "Mineral Aggregate Base" of these Specifications may be used provided the percentage fo aggregate passing the No. 100 sieve is less than 10 percent.

PART 3 – EXECUTION

3.1 EQUIPMENT

A. All equipment necessary for the satisfactory performance of the work shall be on hand and approved by the ENGINEER before construction will be permitted to begin.

B. The equipment shall include wooden or metal tamps of sufficient weight and number to properly compact the slopes on which the riprap or slope pavement is to be placed.

C. Wooden hand tamps, having a tamping face not greater than 1 square foot, and of sufficient weight and number to properly tamp the riprap, shall be furnished when sacked sand-cement is used.

D. Equipment for mixing cement grout or sand cement shall include a mechanical mixer or, if the ENGINEER approves hand mixing for cement grout, a watertight mixing platform or mixing box of adequate size.

3.2 PREPARATION OF FOUNDATION

A. Immediately prior to the construction of riprap, the slopes or ground surface shall be trimmed within reasonably close conformity to the lines and grades indicated on the Drawings or as directed by the ENGINEER, and shall be thoroughly compacted by the use of hand or mechanical tamps.

B. On slopes, the bottom of the riprap shall be placed at least 2 feet below the natural ground surface, unless otherwise shown or directed.

C. No material shall be placed on a frozen or otherwise unsuitable slope.

3.3 PLACEMENT OF FILTER BLANKET

A. Where shown on the Drawings, a filter blanket course shall be placed under the riprap on the prepared subgrade.

B. Filter blanket shall be placed immediately prior to placement of riprap. Compaction of the filter blanket is not required except where called for on the Drawings.

C. Where specifically permitted by the ENGINEER, a synthetic filter fabric may be substituted for the filter blanket course. Filter fabric shall be especially designed for use as slope stabilization under riprap and shall be acceptable to the ENGINEER. Placement of filter fabric shall be in strict conformance with the manufacturer's written instructions and recommendations.

3.4 MACHINE CONSTRUCTION OF PLAIN ROCK RIPRAP

A. Unless otherwise shown on specified, plain rock riprap shall be constructed using a crane and clam-shell or other suitable equipment approved by the ENGINEER. The rock shall be placed as nearly as practicable in final position using powered equipment. If necessary, larger rocks shall be worked up to the surface when the material on the surface does not meet the weight specification or when the voids next to the foundation material are too large.

B. The quantity of small stones shall be kept as low as possible, sufficient only to fill the voids between the larger stones. Care shall be taken that this small material is well distributed throughout the mass and not allowed to segregate or form pockets of small stone. All bridging shall be broken down. Large interstices, or open channels, or voids shall be filled by chinking or otherwise manipulating the stones.

C. When riprap is to be built on existing riprap, special care shall be taken to provide positive anchorage of the new riprap to the existing riprap.

D. The finished riprap surface shall in general conform to the slope lines shown on the Drawings. No objectionable, hazardous, or unsightly projections above the general place surface will be permitted.

3.5 CONSTRUCTION OF HAND PLACED, PLAIN ROCK RIPRAP

A. Hand placed plain rock riprap shall be constructed upon the prepared foundation by hand placing so that the stones shall be as close together as is practicable in order to reduce the voids to a minimum. Construction of riprap on sloped surfaces shall begin horizontal layers.

B. When rock riprap is constructed in more than one layer, it shall be so placed that it will be thoroughly tied together with the larger stones protruding from one layer into the other.

C. The standard depth of rock riprap shall be 12 inches unless otherwise indicated or directed and in no instance shall be less than 10 inches in depth. Rock riprap shall have an average depth for each 25 square feet of surface of not less than the depth indicated on the Drawings or directed by the ENGINEER, or the standard depth required in these Specifications.

D. Each stone shall be so placed that the depth will be perpendicular to the surface upon which it is set. The length shall be placed so that it will be against the adjoining stones. The stones shall be placed in such a manner as to stagger all joints as far as it is possible and practicable.

E. The main stones shall be thoroughly chinked and filled with the smaller stones by throwing them over the surface in any manner that is practicable for the smaller stones to fill the voids. This work shall continue with the progress of the construction. Tamping of the stones will not be required if the stones have been placed in a reasonable and satisfactory manner.

F. Knapping of the stones will not be required except stone protruding more than 4 inches above what is considered the normal surface of the stones, in which case these stone shall be broken down to come within 4 inches of the normal surface.

3.6 CONSTRUCTION OF GROUTED ROCK RIPRAP

A. Grouted rock riprap shall constructed upon the prepared foundation using hand placement and the stone shall be set or placed are close together as is practicable in order to reduce the voids to a minimum. Construction of riprap on slopes shall begin at the bottom and shall progress upward in approximately horizontal layers.

B. When rock riprap is constructed in layers, the layers shall be thoroughly tied together with large stones protruding from one layer into the other.

C. The standard depth of rock riprap shall be 12 inches, unless otherwise indicated or directed, and in no instance shall be less than 10 inches in depth. Rock riprap shall have an average depth for each 25 square feet of not less than the depth indicated on the Drawings or as directed by the ENGINEER, or the standard depth required in these Specifications.

D. Each stone shall be bedded with the depth perpendicular to the surface upon which it is set. The length shall be placed as directed by the ENGINEER and each main stone shall be placed against the adjoining stones with sides and ends in contact. The stone shall be placed in such a manner as to stagger all joints as far as it is possible.

E. After a workable area of the riprap has been set, the stones shall be knapped to a uniform surface and voids shall be thoroughly chinked and filled with smaller stones and spalls. This work shall continue with the progress of the construction.

F. The surface of the completed rock riprap shall not vary from the theoretical surface required by more than 2 inches at any point when tested with a 12-foot straightedge.

G. After chinking and filling, the voids between the stones shall be completely filled with grout. Care shall be take to prevent earth or sand from filling the spaces between the stones before the grout is poured.

H. This grout shall be mixed either in a one-bag mixer or larger, for not less than 1-1/2 minutes, or it may be mixed by hand in a watertight box of sufficient capacity to accommodate a batch of at least one bag of cement. Hand mixing shall be continued in a manner and for a period satisfactory to the ENGINEER.

I. Immediately before pouring the grout, the stones shall be wetted by sprinkling. The grout shall be carefully poured into the voids between the stones. This work shall begin at the lower portions of the riprap and progress upward. The entire bottom line of voids shall be filled with grout before the next line of voids above is poured. The pouring of the grout shall be accomplished by the use of vessels of adequate size and shape. Broadcasting, slopping, or spilling of grout from the vessels on the surface of the riprap will not be permitted. Progress of pouring shall be sufficiently slow to prevent the grout from oozing from the voids and flowing over the surface. During the pouring operations and continuing until the grout has assumed its initial set fiber brooms shall be used to maintain a uniform distribution over the entire surface. The grouting operations shall continue until such a time as all the voids have been completely filled and the grout has set even with the surface of the riprap.

J. As soon as any section of the grouted riprap has hardened sufficiently, it shall be cured by sprinkling with water until is has been covered with burlap, cotton or jute mats, earth or liquid-membrane forming compound. The mats or earth shall be maintained by soaking with water for a period of not less than 72 hours. The water used for wetting and curing the grouted riprap shall be free from salt or alkali.

30.7 CONSTRUCTION OF CONCRETE BLOCK RIPRAP

A. Concrete blocks for riprap shall be constructed to the dimensions shown on the Drawings and in accordance with the applicable provisions of the section entitled "Cast-In-Place Concrete" of these Specifications.

B. The concrete blocks shall be placed upon the prepared foundation by hand. Each block shall be bedded with the depth perpendicular to the surface upon which it is set, or placed and oriented as directed by the ENGINEER. Each block shall be placed against the adjoining blocks with sides and ends in contact. The blocks shall be placed in a manner that the joint will be staggered.

C. The surface of the completed concrete block riprap shall not vary from the desired theoretical plane by more than ½ inch for adjoining blocks and by more than 2 inches at any point when tested with a 12-foot straightedge.

3.8 CONSTRUCTION OF SACKED SAND-CEMENT RIPRAP

A. Sacked sand-cement riprap shall be constructed by placing sacks filled approximately ¾ full with a mixture of sand and cement on the prepared foundation. Sand and cement shall be mixed dry, with a mechanical mixer until the mixture is uniform in color. After the mixing has been completed, the sand-cement mixture shall be poured into sacks of approximately 1 cubic foot capacity until they are approximately ¾ filled. The sack shall then be securely fastened with hog rings by sewing or other suitable methods that prohibit leakage of the mixture from the bags.

B. The sacks of sand cement shall be bedded, by hand, on the prepared grade with all the fastened ends on the grade and with the joints broken. The completed riprap shall have a minimum thickness of 10 inches, measured perpendicular to the slope. The surface shall not vary more than 3 inches above or below the desired theoretical plane.

C. The sacks shall be rammed and packed against each other and tamped on the surface in such a manner as to form close contact and secure a uniform surface. Immediately after placing and tamping the sacks of sand cement, they shall be thoroughly soaked by sprinkling with water. Water shall not be applied under high pressure.

D. Sacks of sand cement ripped or broken in placing shall be removed and replaced before being soaked with water.

3.9 PROTECTION OF STRUCTURES

All structures shall be carefully protected from damage by equipment or impact of stones or blocks. All damage shall be corrected by the CONTRACTOR at his own expense and in a manner acceptable to the ENGINEER.

SECTION 03110

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SCOPE

This Specification section prescribes materials and methods to be used in fabricating, erecting, and removing forms for cast-in-place concrete. The CONTRACTOR shall furnish all form design, forms, shoring, ties, form coating, and materials and all labor, equipment, and other items necessary or convenient to the CONTRACTOR for the fabrication, erection, and removal of formwork.

1.02 GENERAL

A. Forms shall be fabricated, erected, and removed as specified herein and shall be of a type, size, shape, quality and strength to produce hardened concrete having the shape, lines and dimensions indicated on the drawings. The forms shall be true to line and grade in accordance with the tolerances as specified in "Cast-In-Place Concrete" and shall be mortar tight and sufficiently rigid to resist deflection during concrete placement. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes that would deface the finished surfaces.

B. The responsibility for correctly assessing and analyzing the erection stresses induced upon the structure, its elements and supporting foundations during construction will be the total obligation of the CONTRACTOR. Since the ENGINEER does not dictate or determine the CONTRACTOR'S sequence of operations of construction, the ENGINEER cannot determine erection stresses and therefore assumes no responsibility or obligation to do so. The CONTRACTOR must employ or otherwise provide for adequate professional structural engineering supervision to determine erection stresses and notify the ENGINEER of the results of the study.

C. The responsibility for adequate formwork design for construction of cast-in-place, reinforced concrete will be the total obligation of the CONTRACTOR. The CONTRACTOR shall employ competent professional engineering services to design formwork and supervise the erection of all formwork needed for the job.

D. Except as modified herein, form design, fabrication, and erection shall conform to the requirements of ACI 347 and ACI 318 and shall be acceptable to the ENGINEER. Design criteria for plywood shall conform to APA Form V345.

E. Formwork shall comply with the requirements of ANSI A10.9 and OSHA Construction Standards, Part 1926, "Subpart Q, Concrete, Concrete Forms, and Shoring."

1.03 SUBMITTALS

A. When requested by the ENGINEER, the CONTRACTOR shall submit to the ENGINEER for review shop drawings and design calculations for formwork the CONTRACTOR intends to use in constructing the work. The CONTRACTOR shall furnish said shop drawings and design calculations at no additional cost to the OWNER.

B. Prior to beginning concreting operations, the CONTRACTOR shall submit to the ENGINEER for approval engineering data and manufacturer's literature on all form ties, spreaders, bar supports, form coatings, and prefabricated steel forms intended for use in the work.

1.04 STORAGE

All form materials and accessories shall be stored above ground on framework or blocking and shall be covered with a suitable waterproof of covering providing adequate air circulation and ventilation.

PART 2 - PRODUCTS

2.01 FORMS

A. Forms for surfaces which will be exposed to view when construction is completed shall be prefabricated plywood panel forms, job-built plywood forms, or forms that are lined with plywood or fiberboard.

B. Plywood or lined forms will not be required for surfaces which are normally submerged or not ordinarily exposed to view, such as the insides of manholes or wetwells. Other types of forms, such as steel or unlined wooden forms, may be used for surfaces which are not restricted to plywood or lined forms, and may be used as backing for form linings. Forms are required above all extended footings.

C. Forms for cast-in-place concrete shall conform with the following requirement:

1. Prefabricated Steel Forms	Simplex "Industrial Steel Frame Forms", Symons "Steel Ply", Universal "Uniform", or equal.
2. Plywood	Product Standard PSI, waterproof resin-bonded, exterior type Douglas Fir.
a. Normal	Face adjacent to concrete Grade B or better
b. Architectural	Face adjacent to concrete Grade B or better with plastic overlay.

3.	Lumber	Straight, dressed all sides, uniform thickness, and free from knots, offsets, holes, dents, and other surface defects.
4.	Fiberboard	Federal Specification LLL-B-810, Type IX, tempered, waterproof, screenback, concrete form hardboard.
5.	Chamfer Strips	Clear white pine, surface against concrete planed.

C. Reuse of job-built plywood forms shall be permitted only when specifically approved by the ENGINEER. Plywood shall be furnished and placed in 48-inch widths and in uniform lengths of not less than 96 inches, except where the dimension of the member is less. Where plywood is attached directly to studs or joists, the panels shall be not less than 5/8 inch thick. Studs shall be provided sufficiently sized and spaced to prevent bulging of the plywood sheeting.

D. Where earth is too unstable to serve as a form for sides of footings and foundations, the sides against the earth may be formed with 3/4 inch thick No. 2C Yellow Pine with tight butt joints, securely braced to hold a straight line.

2.02 FORM TIES

Form ties shall be approved by the ENGINEER and shall be of the snap cone or she-bolt with cone type as manufactured by a recognized manufacturer of concrete forming accessories. Cones shall leave a hole or depression in the concrete no larger than 7/8 inch in diameter. Plain snap ties or flat bar ties, unless otherwise approve by the ENGINEER, shall not be used. Ties shall be of a type that will accurately tie, lock, and spread the forms. Tie spacing shall be designed to withstand concrete pressures without bulging, spreading, or lifting of the forms. The tie shall be of such a design that when forms are removed no metal shall be within 2 inches of any surface unless stainless steel ties are used, in which case no metal shall be within 1 inch of any surface. Permanently embedded portions of form ties which are not provided with threaded ends shall be constructed so that the removable ends are readily broken off without damage to the concrete.

2.03 FORM COATINGS

Where specified herein, forms shall be coated with a nonstaining form release agent prior to concrete placement. Form coatings shall be Industrial Lubricants "Nox-Crete Form Coating", L & M "Debond", Prater "Pro-Cote", Richmond "Rich Cote", or equal.

PART 3 - EXECUTION

3.01 FABRICATION AND ERECTION

A. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. Forms shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement. Walers, studs, internal ties, and other form supports shall be sized and spaced so that proper working stresses are not exceeded. Joints in forms shall be bolted tightly and shall bear on solid construction. Forms shall be constructed so they can be removed without hammering, wedging, or prying against the concrete. Form ties in exposed surfaces shall be uniformly spaced and aligned in horizontal and vertical rows. The forms shall produce finished surfaces that are free from off-sets, ridges, waves, and concave or convex areas.

B. Forms to be reused shall be thoroughly cleaned and repaired. Split, frayed, delaminated, or otherwise damaged forms shall not be used.

C. All form panels shall be placed in a neat, symmetrical pattern with horizontal joints level and continuous. The CONTRACTOR shall place special attention on mating forms to previously placed walls so as to minimize steps or rough transitions. Form panels shall be of the largest practical size to minimize joints and to improve rigidity.

D. Beams and slabs supported by concrete columns shall be formed so the column forms may be removed without disturbing the supports for the beams or slabs.

E. Wherever the top of a wall will be exposed to weathering, the forms on at least one side shall not extend above the top of the wall and shall be brought to true line and grade. At other locations forms for concrete which is to be finished to a specified elevation, slope, or contour, shall be brought to a true line and grade, or a wooden guide strip shall be provided at the proper location on the forms so that the top surface can be finished with a screed or template. At horizontal construction joints in walls the forms on one side shall not extend more than 2 feet above the joints.

F. Temporary openings shall be provided at the bottom of column and wall forms and at other points where necessary to facilitate cleaning and inspection prior to concrete placement.

G. Unless shown otherwise on the Drawings, all salient corners and edges of beams, columns, walls, slabs, and curbs shall be provided with a 3/4 inch by 3/4 inch chamfer formed by a wood or metal chamfer strip.

H. Forms for exposed surfaces and all steel forms shall be coated with nonstaining form release agent which shall be applied just prior to placement of steel reinforcement. After coating, any surplus form release coating on the form surface shall be removed. Wood forms for unexposed surfaces may be thoroughly wetted with water in lieu of coating immediately before concrete placement, except in freezing weather form release coating shall be used.

I. Should misalignment of forms or screeds, excessive deflection of forms, or displacement of reinforcement occur during concrete placement, immediate corrective measure shall be taken to insure acceptable lines and surface to required dimensions and cross sections.

J. If any forms bulge or show excessive deflection, in the opinion of the ENGINEER, the concrete shall be removed and the forms rebuilt and strengthened.

3.02 FORM REMOVAL

A. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads. Shoring beneath beams or slabs shall be left in place and reinforced as necessary to carry any construction equipment or materials placed thereon.

B. No forms shall be removed without the approval of the ENGINEER. In general and under normal conditions, the ENGINEER will approve removal of forms after the following time has elapsed:

ITEM	TIME AFTER PLACEMENT
Elevated Slabs and Beams	14 days
Columns	7 days
Walls	3 days
Other Concrete	2 days

C. When ambient air temperatures during the curing period fall below 45 degrees F., form removal will take place based on job-cured test cylinder strength only.

D. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, or other damage to the concrete. Immediately after form removal, any damaged or imperfect work shall be repaired as specified in "Cast-In-Place Concrete" of these Specifications.

SECTION 03240

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SCOPE

This specification section describes steel reinforcement to be furnished and installed in cast-in-place concrete. The CONTRACTOR shall furnish all steel reinforcement, supports, and materials and all labor equipment, and other items necessary or convenient to the CONTRACTOR for the proper installation of the reinforcement.

1.02 GENERAL

A. Steel reinforcement shall be designed, detailed, fabricated and placed in conformance with all applicable requirements of ACI 315, ACI 318, and CRSI Manual of Standard Practice.

B. No concrete shall be placed until all steel reinforcement to be covered has been inspected in place and approved by the ENGINEER.

1.03 SUBMITTALS

A. Prior to placing any steel reinforcement, the CONTRACTOR shall submit to the Engineer written evidence that the steel reinforcement has been tested and is in conformance with the material and mechanical requirements specified herein. Certified copies of mill tests may be considered evidence of compliance provided such tests are regularly conducted by the reinforcement supplier by experienced, competent personnel using adequate testing equipment. In case of doubt as to the adequacy or accuracy of the mill tests, the Engineer may require the Contractor to furnish, at no additional cost to the OWNER, test results from an independent testing laboratory acceptable to the ENGINEER on mill samples or delivered steel reinforcement. Mill or laboratory test results for verifying compliance with this specification section shall be provided for each 15 tons of steel reinforcement shipped. Results of laboratory or mill tests submitted to the ENGINEER shall be of tests conducted not earlier than 90 days prior to delivery.

B. The cost of all sampling and testing of steel reinforcement necessary to furnish satisfactory evidence of compliance shall be borne by the CONTRACTOR and no separate payment will be made.

C. Prior to fabrication and bending of steel reinforcement, the CONTRACTOR shall submit to the ENGINEER for review and approval complete shop drawings, bending diagrams, and schedules of all steel reinforcement to be incorporated in the work.

D. The reinforcement shop drawings and bending diagrams shall show all dimensions, details, notes, location, size, length, and each bar mark, together

accessories and other materials belonging to the reinforcement for the concrete. Schedules shall show all information and be of the same general form as those on the Drawings. Concrete walls shall be detailed in elevation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. REINFORCING BARS

Reinforcing bars shall be deformed billet-steel bars conforming to ASTM A 615. All bars #4 and larger shall be Grade 60. All bars #3 and smaller shall be Grade 40. All bars shall be shop fabricated and bent cold. Bars shall be free from defects and kinks and from bends not indicated on the Drawings or approved bending diagrams.

B. MESH REINFORCEMENT

Mesh reinforcement shall be electrically-welded, cold-drawn, mild-steel, plain wire fabric conforming to ASTM A 185. Wire shall be cold-drawn steel conforming to ASTM A 82.

C. SUPPORT CHAIRS

Reinforcement supports shall conform to Product Standard PS7 and CRSI Manual of Standard Practice, Class D or E.

Reinforcement support chairs shall be stainless steel or shall be plastic-tipped when used in walls and elevated slabs. Support chairs used in slabs on grade shall be stainless steel or shall be hot-dip galvanized after fabrication or plastic-tipped in such a manner as to provide a minimum 1-1/2 inches of protection from the subgrade. Nails shall not be used to support reinforcement.

D. TIE WIRE

Tie wire shall conform to Federal Specification QQ-W-461 and shall be of black annealed steel, 16-gauge minimum.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE

A. Reinforcement shall be delivered to the job site carefully bundled and tagged for identification. Reinforcement shall be stored at least 12 inches above ground on timber mats or other supports acceptable to the ENGINEER. Contact between reinforcement and the ground shall not be permitted during storage. Reinforcement shall be supported so as not to bend or deflect excessively under its own weight.

3.02 SURFACE PREPARATION

Before placement, all reinforcement shall be thoroughly cleaned of oil, dirt, mill scale, rust scale, and other coatings that would tend to destroy or reduce bond. A thin coating of orange rust resulting from short exposure will not be considered objectionable; but any reinforcement having heavy rust scale or thick rust coating shall be thoroughly cleaned to the satisfaction of the ENGINEER or shall be ejected and removed from the job site. When there is a considerable delay between placement of reinforcement and placement of concrete, the reinforcement shall be reinspected prior to placement of concrete and recleaned if necessary.

3.03 PLACEMENT

A. Reinforcement shall be accurately positioned and tied at intersections with annealed wire or suitable clips approved by the ENGINEER. Reinforcement shall be supported by concrete or metal chairs, stays, spacers, hangers, or other supports acceptable to the ENGINEER.

B. Reinforcing bars shall be fastened with wire ties at a minimum of three places per bar. Bars shall be tied at every intersection around the periphery of slabs. Wall steel shall be tied at every fourth intersection as a minimum.

C. Reinforcement supports shall have sufficient strength and stability to maintain the reinforcement in place throughout placement and concreting operations. Supports and ties shall not be exposed at the face of the concrete nor shall they discolor the surface of the finished concrete.

D. Movement of steel reinforcement in place during concreting operations shall be prevented. Any reinforcement which is displaced shall be accurately repositioned in the proper place before being completely covered.

E. Dowels for successive work shall be securely fastened in correct position before placing concrete. The sticking of dowels after placing concrete shall not be permitted.

F. Reinforcement which has been exposed for bonding with future work shall be protected from corrosion by heavy wrappings of burlap saturated with a bituminous material.

G. No bar partially embedded in concrete shall be field-bent unless approved by the ENGINEER.

3.04 MINIMUM COVER AND CLEARANCE

The minimum concrete cover for the protection of embedded steel reinforcement shall be as follows:

A. Surfaces cast against crushed rock, sand, or earth:

All bar sizes	3 inches

B. Surfaces exposed directly to water, backfill, or weather after form removal:

All bar sizes	2 inches

C. Surfaces not exposed directly to water, backfill, or weather after form removal:

1.	Elevated Slabs	1 inch
2.	Floors, Walkways, Pavement	1-1/2 inches
3.	Walls	
	Less than 12 inches thick	1-1/2 inches
	12 inches or thicker	2 inches
4.	Beams	
	Stirrups	1-1/2 inches
	Principal Reinforcement	2 inches

The minimum clearance between adjacent parallel bars shall not be less than the nominal diameter of the bars, not less than 1.5 times the maximum course aggregate size, and not less than 1 inch in beams, 1-1/2 inches in columns, and 2 inches in other locations.

3.05 TOLERANCES

A. Allowable tolerances for fabricating steel reinforcement shall be as follows:

ITEM	MAXIMUM TOLERANCE
Sheared Length of Bars	+1" -1"
Depth of Truss Bars	+0.0" -1/2"
Outside Dimensions of Stirrups, ties, and Spirals	+1/2" -1/2"
Location of Bends	+1" -1"

B. Allowable tolerances for placing steel reinforcement shall be as follows:

ITEM	MAXIMUM TOLERANCE
Concrete Cover from Outside of Bar to Finished Surface	+1/4" -0.0"
Lateral Spacing of Bars in Plane of Reinforcement in Beams and Joists	+1/4" -0.0"
Lateral Spacing of Bars in Plane of Reinforcement in Slabs and Walls	+1" -1"
Spacing of Stirrups, Ties, and Spirals along Longitudinal Axis of Member	+1/2" -1/4"
Height of Bottom Bars in Slabs, Beams, and Joists	+1/4" -1/4"
Height of Top Bars in Slabs, Beams, and Joists	
Depth 8" and less	+1/4" -1/4"
Depth 9-24"	+1/2" -1/2"
Depth 25" and greater	+1" -1"

3.06 SPLICES

A. Splices in reinforcement shall conform to the requirements of AC1-318, Chapter 7, Details of Reinforcement. Unless otherwise shown on the Drawings, all bars shall be lapped a minimum of 36 bar diameters where splicing is necessary and splices shall be staggered. Except where indicated on the Drawings, welding or tack welding of reinforcement shall not be permitted. Lapped connections shall be sufficient to transfer the full stress between the bars by bond and shear and to develop the full strength of the bars. In slabs and beams no splices shall be made at points of maximum positive or negative moment, and in no case shall adjacent bars be spliced at the same place.

B. Although tolerances are allowed in the lateral spacing of parallel bars in the plane of reinforcement layers and in the spacing of stirrups, ties, and spirals along the longitudinal axis of a member, in no case shall the number of bars per layer of reinforcement provided in walls and slabs be less than the lateral dimension on the wall or slab in the plane of the reinforcement layer divided by the specified spacing, nor shall the number of stirrups, ties, or spirals provided along the longitudinal axis of a member in a given segment be less than the length of the segment divided by the specified spacing.

C. Welded wire fabric reinforcement shall be lapped a minimum of 6 inches at joints and shall be wired securely. Mesh shall extend to within 2 inches of sides and ends of slabs. Lapped ends of welded wire fabric shall be offset to prevent continuous laps. Splices shall not be made midway between supporting beams or directly over beams of continuous structures.

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SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies demolition, rubblization, removal, and relocation of buildings, portions of buildings, concrete basins, headwalls, columns, utilities, other structures, debris, and miscellaneous materials from the old Lupton Mill site.

1.2 RELATED WORK:

A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 02220, EARTHWORK

1.3 PROTECTION:

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum, dust, or spray the work area daily.

E. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.

G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the City of Chattanooga; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by

demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.

1.4 UTILITY SERVICES:

A. Demolish and remove outside utility service lines shown to be removed.

B. Utility service lines to be abandoned in place shall be treated as indicated on the demolition plans. If no instructions are provided, contractor shall bring that item to the attention of the Engineer before proceeding. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 DEMOLITION:

A. Completely or partially demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:

1. In the area designated on the plans as outside of the "Total Demolition Line", to 12 inches below the elevation of the surrounding surface, or to full depth, whichever is less.

2. In the area inside but near the "Total Demolition Line, to elevations indicated on the Typical Section diagram. Said elevation is that which is required to allow two feet of clean fill to be placed on top of the debris, and still accommodate a minimum of three to one slope toward the southern side of the project.

3. In other areas of the site, as indicated on the demolition plans.

B. Debris, including brick, concrete, stone, and similar materials shall be rubblized and disposed of on-site per the rubblization requirement listed in Section 3.2 A of this specification, and at the locations shown on Sheet "KEY" of the plans.

C. Break up concrete slabs above and below grade that do not require removal from present location into pieces approximately 3 foot square.

C. Metal and other similar recyclable materials shall become property of Contractor and shall be recycled by him in compliance with applicable federal, state, and local laws and permit requirements. Materials that cannot be removed daily shall be stored in areas specified by the Engineer.

D. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to lowest floor level. Demolition of first and second stories may proceed simultaneously.

E. The brick chimney that remains on-site shall be removed in a safe fashion that prohibits it from spreading demolition debris off-site.

D. In the event that drums, tubes, canisters, or other containers containing unknown materials are encountered, the contractor shall segregate such material from other debris in a specified area. It is the contractor's responsibility to have such containers tested to determine the contents, and then to disposed of the container and contents in accordance with all federal, state, and local laws, ordinances, and permit requirements. Payment will be made under the Bid Items for hazardous and non-hazardous classification and disposal. Containers found on site that are readily identified shall be disposed of per these same requirements, with no payment being made for classification.

E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Engineer. When Utility lines are encountered that are not indicated on the drawings, the Engineer shall be notified prior to further work in that area.

3.2 RUBBLIZATION OF MATERIALS

A. The on-site construction debris to be spread on site, including concrete, brick, wood, insulation, roofing material, and other miscellaneous material, shall be broken down to a maximum particle size of 18 inches or smaller. The contractor may use whatever means they deem appropriate to break down the larger pieces of construction debris.

Once broken down, the fill material shall be spread in lifts of a maximum of 2 feet thick. The differing constituent fill material does not need to be segregated prior to placement. The fill should be compacted by making multiple passes with a Caterpillar D9 bull dozer or equivalent. The number of passes should be sufficient to demonstrate the material is densified and stable. Fill slopes shall be constructed at 3 Horizontal to 1 Vertical (3H : 1V) or flatter.

Once material is compacted, in compliance with state requirements, a two foot thick cap of soil shall be placed over the rubble fill. The fill soil should consist of silt or clay with no organic matter or debris and contain no rock fragments larger than 4 inches in any dimension.

To prevent raveling of the soil cap into void spaces in the rubble fill, a 12 ounce non-woven, needle punch filter fabric shall be placed over the first six inches of soil sill. The remaining soil cap shall be placed above the filter fabric.

Soil fill shall be placed in thin lifts with a maximum loose thickness of 8 inches, the compacted to a minimum 0f 90 percent of the standard Proctor maximum dry density, with a moisture content within 3 percent of the optimum moisture content, depending of the shape of the Proctor curve. A representative of a geotechnical consulting company (hired by the City of Chattanooga) shall test the density and moisture content of each lift before placing additional lifts. Sloped area should be seeded as soon as possible to control erosion and help prevent sloughing slope failures.

B. The at grade asphalt paving, wood flooring, and concrete slabs designated to be left in place shall be broken up into approximately 3 foot square pieces to allow for drainage.

3.3 CLEAN-UP:

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Engineer. Clean-up shall include off the disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.