Contract Documents and Specifications

City of Knoxville, Tennessee

2018 Cured-in-Place Pipe (CIPP) Project

CITY OF KNOXVILLE

Engineering Department

Knoxville, Tennessee

CONTENTS

CITY OF KNOXVILLE

INVITATION TO BID

Project: 2019 Cured-in-Place Pipe (CIPP) Project

Sealed bids will be received by the City of Knoxville, in Room 667-674, City County Building, 400 Main St., Knoxville, Tennessee, until 11:00:00 a.m., on Friday, August 30, 2019 for the Cured-in-Place Pipe (CIPP) Project. The work consists of the installation of a Cured-In-Place liner into approximately 350 linear feet of 48-inch diameter storm sewer pipe, 72 linear feet of 30-inch diameter storm pipe, 585 linear feet of 24-inch diameter storm pipe, 95 linear feet of 18-inch diameter storm pipe, and 500 linear feet of 15-inch diameter storm pipe and any other work needed to complete the project as directed by the Engineer.

Project plans, specifications, and bid packages are attached to the Invitation to Bid on the City of Knoxville's website at www.knoxvilletn.gov/bids.

All bidders must be licensed contractors and must have an HRA – Highway, Railroad and Airport Construction classification.

A Pre-Bid Conference will be held at the City of Knoxville, Engineering Department, Room 301, 3131 Morris Avenue at 10:00 a.m. on Tuesday, August 20, 2019.

All interested potential bidders are strongly encouraged to view the "Invitation to Bid and Information for Bidders" on the City of Knoxville's procurement website @ www.knoxvilletn.gov/bids.

INFORMATION FOR BIDDERS

Bids will be received by the City of Knoxville, Tennessee (Herein called the "Owner") by the Purchasing Division of the City of Knoxville, acting for the Mayor, in Room 667-674, City County Building, 400 Main Avenue, Knoxville, Tennessee, 37902 until 11:00 A.M. on Friday, August 30, 2019, and then at said office publicly opened and read aloud.

Each Bid must be submitted in a sealed envelope, addressed to the Purchasing Division for the City of Knoxville; Room 667-674, City County Building; 400 Main Street; Knoxville, Tennessee 37902. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed to the Owner.

No bid will be received or accepted after the above-specified time for the opening of bids. Bids that arrive late due to the fault of U.S. Postal Service, United Parcel Services, DHL, FEDEX, any delivery/courier service, or any other carrier of any sort are still considered late and shall not be accepted by the City. Such bids shall remain unopened and will be returned to the submitting entity upon request.

All Bids must be made on the required bid form supplied with the Contract documents. All blank spaces for bid prices must be filled in, in ink or typewritten, and the bid form must be fully completed and executed when submitted. Only one copy of the bid form is required.

All Bidders must be licensed contractors as required by the Contractors Licensing Act of 1994, and all Acts amendatory thereof and must have an HRA - Highway, Railroad and Airport Construction classification. Bidder's name, address, license number, date of expiration of license, and that part of the license classification applying to the Bid must be placed on the sealed envelope containing the bid. Prior to submitting their bids, bidders are to be registered with the Purchasing Division through the City of Knoxville's online Vendor Registration system. Instructions for registering on-line are available at www.knoxvilletn.gov/purchasing. **Bid submissions from un-registered bidders may be rejected.**

If applicable, sub-contractors for electrical work, plumbing work, and HVAC must be shown on the outside of the envelope along with their respective license numbers, expiration date, and classification; where the total cost of the masonry portion of the project exceeds $100,000 in materials and labor, the license number, expiration date, and classification must be listed on the outside of the envelope for the masonry sub-contractor. The envelope must be plainly marked, "Bid on (project) to be opened on (date) at (time)," otherwise the bid cannot be opened or considered. Any bid envelope which contains the listing of more than one contractor in each classification shall be considered in violation and the bid shall not be opened or considered. These requirements are detailed in Tennessee Code Annotated § 62-6-119 (B), the State of Tennessee, Department of Commerce and Insurance Board for licensing contractors can provide additional information if required.

Attention is called to Chapter 2, Article VIII (Procurement Code) of the Knoxville City Code, which requires that prevailing wages shall be paid workmen on all buildings and construction projects wherein any City funds are expended for such purposes. The Contractor agrees to comply with and to post the prevailing wage laws as provided in the "Prevailing Wage Act of 1975," Tennessee Code Annotated § 12-4-401 et seq. For the purpose of this contract the prevailing wage rates shall be the wage rate incorporated in these documents. The City reserves the right to demand the payroll records of Contractor at any time to monitor compliance with the wage rate/discrimination clause(s). Failure by Contractor to provide City with said records within ten working days of the written notice shall constitute a breach of this agreement.

Any Bid may be withdrawn prior to the above scheduled time for the opening of the Bids or authorized postponement thereof. Any Bid received after the time and date specified shall not be considered. No Bidder may withdraw a Bid within ninety (90) days after the actual date of the opening thereof. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the Owner and the Bidder.

Bidders must satisfy themselves of the accuracy of the estimated quantities in the Bid Schedule by examination of the site and a review of the drawings and Specifications including addenda. After Bids have been submitted, the Bidder shall not assert that there was a misunderstanding concerning the quantities of work or of the nature of the work to be done. When discrepancies occur between unit prices and total prices on the Bid Schedule, the total price submitted for each pay item will be maintained and corrections will be made to the unit prices.

The Contract documents contain the provisions required for the construction of the project. Information obtained from an officer, agent, or employee of the Owner or any other person shall not affect the risks or obligations assumed by the Contractor or relieve him from fulfilling any of the conditions of the Contract.

Inquiries pertaining to this ITB shall be made in writing and be in the hands of the Purchasing Division by the close of the business day on Friday, August 23rd, 2019. Questions can be submitted by letter, fax (865-215-2277), or email to Procurement Specialist Karisa Scott (kscott@knoxvilletn.gov) or City County Building; 400 Main Street; Room 667-674; P.O. Box 1631; Knoxville, TN 37901. The City is not responsible for oral interpretations given by any City employee, representative, or others; and no interpretation of the meaning of the plans, specifications, or other pre-bid documents will be made to any bidder orally. The issuance of written addenda is the only official method whereby interpretation, clarification, or additional information can be given. To be given consideration, such requests/questions must be received at least five (5) business days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be posted to the City's website at www.knoxvilletn.gov/bids. Submitting organizations are strongly encouraged to view this website often to see if addenda are posted. Failure of any bidder to receive any such addendum or interpretation shall not relieve such Bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

All Bids must be signed in full by the Bidder or Bidders in their business name or style and must show his or their complete address. If the Bidder be a firm or a corporation, the signature shall be a duly authorized member of the firm or officer of the corporation stating his official title or position with such firm or corporation, with the corporate seal attached, attested to by the proper officer. If the Bidder be a firm, the full names and addresses of all members of the firm must be shown. If the Bidder be a corporation, the name of the state under the laws of which it is incorporated must be shown. If the Bid is signed in the name of an agent, legal evidence of his authority to bind his principals must accompany the papers.

All Bids exceeding $100,000 must be accompanied by a Bidder's Bond equal to 5 percent of the bid price, executed by the Bidder and a surety company authorized to transact business in the State of Tennessee or by a cashier's or certified check on a duly authorized bank made payable to the City of Knoxville, as a guarantee that, if the Bid is accepted, the required Contract will be executed and the required Performance and Payment Bonds furnished. As soon as the bid prices have been compared, the Owner will return the bonds of all except the three lowest responsible Bidders. When the Agreement is executed, the bonds of the two (2) remaining unsuccessful Bidders will be returned. The Bid Bond of the successful Bidder will be retained until the Payment Bond and Performance Bond have been executed and approved, after which it will be returned.

A Performance Bond and a Payment Bond, each in the amount of one hundred percent (100%) of the Contract price, with a corporate surety approved by the Owner, will be required for the faithful performance of the Contract.

Attorneys-in-fact who sign Bid Bonds and Performance Bonds must file with each bond a certified and effective dated copy of their power of attorney.

The party to whom the Contract is awarded will be required to execute the Agreement and obtain the Performance Bond and Payment Bond within fifteen (15) days from the date when notice of award is delivered to the Bidder. The notice of award shall be accompanied by the necessary Agreement and bond forms. In case of failure of the Bidder to execute the Agreement, the Owner may at his option consider the Bidder in default, in which case the Bid Bond accompanying the proposal shall become the property of the Owner.

The Owner within ninety (90) calendar days of receipt of acceptable Performance Bond, Payment Bond, and Agreement signed by the party to whom the Agreement was awarded shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the Owner not execute the Agreement within such period, the Bidder may by written notice withdraw his signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the Owner.

Notice to proceed shall be issued within ninety (90) days of the execution of the Agreement by the Owner. Should there be reasons why the notice to proceed cannot be issued within such period, the time may be extended by mutual agreement between the Owner and Contractor. If the Notice to Proceed has not been issued within the ninety (90) day period or within the period mutually agreed upon, the Contractor may terminate the Agreement without further liability on the part of either party.

The Owner may make such investigations as he deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the owner may request. The Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the work contemplated therein.

Award will be made as a whole to one Bidder. By execution and delivery of a bid submission, the bidder agrees that any additional terms and conditions, whether submitted to the City purposely or inadvertently, shall have no force or effect.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout. Attention is called to Section 2-1016 et seq. of the Knoxville City Code, which requires that prevailing wages shall be paid workmen on all buildings and construction projects wherein any City funds are expended for such purposes. The Contractor agrees to comply with and to post the prevailing wage laws as provided in the "Prevailing Wage Act of 1975," Tennessee Code Annotated 12-4-401 et seq.

Each Bidder is responsible for inspecting the site and for reading and being thoroughly familiar with the Contract documents. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation in respect to his Bid.

Further, the Bidder agrees to abide by the requirements under Executive Order No. 11246, as amended, including specifically the provisions of the equal opportunity clause set forth in the General Conditions. Attention is also called to Section 15-26 of the Knoxville City Code, requiring and defining a non-discrimination clause which shall be contained in all Contracts with the City of Knoxville wherein City funds are expended for the purpose of construction, alteration, repair of demolition of any building, street, alley or sewer, or for the providing of any services, and all leases, franchises or concession through which property of the City of Knoxville is to be used.

All bidders must comply with Title VI of the Civil Rights Act of 1964, as codified in 42 U.S.C. 2000 (d). The successful bidder must follow Title VI guidelines in all areas including hiring practices, operating facilities, insurance, and wages. The City of Knoxville reserves the right to review all compliance records by a contract compliance officer designated by the City. The Drug Free Workplace Affidavit form must be submitted with the bid.

The Drug Free Workplace Affidavit, the Non-Collusion Affidavit, the Iran Divestment Act Form, and the Subcontractor/Consultant Statement from the Diversity Business Enterprise Program packet, fully executed, must be submitted with the bid.

The Contractor shall maintain such insurance as detailed in the General Conditions section of this ITB as will protect him and/or the City from all claims including Workman's Compensation and will save harmless the City from all claims and damages which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by himself or by any subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. Certificates of insurance acceptable to the City shall be filed with the City prior to commencement of the work.

The Contract will be awarded with reasonable promptness by written notice to the responsive and responsible Bidder whose Bid is determined to contain the lowest bid price or lowest evaluated bid price in accordance with Section 2-862 of the Knoxville City Code.

The City may waive technicalities concerning bid documents and may follow up with individual organizations after the bid opening to obtain such documents when it is in the best interests of the City. The City of Knoxville reserves the right to waive any informalities or to reject any or all bids, to evaluate bids, and to accept any bid which, in its opinion, may be in the best interest of the City.

CITY OF KNOXVILLE - 2018 Cured-in-Place (CIPP) Project

ITEM NO.	DESCRIPTION	UNITS	TOTAL QUANTITY	PRICE PER UNIT	TOTAL PRICE PER ITEM
1	**48-Inch Storm Sewer**				
a	40.5 mm (UV 15.0 mm) - Ed Shouse	LF	350		
b	Storm Sewer Internal Void Repair up to 20 Feet in Length	EA	4		
2	**30-Inch Storm Sewer**				
a	19.5 mm (UV 9.0 mm) - Edonia	LF	72		
b	Storm Sewer Internal Void Repair up to 20 Feet in Length	EA	1		
3	**24-Inch Storm Sewer**				
a	16.5 mm (UV 7.5 mm) - Nancy Lynn	LF	125		
b	16.5 mm (UV 7.5 mm) - 1500 Washington	LF	460		
c	Storm Sewer Point Repair up to 20 Feet in Length	EA	1		
d	Storm Sewer Internal Void Repair up to 20 Feet in Length	EA	3		
4	**18-Inch Storm Sewer**				
a	13.5 mm (UV 6.0 mm) - S. Concord	LF	40		
b	13.5 mm (UV 6.0 mm) - Uppingham	LF	55		
c	Storm Sewer Point Repair up to 20 Feet in Length	EA	1		
d	Storm Sewer Internal Void Repair up to 20 Feet in Length	EA	2		
5	**15-Inch Storm Sewer**				
a	10.5.0 mm (UV 6.0 mm) - 1600 Washington	LF	500		
b	Storm Sewer Point Repair up to 20 Feet in Length	EA	1		
c	Storm Sewer Internal Void Repair up to 20 Feet in Length	EA	1		
6	**42-Inch x 30-Inch Arch Storm Sewer**				
a	42.0 mm (UV 21.00 mm) - Arrowhead	LF	80		
b	Storm Sewer Point Repair up to 20 Feet in Length	EA	1		
c	Storm Sewer Internal Void Repair up to 20 Feet in Length	EA	1		
7	**Pre-CCTV**	LF	1,600		
8	**Cash Allowances**				
a	Soils and Concrete Testing Services	LS	1		
b	Cured-In-Place Pipe Testing Laboratory Services	LS	1		
c	Pavement Removal and Replacement	SF	50		
9	**Asphalt**				
a	Concrete	CF	50		
b	Infrared Pavement Restoration	SF	50		
10	**Additional Work if Ordered by the Engineer**				
a	Catch Basin Excavation	EA	5		
b	Heavy Cleaning or Obstruction Removal	LF	1,200		
c	Flowable Fill	CY	5		
d	Trench Stablization - Crushed Stone	CY	75		
e	Trench Stablization - Filter Fabric	SF	50		
				TOTAL BID	

In submitting this bid it is understood that the right is reserved by the City of Knoxville to reject any and all bids. If written notice of the acceptance of this bid is mailed, telegraphed or delivered to the undersigned within ninety (90) days after the opening thereof, or at any time thereafter before this bid is withdrawn, the undersigned agrees to execute and deliver a contract in the prescribed form and furnish the required bond within fifteen (15) days after the contract is presented to him for signature.

Security of the sum of _____ Dollars ($_____), in the form of _____, is submitted herewith in accordance with the Specifications.

The bidder certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The bidder agrees that a breach of this certification will be a violation of the Equal Opportunity clause in any contract resulting from acceptance of this bid. As used in this certification, the term "segregated facilities" means any waiting room, work areas, rest rooms and wash rooms, restaurants and other eating areas, time-clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment area, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. The bidder agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certifications in his files.

Bidder hereby agrees to commence work under this contract on or before a date to be specified in the Notice to Proceed and to fully complete the Project within _____(___) calendar days thereafter. Bidder further agrees to pay liquidated damages in the sum of two hundred dollars ($200.00) for each consecutive calendar day thereafter as provided in the General Conditions.

Bidder acknowledges receipt of the following addendum:

The Bidder is prepared to submit a financial and experience statement upon request.

Attached hereto is an affidavit in proof that the undersigned has not entered into any collusion with any person in respect to this proposal or any other proposal. Also attached is a Statement of Bidder's Qualifications.

Date:_____, 20____ _____

Name of Bidder

State License No:_____ By

Tax ID Number: _____ Title

Official Address (including Zip Code):

Incorporated under the laws of the State of

NON-COLLUSION AFFIDAVIT OF PRIME BIDDER

State of .....)
)ss.
County of.....)

_____, being first duly sworn, deposes and says that:

(1) He is (owner, partner, officer, representative, or agent) of _____, the Bidder that has submitted the attached Bid;

(2) He is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a collusive or sham bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or, to fix any overhead, profit or cost element of the bid price or the bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the City of Knoxville or any person interested in the proposed Contract;

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

(Signed)

Title

Subscribed and sworn to before me
this _____ day of _____, 20____

Title
My commission expires: _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,

As Principal, and

as Surety, are hereby held and firmly bound unto

_____as Owner in the penal sum of

_____for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this _____ day of _____, 20_____.

The condition of the above obligation is such that whereas the Principal has submitted to

_____ a certain Bid, attached hereto and hereby made a part hereof to enter into a contract in writing for the

NOW, THEREFORE,

(a) If said Bid shall be rejected, or in the alternate,

(b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such extension.

IN WITNESS, THEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____(L.S.)
Principal

Surety

SEAL By_____

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

_____

(Name of Contractor)

(Address of Contractor)

a _____hereinafter called Principal,

(Corporation, Partnership, or Individual)

and _____

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

(Name of Owner)

(Address of Owner)

hereinafter called Owner, in the penal sum of

_____Dollars, $(_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the Owner, dated the _____day of _____, 20 ___, a copy of which is hereto attached and made a part hereof for the construction of:

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety and during the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to work to be performed thereunder to the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

In Witness Whereof, this instrument is executed in _____
(number)
counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20 _____.

ATTEST:

(Principal)

_____ By_____(S)
(Principal) Secretary
(SEAL)

(Witness as to Principal) (Address)

_____ _____
(Address)

(Surety)

ATTEST:

(Surety) Secretary

(SEAL)

_____ By
Witness as to Surety Attorney-in-fact

(Address) (Address)

NOTE: Date of Bond must not be prior to date of Contract. If Contractor is Partnership, all partners should execute Bond.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

_____

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called
(Corporation, Partnership or Individual)
Principal, and _____
(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

(Name of Owner)

(Address of Owner)

hereinafter called Owner, in the penal sum of _____Dollars, $(_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the Owner, dated the _____ day of _____20____, a copy of which is hereto attached and made a part hereof for the construction of:

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amount due for materials, lubricants, oil, gasoline, coal and coke, repairs or machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, and all taxes, licenses, assessments, contributions, penalties, and interest thereon, when and if the same may be lawfully due, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice to any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20_____.

ATTEST:

_____
Principal

(Principal) Secretary

(SEAL) By _____(s)

_____
(Address)

Witness as to Principal

(Address)

_____ _____
Surety

ATTEST: BY _____
Attorney-in-fact

(Surety) Secretary

(SEAL)

_____ _____
Witness as to Surety (Address)

_____
(Address)

NOTE: Date of Bond must not be prior to date of Contract. If Contractor is Partnership, all partners should execute bond.

CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned, _____, the

duly authorized and acting legal representative of

_____, do hereby certify as follows:

I have examined the attached contract(s) and surety bonds and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions and provisions thereof.

Date:

NOTICE TO PROCEED

To: _____ Date: _____

_____ Project: _____

_____ Contract No: _____

You are hereby notified to commence work in accordance with Agreement dated

_____ , 20_____, on or before _____, 20 _____, and you are to complete the WORK within _____ calendar days thereafter. The date of completion of all WORK is therefore _____, 20 _____.

City of Knoxville
Owner

By _____

Title Chief Civil Engineer

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____,

this the _____ day of _____,

20 ____ .

By

Title

cc: Contractor
Law Department
Finance Department
Real Estate Management
James R. Hagerman, P.E., Director of Engineering
Alisha Grisham, Capital Projects Technician
Natalie Reyes, Contract Manager
Robin Tipton, P.E., Civil Engineer Manager
Project Inspector

CHANGE ORDER

Order No. _____

Date: _____

NAME OF PROJECT: _____

_____

OWNER: City of Knoxville, Tennessee

CONTRACTOR: _____

THE FOLLOWING CHANGES ARE HEREBY MADE TO THE CONTRACT DOCUMENTS:

JUSTIFICATION:

CHANGE TO CONTRACT PRICE:

Original Contract Price $

Current Contract Price adjusted by previous Change Order $ _____.

The Contract Price due to this Change Order will be (increased) (decreased) by: $ _____.

The new Contract Price including this Change Order will be $ _____.

CHANGE TO CONTRACT TIME:

The Contract Time will be (increased) (decreased) by _____ calendar days.

The date for completion of all work will be _____.

All other provisions of document number _____ shall remain in full force and effect.

Requested by (Civil Engineering Chief) _____

Accepted by (Contractor) _____

Approved by (Director of Engineering) _____

Approved by (Director of Finance) _____

Approved as to form (Director of Law) _____

Ordered by (Mayor) _____

STATEMENT OF BIDDER'S QUALIFICATIONS

(To be submitted by the Bidder only upon the specific request of the Local Public Agency.)

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information he desires.

1. Name of Bidder.

2. Permanent main office address, including City, State, and Zip Code.

3. When organized.

4. If a corporation, where incorporated.

5. Contracts on hand: (Schedule these, showing gross amount of each contract and the appropriate anticipated dates of completion.)

6. General character of work performed by your company.

7. Have you ever failed to complete any work awarded to you? If so, where and why?

8. Have you ever defaulted on a contract? If so, where and why?

9. List the more important contracts recently completed by you, stating approximate gross cost for each, and the month and year completed.

10. List your major equipment <u>available for this contract.</u>

11. Experience in reinforced concrete and masonry retaining walls, grading, paving, and other work similar in importance to this project.

12. Background and experience of the principal members of your organization including the officers.

13. Credit available: $ _____.

14. Give bank reference.

15. Will you upon request, fill out a detailed financial statement and furnish any other information that may be required by the City of Knoxville?

16. (a) Have you ever been a party to or otherwise involved in any action or legal proceeding involving matters related to race, creed, nationality, sex, religion or nationality? If so, give full details.

(b) Have you ever been accused of discrimination based upon race, color, sex, nationality, or religion in any action or legal proceeding, including any proceeding related to any Federal Agency? If so, give full details.

17. The undersigned hereby authorizes and requests any person, firms, or corporation to furnish any information requested by the City of Knoxville in verification of the recitals comprising this Statement of Bidder's Qualifications.

Dated at _____ this_____ day of _____, 20____.

By

Title

State of _____)
)ss
County of _____)

_____ being duly sworn, deposed and

says that he is the _____of
and that the answers to the foregoing questions and all statements therein contained are true and

correct.

Subscribed and sworn to before me this _____ day _____,20_____.

_____
Notary Public

My commission expires

CONTRACT AGREEMENT

THIS AGREEMENT made this _____ day of _____, by and between the CITY OF KNOXVILLE, a municipal corporation organized and existing under the laws of the State of Tennessee, and .

WHEREAS, the Purchasing Division for the City of Knoxville advertised for competitive sealed bids for the "_____", Project No. _____ and

WHEREAS, _____ submitted the lowest qualified (Unit Price Bid)(Lump Sum Bid) _____, which bid was approved by the Council of the City of Knoxville on _____, by Resolution _____.

NOW, THEREFORE, the CITY OF KNOXVILLE and

for the mutual considerations stated herein agree as follows:

1. STATEMENT OF WORK. _____ shall furnish all supervision, technical personnel, labor, materials, machinery, tools, equipment and services, and perform and complete all work required on the _____, and required supplemental work for the City of Knoxville, Tennessee, all in strict accordance with the contract documents for said project including all addenda thereto as prepared by the Engineering Department of the City of Knoxville and dated _____.

II. CONTRACT PRICE. The City of Knoxville shall pay to _____ for the satisfactory performance of the contract in current funds, subject to additions and deductions and in accordance with the (Unit Prices Bid)(Lump Sum Bid) as provided in the contract documents, but not to exceed the sum of _____ unless modified by a Contract Change Order.

III. CONTRACT. The executed Contract Documents shall consist of the following:

a. This contract
b. Addenda
c. Invitation for Bids
d. Instructions to Bidders
e. Signed copy of Bid and Proposal
f. General Conditions
g. Supplemental General Conditions
h. Special Conditions
i. Technical Specifications
j. Drawings

This Agreement, together with other documents enumerated in this Article III, which said other documents are as fully a part of the contract as if hereto attached or herein repeated, forms an Agreement between the parties hereto.

IN WITNESS WHEREOF, the CITY OF KNOXVILLE and _____

have caused this Agreement to be executed in five copies on the day and year first written above.

CITY OF KNOXVILLE

By
MADELINE ROGERO
Mayor

APPROVED AS TO FORM
AND CORRECTNESS:

CHARLES SWANSON
Senior Law Director

By

(Title)

_____

_____
(Business Address)

DRUG-FREE WORKPLACE AFFIDAVIT

State of

County of

_____, being duly sworn, deposes, and says that:

(1) He/She is a principal officer of _____, the firm that has submitted the attached Proposal, his or her title being _____ of the firm; and

(2) He/She has personal knowledge of the policies of the above-named firm with respect to the maintenance of a drug-free workplace; and

(3) He/She certifies that all provisions and requirements of the Tennessee Drug-Free Workplace Program, as established by Tenn. Code Ann. §§ 50-9-100 et. seq., have been met and implemented.

(Signed)

(Title)

Subscribed and sworn to before me this ____day of _____, _____.

Title

My Commission expires

IRAN DIVESTMENT ACT

Certification of Noninclusion

NOTICE: Pursuant to the Iran Divestment Act of 2014, Tenn. Code Ann. § 12-12-106 requires the State of Tennessee Chief Procurement Officer to publish, using creditable information freely available to the public, a list of persons it determines engage in investment activities in Iran, as described in § 12-12-105. Inclusion on this list makes a person ineligible to contract with the state of Tennessee; if a person ceases its engagement in investment activities in Iran, it may be removed from the list. A list of entities ineligible to contract in the State of Tennessee Department of General Services or any political subdivision of the State may be found here:

https://www.tn.gov/content/dam/tn/generalservices/documents/cpo/cpo-library/public-information-library/List_of_persons_pursuant_to_Tenn._Code_Ann._12-12-106_Iran_Divestment_Act_updated_7.7.17.pdf

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each bidder is not on the list created pursuant to T.C.A. § 12-12-106.

Vendor Name (Printed)	Address
By (Authorized Signature)	Date Executed
Printed Name and Title of Person Signing	

NOTARY PUBLIC:

Subscribed and sworn to before me this _____ day of _____, 2_____.

My commission expires:_____

GENERAL CONDITIONS

GENERAL CONDITIONS

1. Definitions
2. Additional Instructions and Detail Drawings
3. Schedules, Reports, and Records
4. Drawings and Specifications
5. Shop Drawings
6. Materials, Services and Facilities
7. Inspection and Testing
8. Substitutions
9. Patents
10. Surveys, Permits, Regulations
11. Protection of Work, Property, Persons
12. Supervision by Contractor
13. Changes in the Work
14. Changes in Contract Price
15. Time for Completion and Liquidated Damages
16. Correction of Work
17. Subsurface Conditions
18. Suspension of Work, Termination and Delay
19. Payments to Contractor
20. Acceptance of Final Payment as Release
21. Insurance Requirements for Contractors
22. Contract Security
23. Assignments
24. Indemnification
25. Separate Contracts
26. Subcontracting
27. Engineer's Authority
28. Land and Rights-of-Way
29. Guaranty
30. Taxes
31. Traffic Control
32. Job Offices and Other Temporary Buildings
33. Work by Utilities
34. Maintenance
35. Estimate of Quantities
36. Air Pollution and Dust Control
37. Care of Work
38. Tennessee One Call
39. Notice of City Procurement Code Prohibitions
40. Prevailing Wages
41. Equal Business Opportunity Program

Forms

1. Definitions - Wherever used in the Contract Documents, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

1.1 Abbreviations -

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
KUB	Knoxville Utilities Board
TDOTSS	Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, 2015

1.2 Approved (also "directed," "required," "permitted") shall mean as approved, directed, required or permitted by the Engineer, unless specified otherwise.

1.3 Addenda - Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, Drawing, and Specifications, by additions, deletions, clarifications or corrections.

1.4 Bid - The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed. Included in the Bid Schedule which shall list all items to bid upon, and the total bid price for the Work.

1.5 Bidder - Any person, firm, or corporation submitting a Bid for the Work.

1.6 Bonds - Bid, Performance, and Payment Bonds and other instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.

1.7 Change Order - A written order to the Contractor authorizing an addition, deletion or revision in the Work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.

1.8 Contract Documents - The Contract including Advertisement for bids, Information for Bidders, Bid, Bid Bond, Agreement, Payment Bond, Performance Bond, Notice of Award, Notice to Proceed, Change Order, Drawings, Specifications, Addenda, General Conditions, Supplemental General Conditions, and Certificate of Owner's Attorney.

1.9 Contract Price - The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

1.10 Contract Time - The number of calendar days stated in the Contract Documents for the completion of the Work.

1.11 Contractor - The person, firm, or corporation with whom the Owner has executed the Agreement.

1.12 Drawings - The part of the Contract Documents which show the characteristics and scope of the Work to be performed and which have been prepared or approved by the Engineer.

1.13 Engineer - The Director of Engineering or his duly authorized assistant or representative.

1.14 Field Order - A written order effecting a change in the Work not involving an adjustment in the Contract Price or an extension of the Contract Time, issued by the Engineer to the Contractor during construction.

1.15 Notice of Award - The written notice of the acceptance of the Bid from the Owner to the successful Bidder.

1.16 Notice to Proceed - Written communication issued by the Owner to the Contractor authorizing him to proceed with the work and establishing the date of commencement of the Work.

1.17 Owner - City of Knoxville, Tennessee

1.18 Plans - The approved Plans, profiles, cross-sections, working drawings and supplemental drawings which show the location, character, dimensions, and details of the construction to be performed.

1.19 Project - The undertaking to be performed as provided in the Contract Documents.

1.20 Resident Project Representative - The authorized representative of the Director of Engineering who is assigned to the Project site or any part thereof.

1.21 Shop Drawings - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, supplier or distributor, which illustrate how specific portions of the Work shall be fabricated or installed.

1.22 Specifications - A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

1.23 Subcontractor - An individual, firm, or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the site.

1.24 Substantial Completion - That date as certified by the Engineer when the construction of the

Project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.

1.25 Supplemental General Conditions - Modifications and Additions to General Conditions as deemed necessary by the Owner or Engineer prior to inclusion in the Contract Documents.

1.26 Suppliers - Any person, supplier, or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

1.27 Work - All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the Project.

1.28 Written Notice - Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the Work.

2. Additional Instructions and Detail Drawings

2.1 The Contractor may be furnished additional instructions and detail drawings, by the Engineer, as necessary to carry out the Work required by the Contract Documents.

2.2 The additional drawings and instruction thus supplied will become a part of the Contract Documents. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions.

3. Schedules, Reports, and Records

3.1 The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records, and other data as the Owner may request concerning Work performed or to be performed.

3.2 Prior to the first partial payment estimate, the Contractor shall submit schedules showing the order in which he proposes to carry on the Work, including dates at which we will start the various parts of the Work, estimated date of completion of each part and, as applicable:

3.2.1 The dates at which special detail drawings will be required; and

3.2.2 Respective dates for submission of Shop Drawings, the beginning of manufacture, the testing and the installation of materials, supplies and equipment. Each such schedule to be subject to change from time to time in accordance with the progress of the Work.

4. Drawings and Specifications

4.1 The intent of the Drawings and Specifications is that the Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the Work in accordance with the Contract Documents and all incidental work necessary to complete the Project in an acceptable manner, ready for use, occupancy or operation by the Owner.

4.2 In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over scale dimensions, and detailed drawings shall govern over general drawings. Anything mentioned in the Specifications and not shown on the Drawings or shown on the Drawings and not mentioned in the Specifications shall be of like effect as if shown or mentioned in both.

4.3 Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported to the Engineer, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk.

5. Shop Drawings

5.1 The Contractor shall provide Shop Drawings as may be necessary for the prosecution of the Work as required by the Contract Documents. The Engineer shall promptly review all Shop Drawings. The Engineer's approval of any Shop Drawing shall not release the Contractor from responsibility for deviations from the Contract Documents. The approval of any Shop Drawing which substantially deviates from the Requirement of the Contract Documents shall be evidenced by a Change Order.

5.2 When submitted for the Engineer's review, Shop Drawings shall bear the Contractor's certification that he has reviewed, checked and approved the Shop Drawings and that they conform to the requirements of the Contract Documents.

5.3 Portions of the Work requiring a Shop Drawing or sample submission shall not begin until the Shop Drawing or submission has been approved by the Engineer.

6. Materials, Services and Facilities

6.1 It is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete and deliver the Work within the specified time.

6.2 Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection.

6.3 Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

6.4 Materials, supplies and equipment shall be in accordance with samples submitted by the Contractor and approved by the Engineer.

6.5 The Contractor warrants that he has good title to all materials, supplies, and equipment used by him in the work. Materials, supplies or equipment to be incorporated into the Work shall not be purchased by the Contractor or the Subcontractor subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

6.6 All materials required in the Work may be stored on the site subject to approval by the Engineer, but all such materials and machinery shall be neatly and compactly stored in such a manner as to cause the least inconvenience to property owners and traffic. All fire hydrants, water and gas shut-off boxes, and other underground utility accesses must be kept free and unobstructed at all times. Proper lighting and signing must be provided to warn the traffic of any obstructions caused by the storage of materials or equipment upon public thoroughfares.

6.7 The Contractor shall make his own arrangements for delivery and handling of equipment and materials as he may require for the prosecution of the Work. The location of all temporary lines, roadways and similar facilities shall be subject to the approval of the Engineer and these shall be located and operated so as not to interfere with other work carried on by the Owner or by other Contractors. These temporary power lines, roadways or other facilities which the Contractor furnishes, installs, maintains, and removes may be used by the Owner or other Contractors at such reasonable times as may be directed by the Engineer.

6.8 Adequate sanitary facilities shall be provided by the Contractor. All such sanitary facilities shall conform to the requirements of the Tennessee Department of Public Health and the Knoxville-Knox County Health Department.

7. Inspection and Testing

7.1 All materials and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with accepted standards.

7.2 The Contractor shall provide at his expense the necessary testing and inspection services required by the Contract Documents, unless otherwise provided.

7.3 Where mill tests of materials are found necessary by the Engineer to be used for acceptance, the Contractor shall furnish certified copies of such mill tests.

7.4 Where shop equipment performance tests are specified, the Engineer shall be permitted to witness such tests. In the absence of a witnessed test, certified copies of shop tests shall be submitted at the discretion of the Engineer.

7.5 The Owner shall provide all other inspection and testing services not required by the Contract Documents. No payment will be made to the Contractor for samples taken for tests, such as concrete cylinders, etc.

7.6 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested, or approved by someone other than the Contractor, the Contractor will give the Engineer timely notice of readiness. The Contractor will then furnish the Engineer the required certificates of inspection, testing or approval.

7.7 Neither observations by the Engineer nor inspections, tests or approvals by persons other than the Contractor shall relieve the Contractor from his obligations to perform the Work in accordance with the requirements of the Contract Documents.

7.8 The Engineer and his representatives will at all times have access to the Work. In addition, authorized representatives and agents of any participating Federal or state agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any inspection, or testing thereof.

7.9 If any Work is covered contrary to the written request of the Engineer, it must if requested by the Engineer, be uncovered for his observation and replaced at the Contractor's expense.

7.10 If any Work has been covered which the Engineer has not specifically requested to observe prior to its being covered, or if the Engineer considers it necessary or advisable that covered Work be inspected or tested by others, the Contractor at the Engineer's request, will uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the Work in question, furnishing all necessary labor, materials, tools and equipment. If it is found that such Work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate Change Order shall be issued.

8. Substitutions

8.1 Whenever a material, article or piece of equipment is identified on the Drawings or Specifications by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and functions for those referred to in the Contract Documents by reference to brand name or catalogue number and if, in the opinion of the Engineer, such material, article,

or piece of equipment is of equal substance and function to that specified, the Engineer may approve its substitution and use by the Contractor. Any cost differential shall be deductible from the Contract Price and the Contract Documents shall be appropriately modified by Change Order. The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the Project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time.

9. Patents

9.1 The Contractor shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and save the Owner harmless from loss on account thereof except that the Owner shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer or manufacturers is specified, but if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Engineer.

10. Survey, Permits, Regulations

10.1 The Owner shall furnish all land surveys and establish all base lines for locating the principal component parts of the Work together with a suitable number of bench marks adjacent to the Work as shown in the Contract Documents. Unless otherwise specified in the Contract Documents, the Engineer shall furnish the Contractor all lines, profiles, grades and measurements necessary for proper construction of the project. The Contractor's attention is called to the fact that the Engineer will determine what surveying and construction layout is necessary for the Project and that minor measurements incidental to the construction process will be made by the Contractor. Items normally determined as necessary include such things as staking grades and alignment of the roadway, "Blue top stakes", slope stakes, grades and alignments of storm sewers, and staking 50' centerline stations. The Contractor shall notify the Engineer 48 hours in advance of needed construction staking.

10.2 The Contractor shall carefully preserve bench marks, reference points and stakes and, in case of willful or negligent destruction by the Contractor, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

10.3 Permits and licenses of a temporary nature necessary for the prosecution of the Work shall be secured and paid for by the Contractor. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, he shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in Section 13, Changes in the Work.

10.4 Construction and demolition debris must be disposed of in a state permitted and approved construction and demolition landfill (TDEC Class I, III, or IV).

10.5 Debris shall be removed and transported in such a manner that prevents spillage on streets or adjacent areas. Federal, State and local regulations regarding hauling and disposal of waste shall apply.

11. Protection of Work, Property and Persons

11.1 The Contractor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of Construction.

11.2 The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. He will notify owners of adjacent utilities when prosecution of the Work may affect them. The Contractor will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, and not attributable directly or indirectly in whole or in part to the fault or negligence of the Contractor.

11.3 In emergencies affecting the safety of persons or the Work or property at the side or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Owner, shall act to prevent threatened damage, injury or loss. He will give the Engineer prompt Written Notice of any significant changes in the Work or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be issued covering the changes and deviations involved.

11.4 In order to protect the lives and health of his employees under the Contract, the Contractor shall comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease and injury requiring medical attention or causing loss of time from work, arising out of and in course of employment on work under the Contract.

11.5 The Contractor alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances and methods, and for any damage which may result from their failure or their

improper construction, maintenance or operation.

11.6 The Contractor shall, at his own expense, shore up and protect any buildings, bridges, or other public or private structures which may be encountered or endangered in the prosecution of the Work, and that may not be otherwise provided for, and he shall repair and make good any damages to such property by reason of his operations. All existing fences which due to prosecution of the Work that were removed shall be replaced by the Contractor. No extra payment will be made for said work or materials unless specified.

11.7 Contractor shall repair or replace at his own expense any property pins, bench marks, existing water pipes, sewers, drainage ditches and all plantings including grass that are damaged during construction. The site shall be left in its present condition after all clean up work has been done. Any damage to drainage or water pipes, local sewers, planting including grass, utilities, roads, parking space or other structures, shall be repaired and replaced immediately in the condition found. Such repairs and replacements shall be at the expense of the Contractor.

11.8 Contractor will be required, at his own expense, to do everything necessary to support, protect and sustain all sewer, water or gas pipes; service pipes; electric lights; power, telephone or telegraph poles; conduits; and other fixtures laid across or along the site of the Work. The Engineer, as well as the company or corporation owning said poles, pipes or conduits must be notified by the Contractor before any such fixtures are removed or molested. In case any of the said sewer, gas, or water pipes; service pipes; electric lights; power; telephone or telegraph poles; conduits; or other fixtures be damaged, they shall be repaired by the authorities having control of the same, and the expense of said repairs shall be deducted from the monies due or to become due the Contractor under this Contract.

11.9 Should it become necessary to temporarily change the position or remove poles, electric conduits, water pipes, gas pipes, or other pipes or wires, the Contractor shall notify the Engineer and company or the corporation owning the said poles, pipes or conduits of the location and circumstances, and shall cease work if necessary until satisfactory arrangements have been made by the owners of the said poles, pipes, conduits or wires to properly care for the same. No claims for damages will be allowed on account of any delay occasioned thereby. The entire cost of such temporary changes or removal must be included in the unit or lump sum prices bid for the various items under this Contract.

11.10 Before, during and after installation, the Contractor shall furnish and maintain satisfactory protection to all equipment against injury by weather, flood or breakage, thereby permitting the Work to be left in a perfect condition at the completion of the Contract. No extra payment will be made for this work but the entire cost of the same shall be included in the price bid for the construction of the work done under this contract.

12. Supervision by Contractor

12.1 The Contractor will supervise and direct the Work. He will be solely responsible for the

means, methods, techniques, sequences and procedures of construction. The Contractor will employ and maintain on the Work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to the supervisor shall be as binding as if given to the Contractor. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

13. Changes in the Work

13.1 The Owner may at any time, as the need arises, order changes within the scope of the Work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the Work, an equitable adjustment shall be authorized by Change Order. All Change Orders must be approved by the Owner and the Engineer.

13.2 The Engineer, also, may at any time, by issuing a Field Order make changes in the details of the Work. The Contractor shall proceed with the performance of any changes in the Work so ordered by the Engineer unless the Contractor believes that such Field Order entitles him to a change in Contract Price or Time, or both, in which event he shall give the Engineer Written Notice thereof within fifteen (15) days after the receipt of the ordered change, and the Contractor shall not execute such changes pending the receipt of an executed Change Order or further instruction from the Owner.

13.3 No claim for extra work or cost shall be allowed unless the same was done in pursuance of a written order of the Engineer approved by the Owner, and the claim presented with the first estimate after the change or extra work is done. When the Work is performed under the terms of Article 14 of the General Conditions, the Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost and when requested by the Owner, give the Owner access to accounts relating thereto.

14. Changes in Contract Price

14.1 The Contract Price may be changed only by a Change Order. The value of any Work covered by a Change Order or of any claim for increase or decrease in the Contract Price shall be determined by one or more of he following methods in the order of precedence listed below:

(a) Unit prices previously approved.

(b) An agreed lump sum.

(c) The actual cost for labor, direct overhead, materials supplies, equipment, and other services necessary to complete the work. In addition there shall be added an amount to be agreed upon but not to exceed fifteen (15) percent of the actual cost of the Work to cover the cost of general overhead and profit.

15. Time for Completion and Liquidated Damages

15.1 The date of beginning and the time for completion of the Work are essential conditions of the Contract Documents and the Work embraced shall be commenced on a date specified in the Notice to Proceed.

15.2 The Contractor will proceed with the Work at such rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed, by and between the Contractor and the Owner, that the Contract Time for the completion of the Work described herein is a reasonable time, taking into consideration average climatic and economic conditions and other factors prevailing in the locality of the Work.

15.3 If a Contractor shall fail to complete the Work within the Contract Time, or extension of time granted by the Owner, then the Contractor will pay to the Owner the amount for liquidated damages as specified in the Bid for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents.

15.4 The Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the Work is due to the following, and Contractor has promptly given Written Notice as such delay to the Owner or Engineer.

15.4.1 To any preference, priority or allocation order duly issued by the Owner.

15.4.2 To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and

15.4.3 To any delays of Subcontractors occasioned by any of the causes specified in paragraphs 15.4.1 and 15.4.2 of this article.

16. Correction of Work

16.1 The Contractor shall promptly remove from the premises all Work rejected by the Engineer for failure to comply with the Contract Documents, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to the Owner and shall bear the expense of making good all Work of other Contractors destroyed or damaged by such removal or replacement.

16.2 All removal and replacement Work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected Work within ten (10) days after receipt of Written Notice, the Owner may remove such Work and store the materials at the

expense of the Contractor.

16.3 If, in the opinion of the Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the Work injured or not performed in accordance with the Contract Documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as in the judgement of the Engineer shall be equitable.

17. Subsurface Conditions

17.1 The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the Owner by Written Notice of:

17.1.1 Subsurface or latent physical conditions at the site, differing materially from those indicated in the Contract Documents; or

17.1.2 Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inhering in Work of the character provided for in the Contract Documents.

17.2 The Owner shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the Work, and equitable adjustment shall be made and the Contract Documents shall be modified by a Charge Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless he has given the required Written Notice; provided that the Owner may, if he determines the facts justify, consider and adjust any such claims asserted before the date of final payment.

17.3 If the Bidder wishes to make borings for his own use, the Owner will make the site of the Work available to the Bidder to do this exploratory work. Written permission must be obtained from the Engineer before the Bidder begins Work on the site. Cost of such borings shall be at the expense of the Bidder.

18. Suspension of Work, Termination and Delay

18.1 The Owner may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the Contractor, by Written Notice to the Contractor and the Engineer on which Notice shall fix the date on which Work shall be resumed. The Contractor will resume that Work on the date so fixed. The Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension.

18.2 If the Contractor is adjudged a bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the Contractor or for any of his property, or if he files a petition to take advantage of any debtor's act, or to

reorganize under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or if he repeatedly fails to make prompt payments to Subcontractors or for labor, materials or equipment or if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the Work or if he disregards the authority of the Engineer, or if he otherwise violates any provision of the Contract Documents, then the Owner may, without prejudice to any other right or remedy and after giving the Contractor and his surety a minimum of ten (10) days from delivery of a Written Notice, terminate the services of the Contractor and take possession of the Project and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor, and finish the Work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Project, including compensation for additional professional services, such excess shall be paid to the Contractor. If such costs exceed such unpaid balance, the Contractor will pay the difference to the Owner. Such costs incurred by the Owner will be determined by the Engineer and incorporated in a Change Order.

18.3 Where the Contractor's services have been so terminated by the Owner, said termination shall not affect any right of the Owner against the Contractor then existing or which may thereafter accrue. Any retention or payment of monies by the Owner due the Contractor will not release the Contractor from compliance with the Contract Documents.

18.4 After ten (10) days from delivery of a Written Notice to the Contractor and the Engineer, the Owner may, without cause and without prejudice to any other right or remedy, elect to abandon the Project and terminate the Contract. In such case, the Contractor shall be paid for all Work executed and any expense sustained plus reasonable profit.

18.5 If, through no act or fault of the Contractor, the Work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any request for payment within thirty (30) days after it is submitted, or the Owner fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within thirty (30) days of its approval and presentation, then the Contractor may, after ten (10) days from delivery of a Written Notice to the Owner and the Engineer, terminate the Contract and recover from the Owner payment for all Work executed and all expenses sustained. In addition and in lieu of terminating the Contract, if the Engineer has failed to act on a request for payment or if the Owner has failed to make any payment as aforesaid, the Contractor may upon ten (10) days notice to the Owner and the Engineer stop the Work until he has been paid all amounts then due, in which event and upon resumption of the Work, Change Orders shall be issued for adjusting the Contract Price or extending the Contract Time or both to compensate for the costs and delays attributable to the stoppage of the Work.

18.6 If the performance of all or any portion of the Work is suspended, delayed, or interrupted as a result of a failure of the Owner or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time, an adjustment in the Contract

Price or an extension of the Contract Time, or both, shall be made by Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of the Owner or Engineer.

18.7 The Owner may terminate this Agreement at any time, with or without cause, by written notice of termination to the Contractor. If the Owner terminates this Agreement, and such termination is not a result of a default by the Contractor, the Contractor shall be entitled to receive as its sole and exclusive remedy the following amount from the Owner, and the Owner shall have no further or other obligations to the Contractor: The amount due to the Contractor for work executed through the date of termination, not including any future costs, profits, or other compensation or payments which the Contractor would have been entitled to receive if the Agreement had not been terminated.

19. Payments to Contractor

19.1 Payment by the Owner to the contractor will be made on a monthly basis. Work performed during the month will be submitted by the Engineer for payment on or before the 10th day of the following month. Payment will then be made by the City of Knoxville Finance Department to the Contractor. The Owner shall retain five (5%) percent of all work covered by the Contract Documents.

19.2 The Contractor may request partial payment for materials and equipment not incorporated in the Work but delivered and suitably stored at or near the site. Such a request shall be accompanied by supporting data, satisfactory to the Owner, as will establish the Owner's title to the material and equipment and protect his interest therein, including applicable insurance.

19.3 All Work covered by payments made shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the Work upon which payments have been made or the restoration of any damage Work, or as a waiver of the right of the Owner to require the fulfillment of all terms of the Contract Documents.

19.4 Upon completion and acceptance of the Work, the Engineer shall issue a certificate attached to the final payment request that the Work has been accepted by him under conditions of the Contract Documents. The entire balance found to be due the Contractor, including the retained percentages, but except such sums as may be lawfully retained by the Owner, shall be paid to the Contractor within thirty (30) days of completion and acceptance of the Work.

19.5 The Contractor will indemnify and save the Owner or the Owner's agents harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the Work. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the Contractor fails to do so the Owner may, after having notified the Contractor, either pay unpaid bills or withhold from the

Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor, his Surety, or any third party. In paying any unpaid bills of the contractor, any payment so made by the Owner shall be considered as a payment made under the Contract Documents by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

19.6 No separate payment will be made for any items specified in the General Conditions, Supplementary General Conditions or the General Provision, Payments for such items shall be included in the unit price and lump sum prices bid by the Contractor for items listed in the Bid Schedule.

20. Acceptance of Final Payment as Release

20.1 The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor other than claims in state amounts as may be specifically excepted by the Contractor for all things done or furnished in connection with this Work and for every act and neglect of the Owner and others relating to or arising out of this Work. Any payment, however, final or otherwise, shall not release the Contractor or his sureties from any obligations under the Contract Documents or the Performance Bond and Payment Bonds.

21. Insurance Requirements for Contractors

21.1 Contractor shall at its sole expense obtain and maintain in full force and effect for the duration of the Agreement and any extension hereof at least the following types and amounts of insurance for claims which may arise from or in connection with this Agreement. All insurance must be underwritten by insurers with an A.M. Best rating of A-VIII or better.

21.2 *Commercial General and Umbrella Liability Insurance:* occurrence version commercial general liability insurance, and if necessary umbrella liability insurance, with a limit of not less than $2,000,000 each occurrence for bodily injury, personal injury, property damage, and products and completed operations. If such insurance contains a general aggregate limit, it shall apply separately to the work/location in this Agreement or be no less than $3,000,000.

Such insurance shall:

a. Contain or be endorsed to contain a provision that includes the City, its officials, officers, employees, and volunteers as additional insureds with respect to liability arising out of work or operations performed by or on behalf of the Contractor including materials, parts, or equipment furnished in connection with such work or operations. The coverage shall contain no special limitations on the scope of its

protection afforded to the above-listed insureds. Proof of additional insured status up to and including copies of endorsements and/or policy wording will be required.

b. For any claims related to this project, Contractor's insurance coverage shall be primary insurance as respects the City, its officers, officials, employees, and volunteers. Any insurance or self-insurance programs covering the City, its officials, officers, employees, and volunteers shall be excess of Contractor's insurance and shall not contribute with it.

c. At the sole discretion of the City, dedicated limits of liability for this specific project may be required.

21.3 *Automobile Liability Insurance:* including vehicles owned, hired, and non-owned, with a combined single limit of not less than $1,000,000 each accident. Such insurance shall include coverage for loading and unloading hazards. Insurance shall contain or be endorsed to contain a provision that includes the City, its officials, officers, employees, and volunteers as additional insureds with respect to liability arising out of automobiles owned, leased, hired, or borrowed by or on behalf of Contractor.

21.4 *Workers' Compensation Insurance.* Contractor shall maintain workers' compensation insurance with statutory limits as required by the State of Tennessee or other applicable laws and employers' liability insurance with limits of not less than $500,000. Contractor shall require each of its subcontractors to provide Workers' Compensation for all of the latter's employees to be engaged in such work unless such employees are covered by Contractor's workers' compensation insurance coverage. Such insurance shall include a waiver of subrogation in favor of the City. Proof of waiver of subrogation up to and including copies of endorsements and/or policy wording will be required.

21.5 *Other Insurance Requirements.* Contractor shall:

a. Prior to commencement of services, furnish the City with original certificates and amendatory endorsements effecting coverage required by this section and provide that such insurance shall not be cancelled, allowed to expire, or be materially reduced in coverage except on 30 days' prior written notice to the City Attorney of Knoxville, P.O. Box 1631, Knoxville, Tennessee 37901. Proof of policy provisions regarding notice of cancellation will be required.

b. Upon the City's request, provide certified copies of endorsements and policies in lieu of or in addition to certificates of insurance. Copies of policies will only be requested when contracts are deemed to be extremely or uniquely hazardous, include a dollar amount that is significant to the overall budget of the City or a City Department, or the coverage(s) may not follow standard insurance forms. A policy will only be requested after the City's Risk Manager has reviewed the contract and proof of coverage has been provided. Should the certificate of insurance refer to

specific coverage wording or endorsement(s), proof of such policy wording or endorsement(s) will be required.

c. Replace certificates, policies, and endorsements for any such insurance expiring prior to completion of services.

d. Maintain such insurance from the time services commence until services are completed. Failure to maintain or renew coverage or to provide evidence of renewal may be treated by the City as a material breach of contract.

e. If Contractor cannot procure insurance through an insurer having an A.M. Best rating of A-VIII, Contractor may, in the alternative, place such insurance with insurer licensed to do business in Tennessee and having A.M. Best Company ratings of no less than A. Modification of this standard may be considered upon appeal to the City Law Director.

f. Require all subcontractors to maintain during the term of the Agreement Commercial General Liability insurance, Business Automobile Liability insurance, and Workers' Compensation/Employer's Liability insurance (unless subcontractor's employees are covered by Contractor's insurance) in the same manner as specified for Contractor. Contractor shall furnish subcontractors' certificates of insurance to the City without expense immediately upon request.

Any deductibles and/or self-insured retentions greater than $50,000 must be disclosed to and approved by the City of Knoxville prior to the commencement of services. Use of large deductibles and/or self-insured retentions will require proof of financial ability as determined by the City.

The insurer shall agree to waive all rights of subrogation against the City, its officers, officials, and employees for losses arising from work performed by Contractor for the City. Proof of waiver of subrogation up to and including copies of endorsements and/or policy wording will be required.

All general liability policies must be written on an occurrence basis unless the Risk Manager determines that a claims made basis is reasonable in the specific circumstance. Use of policies written on a claims made basis must be approved by the Risk Manager and retroactive dates and/or continuation dates must be provided to the City prior to commencement of any work performed. Professional Liability and Environmental Liability (Pollution Coverage) are most commonly written on a claims made basis and are generally acceptable in that form.

22. Contract Security

22.1 The Contractor shall within fifteen (15) days after the receipt of the Notice of Award furnish the Owner with a Performance Bond and Payment Bond in penal sums equal to the amount

of the Contract Price, conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the Work provided by the Contract Documents. Such Bonds shall be executed by the Contractor and a corporate bonding company licensed to transact such business in the state in which the Work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these Bonds shall be borne by the Contractor. If at any time a surety on any such Bond is declared a bankrupt or loses its right to do business in the state in which the Work is to be performed or is removed from the list of Surety Companies accepted on Federal Bonds, Contractor shall within ten (10) days after notice from the Owner to do so, substitute an acceptable Bond (or Bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such Bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable Bond to the Owner.

23. Assignments

23.1 Neither the Contractor nor the Owner shall sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein, or his obligations thereunder, without written consent of the other party.

23.2 In case the Contractor assigns all or any part of any monies due or to become due under this contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the Work call for in this contract.

24. Indemnification Clause

24.1 Contractor shall defend, indemnify and hold harmless the City, its officers, employees and agents from any and all liabilities which may accrue against the City, its officers, employees and agents or any third party for any and all lawsuits, claims, demands, losses or damages alleged to have arisen from an act or omission of Contractor in performance of this Agreement or from Contractor's failure to perform this Agreement using ordinary care and skill, except where such injury, damage, or loss was caused by the sole negligence of the City, its agents or employees.

24.2 Contractor shall save, indemnify and hold the City harmless from the cost of the defense of any claim, demand, suit or cause of action made or brought against the City alleging liability referenced above, including, but not limited to, costs, fees, attorney fees, and other expenses of any kind whatsoever arising in connection with the defense of the City; and Contractor shall assume and take over the defense of the City in any such claim, demand, suit, or cause of action upon written notice and demand for same by the City. Contractor will have the

right to defend the City with counsel of its choice that is satisfactory to the City, and the City will provide reasonable cooperation in the defense as Contractor may request. Contractor will not consent to the entry of any judgment or enter into any settlement with respect to an indemnified claim without the prior written consent of the City, such consent not to be unreasonably withheld or delayed. The City shall have the right to participate in the defense against the indemnified claims with counsel of its choice at its own expense.

24.3 Contractor shall save, indemnify and hold City harmless and pay judgments that shall be rendered in any such actions, suits, claims or demands against City alleging liability referenced above.

24.4 The indemnification and hold harmless provisions of this Agreement shall survive termination of the Agreement.

25. Separate Contracts

25.1 The Owner reserves the right to let other contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly connect and coordinate his Work with theirs. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.

25.2 The Owner may perform additional Work related to the Project by himself, or he may let other contracts containing provisions similar to these. The Contractor will afford the other Contractors who are parties to such Contracts (Or the Owner, if he is performing the additional work himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of Work, and shall properly connect and coordinate his Work with theirs.

25.3 If the performance of additional Work by other Contractors or the Owner is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional Work. If the Contractor believes that the performance of such additional Work by the Owner or others involves in additional expense or entitles him to an extension of the Contract Time, he may make claim therefore as provided in Sections 14 and 15.

26. Subcontracting

26.1 The Contractor may utilize the services of specialty Subcontractors on those parts of the Work which, under normal contracting practices, are performed by specialty Subcontractors. Work shall not be awarded to the Subcontractor without prior approval of the Owner.

26.2 The Contractor shall not award Work to Subcontractor(s), in excess of fifty (50%) percent of the Contract Price, without prior written approval of the Owner.

26.3 The Contractor shall be fully responsible to the Owner for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

26.4 The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the Work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

26.5 Nothing contained in this Contract shall create any contractual relation between any Subcontractor and the Owner.

27. Engineer's Authority

27.1 The Engineer shall act as the Owner's representative during the construction period. He shall decide questions which may arise as to quality and acceptability of materials furnished and Work performed. He shall interpret the intent of the Contract Documents in a fair and unbiased manner. The Engineer will make visits to the site and determine if the Work is proceeding in accordance with the Contract Documents.

27.2 The Contractor will be held strictly to the intent of the Contract Documents in regard to the quality of materials, workmanship and execution of the Work. Inspections may be made at the factory of fabrication plant of the source of material supply.

27.3 The Engineer will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

27.4 The Engineer shall promptly make decisions relative to interpretation of the Contract Documents.

27.5 The Engineer may appoint inspectors as he desires. An inspector is placed on the Work to keep the Engineer informed as to the progress and manner in which construction is being done, and to assure adherence by the Contractor to the Drawings and Specifications. The inspector will have the authority to reject defective materials and to suspend any construction that is being improperly done, subject to final decision of the Engineer. The inspector will not have the authority to revoke, alter, enlarge or relax the provisions of these conditions, or to issue instructions contrary to Drawings and Specifications.

28. Land and Rights-of-Way

28.1 Prior to issuance of Notice to Proceed, the Owner shall obtain all land and rights-of-way

necessary for carrying out and for the completion of the Work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed.

28.2 The Owner shall provide to the Contractor information which delineates and describes the lands owned and rights-of-way acquired.

28.3 The Contractor shall provide at his own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

29. Guaranty

29.1 The Contractor shall guarantee all materials and equipment furnished and Work performed for a period of one (1) year from the date of Substantial Completion.

30. Taxes

30.1 The Contractor will pay all sales, consumer, use and other similar taxes required by the law of the place where the Work is performed.

31. Traffic Control

31.1 The Contractor shall submit to the City of Knoxville Traffic Engineer a traffic control plan for the roadways within the project area. The Contractor shall not begin construction until the traffic control plan has been approved by the Traffic Engineer. Flagmen, barricades, signs and traffic control furnished by the Contractor shall conform to the standards established in the latest edition of the "Manual on Uniform Traffic Control Devices," published by the U.S. Department of Transportation.

32. Job Offices and other Temporary Buildings

32.1 The Contractor shall furnish office space for the Resident Engineer. Space shall be at least 150 square feet in area and shall be located conveniently to the Work. Office shall be furnished with a desk, drafting table, applicable chairs, drawing rack, surveying instrument storage, telephone service, lights, heat, air conditioning, windows and one door with cylinder lock.

32.2 No shanties, camps or buildings for the housing of men employed on the Work shall be erected on land owned or leased by the Owner unless a permit, in writing, is secured from the Engineer allowing their construction. Should permission be asked and granted, the Contractor must comply with all regulations regarding the construction and maintenance of such buildings.

33. Work by Utilities

33.1 During the life of the contract, the Knoxville Utility Board Bureau of Water, Bureau of Gas and Bureau of Electricity; BellSouth Telephone Company, Scripps-Howard Cable Television, Traffic Engineering Department, and Service Department may install or adjust their respective utilities in the project area and work shall be performed by the Contractor in cooperation with the Utilities. The Contractor shall be responsible for the coordination of his work with the respective Utility Owner.

33.2 Any costs for relocation of the Utility during construction such as power poles, etc. to facilitate the work of the Contractor for the convenience of the Contractor shall be borne by the Contractor.

34. Maintenance

34.1 The Contractor shall undertake to provide reasonable maintenance for those items listed below and cost of said work shall be included in the unit or lump sum prices bid for the various items of Work under this Contract, and the manner of providing for this work shall meet with the approval of the Engineer:

34.1.1 The Contractor shall make ample provisions for both vehicular and pedestrian traffic on any public road. Effort must be made to minimize by-passing traffic during construction.

34.1.2 The Contractor shall furnish all the necessary equipment, shall take all necessary precautions and shall assume the entire cost of handling any sewage, seepage, storm, surface and flood flows which may be encountered at any time during the construction of the Work.

34.1.3 The Contractor shall lay and maintain temporary driveways, culverts, and crossings, such as in the opinion of the Engineer are necessary to reasonably accommodate the public.

34.1.4 The Contractor will minimize siltation and bank erosion during construction.

34.2 The contractor will be required to restore all street surfaces and utilities damaged by his operations to as good condition as they were previous to the work. He will be required to maintain all improvements, constructed by him, in good condition until they are accepted by the Engineer.

35. Estimate of Quantities

35.1 Wherever the estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of the Contract Documents including the proposal, they are given for use in comparing Bids and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the Work contemplated by this Contract, and such increase or diminution shall in no way vitiate this Contract, nor shall any such

increase or diminution give cause for claims or liability for damages.

36. Air Pollution and Dust Control

36.1 The contractor shall comply with all air pollution control rules, regulations, ordinances, and statues which apply to any work performed pursuant to the contract, including any air pollution control rules, regulations, ordinances and statues, specified in the Tennessee Department of Public Health's, "Air Pollution Control Regulations" or any municipal regulations pertaining to air pollution.

36.2 All available precautions shall be taken to control dust. When the Engineer judges dust to be a problem, the Contractor shall control the dust by sprinkling, by applying calcium chloride, or by other methods as directed. Payment for dust control will be made at the applicable contract unit prices for the various items used and said contract unit prices will be full compensation for furnishing all materials, equipment, tools, labor and incidentals required to control dust. No additional compensation will be allowed for any costs incurred due to delays caused by necessary dust control operations.

37. Care of Work

37.1 The Contractor expressly undertakes at his own expense:

a. To clean up frequently all refuse, rubbish, scrap materials and debris caused by his operations, to the end that at all times the site of the Work shall present a neat, orderly and workmanlike appearance;

b. Before final payment to remove all surplus material, false work, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in a neat, orderly condition;

37.2 The Owner expressly disclaims any responsibility for the accuracy or completeness of the information given on the Drawings with regard to existing structures and pipelines and the Contractor will not be entitled to any extra compensation on account of inaccuracy or incompleteness of such information, said structures and pipelines being shown only for the convenience of the Contractor who must verify the information to his own satisfaction. The giving of this information upon the Drawings will not relieve the Contractor of his obligations to support and protect all pipelines and other structures which may be encountered during the construction of the Work and to make good all damages done to such pipelines and structures.

38. Tennessee One Call

38.1 The Contractor shall notify Tennessee One Call (1-800-351-1111) 3 working days prior to any excavation in public street right-of-way. This is a requirement of Tennessee state law to

protect facilities located within the right-of-way.

39. Notice of City Procurement Code Prohibitions

39.1 It shall be unlawful for any employee of the City to participate, directly or indirectly, through decision, approval, disapproval, recommendation, preparation of any part of a purchase request, influencing the content of any specification or purchase standard, rendering of advice, investigation, auditing or otherwise, in any proceeding or application, request for ruling or other determination, claim or controversy or other matter pertaining to any contract or subcontract and any solicitation or proposal therefore, where to the employee's knowledge there is a financial interest possessed by:

(1) The employee or the employee's immediate family;

(2) A business other than a public agency in which the employee or a member of the employee's immediate family serves as an officer, director, trustee, partner or employee; or

(3) Any other person or business with whom the employee or a member of the employee's immediate family is negotiating or has an arrangement concerning prospective employment.

39.2 It shall be unlawful for any member of council, member of the board of education, officer or employee of the city to have or hold any interest in the profits or emoluments of any contract, job, work or service, either by himself or by another, directly or indirectly. Any such contract for a job, work or service for the City in which any member of council, member of the board of education, officer or employee has or holds any such interest is void.

39.3 It is unlawful for any person to offer, give or agree to give to any person, while a city employee, or for any person, while a city employee, to solicit, demand, accept or agree to accept from other person, anything of a pecuniary value for or because of:

(1) Any official action taken, or to be taken, or which could be taken;

(2) A legal duty performed, or to be performed, or which could be performed; or

(3) A legal duty violated, or to be violated, or which could be violated by such person while a City employee.

Anything of nominal value shall be presumed not to constitute a gratuity under this section. It is unlawful for any payment, gratuity or benefit to be made by or on behalf of a

subcontractor or any person associated therewith as an inducement for the award of a subcontract or order.

40. Prevailing Wages

40.1 Contractor shall at all times in performing the work under this contract comply with the City's policy on payment of prevailing wages as set forth in the Knoxville Municipal Code sections 2-1016 et seq. More specifically, but without limiting the scope of these ordinances, Contractor shall pay not less than the prevailing wage rates for all types and classifications of the Contractor's employees as determined by the City Purchasing Department under section 2-1018 of the Knoxville Municipal Code. Contractor shall furnish to the City any forms, papers, payroll copies or other information that may be required by the City and the City shall have the right to audit Contractor's books to verify that the Contractor is in compliance with the provisions cited above.

DIVERSITY BUSINESS ENTERPRISE (DBE) PROGRAM

The City of Knoxville strongly encourages prime contractors to employ diverse businesses in the fulfillment of contracts/projects for the City of Knoxville.

The City of Knoxville's Fiscal Year 2019 goal is to conduct 4.03% of its business with minority-owned businesses, 16.3% of its business with women-owned businesses, and 39.77% with small businesses.

While the City cannot engage (pursuant to state law), in preferential bidding practices, the city does **strongly encourage** prime contractors to seek out and hire diverse businesses in order to help the city meet its goals as stated above. As such, the City encourages prime contractors to seek out and consider competitive sub-bids and quotations from diverse businesses.

For DBE tracking purposes, the City requests that prime contractors who are bidding, proposing, or submitting statements of qualifications record whether or not they plan to employ DBE's as sub-contractors or consultants. With that in mind, please fill out, sign and submit (with your bid/proposal) the following sub-contractor/consultant statement.

Subcontractor/Consultant Statement

(TO BE SUBMITTED IN THE BID/PROPOSAL ENVELOPE)

We_____ do certify that on the
(Bidder/Proposer Company Name)

_____
(Project Name)

($_____)
(Amount of Bid)

Please select one:

□ **Option A: Intent to subcontract using Diverse Businesses**

A Diversity business will be employed as subcontractor(s), vendor(s), supplier(s), or professional service(s). The estimated **dollar value** of the amount that we plan to pay is:

$_____.
Estimated Amount of Subcontracted Service

Diversity Business Enterprise Utilization			
Description of Work/Project	Amount	Diverse Classification (MOB, WOB, SB, SDOV)	Name of Diverse Business

□ **Option B: Intent to perform work "without" using Diverse Businesses**

We hereby certify that it is our intent to perform 100 % of the work required for the contract, work will be completed without subcontracting, or we plan to subcontract with non-Diverse companies.

DATE:_____ COMPANY NAME:_____

SUBMITTED BY: _____ TITLE:_____
(Authorized Representative)

ADDRESS:_____

CITY/STATE/ZIP CODE: _____

TELEPHONE NO: _____

CITY OF KNOXVILLE DIVERSITY BUSINESS
DEFINITIONS

Diversity Business Enterprise (DBE's) are minority-owned (MOB), women-owned (WOB), service-disabled veteran-owned (SDVO), and small businesses (SB), who are impeded from normal entry into the economic mainstream because of past practices of discrimination based on race or ethnic background. These persons must own at least 51% of the entity and operate or control the business on a daily basis.

Minority: A person who is a citizen or lawful admitted permanent resident of the United States and who is a member of one (1) of the following groups:

a. African American, persons having origins in any of the Black racial groups of Africa;

b. Hispanic American, persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin, regardless of race;

c. Native American, persons who have origin in any of the original peoples of North America ;

d. Asian American, person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands.

Minority-owned business (MOB) is a continuing, independent, for profit business that performs a commercially useful function, and is at least fifty-one percent (51%) owned and controlled by one (1) or more minority individuals.

Woman-owned business (WOB) is a continuing, independent, for profit business that performs a commercially useful function, and is at least fifty-one percent (51%) owned and controlled by one (1) or more women.

Service Disabled Veteran-owned business (SDOV) is a continuing, independent, for profit business that performs a commercially useful function, owned by any person who served honorably on active duty in the armed forces of the United States with at least a twenty percent (20%) disability that is service connected. Meaning such disability was incurred or aggravated in the line of duty in the active military, naval or air service, and is at least fifty-one percent (51%) owned and controlled by one (1) or more service disabled veteran.

Small Business (SB) is a continuing, independent, for profit business which performs a commercially useful function and has total gross receipts of not more than ten million dollars ($10,000,000) average over a three-year period or employs no more than ninety-nine (99) persons on a full-time basis.

SPECIAL CONDITIONS

SPECIAL CONDITIONS

General

All bidders must submit with their bid a non-collusion affidavit as contained in these documents.

Where there appears to be a discrepancy between the Special Conditions and any other part of the Contract documents and Specifications these Special Conditions shall govern.

The Contractors attention is called to the fact that in some instances reference may be made in the Technical Specifications to the 2006 edition of the Tennessee Department of Highway Standard Specifications for Road and Bridge Construction. This reference, if made, is amended to refer to the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction (TDOTSS) dated January 1, 2015, and any current revisions and special provision thereto.

The City of Knoxville reserves the right to increase or decrease quantities for the items listed in the Bid Proposal and also add or delete from the proposed construction.

Materials Testing and Sampling:

Materials for construction shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended. All testing, sampling, and inspection of materials, as described below, shall be provided and paid for by the Contractor. All materials testing shall utilize methods as detailed in the technical specifications or as approved by the Engineer. Personnel performing materials testing shall be properly certified and approved by the Engineer. It is the Contractor's responsibility to take said samples to an approved independent laboratory and obtain test results. A minimum of three copies of all test results shall be provided to the Engineer to verify conformance to contract specifications.

The materials testing required by the Contractor shall be as described below:

Grading:

Borrow excavation shall be tested to determine maximum density and optimum moisture content in accordance with AASHTO Designation T 99, Method C. The Engineer will determine the density of the soil in place in accordance with an approved AASHTO method.

Concrete:

Concrete shall be tested for slump, air entrainment, temperature and compressive strength for the first load of concrete delivered on the project. If the first load of concrete does not meet specifications, then each load delivered thereafter will be tested for slump, air entrainment and temperature until the concrete meets specifications. Once the concrete meets

specifications, then it shall be tested for slump, air entrainment, temperature and compressive strength a minimum of every fifth load of concrete delivered or as directed by the Engineer. Compressive strength testing shall consist of four (4) cylinders and tests performed at ages of 7, 28, 28 days and one reserve cylinder. Compressive strength tests shall be in accordance with AASHTO Designation T 22 and T 23. Air entrainment testing shall be in accordance with AASHTO Designation T 152. Slump testing shall be in accordance with AASHTO Designation T 119.

Core Drilling

The City of Knoxville reserves the right to coredrill any pavement section and have the core evaluated for compliance with the appropriate specifications. The cost of such coring and testing shall be borne by the Contractor. These costs to the City of Knoxville shall be deducted from monies earned or to be earned by the Contractor.

Measurement

The Contractor will reconcile each day with the City of Knoxville Project Representative, materials incorporated into construction during that day, or materials shipped to the project and adequately stored and protected for which the Contractor requests payment.

The Contractors attention is specifically directed to Tennessee Code Annotated 47-26-101 Et seq. governing certification and bond of scale operators. The provisions of this code as well as all other Federal, State and City of Knoxville laws, ordinances, rules and regulations that are applicable to the construction of the project shall apply throughout the construction of the project. The City of Knoxville reserves the right to direct the contractors hauling units to a state, city or commercially owned scale to verify weights provided by the Contractor.

Tennessee One Call

Contractor shall notify Tennessee One Call prior to excavation on street right-of-way according to Tennessee State Law (1-800-351-1111).

Title VI Compliance

All bidders must comply with Title VI of the Civil Rights Act of 1964, as codified in 42 U.S.C. 2000d. The successful bidder must follow Title VI guidelines in all areas including hiring practices, open facilities, insurance, and wages. The City of Knoxville reserves the right to review all compliance records by a contract compliance officer designated by the City.

Prevailing Wage Rate

The attached wage rates are included herein and made a part of this contract in accordance with Chapter 2, Article VIII, "Procurement Code," of the City of Knoxville Code. The attached wage rates must be displayed at the job site. The Contractor agrees to comply with and to post the

prevailing wage laws as provided in the "Prevailing Wage Act of 1975," Tennessee Code Annotated 12-4-401 et seq. Highway classification descriptions are found in the State of Tennessee Department of Labor & Workforce Development's document "Classification of Workers Under Tennessee's Prevailing Wage Law – Highway Construction Crafts." This document can be found at http://www.state.tn.us/labor-wfd/ClassificationHighway9-13-2006.htm .

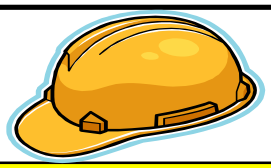
Certified Payrolls

The Contractor and subcontractors shall submit certified payrolls to the Engineer each week in which any work is performed. During construction, if the work of the Contractor or subcontractor will be interrupted for a week or more, the following statement shall be placed on the signature sheet of the payroll for the last week in which work was performed: "No additional work will be performed until further notice."

In the event a work stoppage of a week or more occurs which is not anticipated, the Engineer shall be furnished the following statement on the signature sheet of the payroll form for the week immediately after the week in which work was interrupted: "No work performed, and no work will be performed until further notice."

When work has ceased in either case as stipulated above, the Contractor or subcontractor shall note the following statement on the payroll for the week on which work is resumed: "Last previous work was performed the week ending _____."

2019 HIGHWAY PREVAILING WAGE RATES



CLASSIFICATION	CRAFT NUMBER	2019
Bricklayer	1	16.15
Carpenter/Leadsperson	2	19.84
Class "A" Operators	3	21.68
Class "B" Operators	4	19.34
Class "C" Operators	5	20.10
Class "D" Operators	6	18.66
Concrete Finisher	7	17.40
Drill Operator (Cassion)	8	33.61
Electrician	9	30.11
Farm Tractor Operator (Power Broom)	10	15.29
Ironworkers Reinforcing	11	18.44
Ironworkers (Structural)	12	19.13
Mechanic (Class I) Heavy Duty	13	24.31
Mechanic (Class II) Light Duty	14	21.54
Painter/Sandblaster	15	29.85
Powder Person Blaster	16	22.40
Skilled Laborer	17	17.30
Survey Instrument Operator	18	23.68
Sweeping Machine (Vacuum) Operator	19	17.63
Truck Driver (2 axles)	20	17.39
Truck Driver (3/4 axles)	21	16.60
Truck Driver (5 or more axles)	22	18.61
Unskilled Laborer	23	14.84
Worksite Traffic Coordinator	24	19.12
Large Crane Operator	25	23.15

Effective 01/01/2019

REGION 1	REGION 2	REGION 3	REGION 4	REGION 5	REGION 6
Shelby	Crockett	Benton	Madison	Cheatham	Bedford
	Dyer	Carroll		Dekalb	Cannon
	Fayette	Chester		Dickson	Coffee
	Gibson	Decatur		Macon	Franklin
	Hardeman	Hardin		Montgomery	Giles
	Haywood	Henderson		Robertson	Grundy
	Lake	Henry		Smith	Hickman
	Lauderdale	Houston		Sumner	Lawrence
	Obion	Humphreys		Trousdale	Lewis
	Tipton	McNairy		Williamson	Lincoln
	Weakley	Perry		Wilson	Marion
		Stewart			Marshall
		Wayne			Maury
					Moore
					Rutherford
					Warren

REGION 7	REGION 8	REGION 9	REGION 10	REGION 11	REGION 12
Anderson	Hamilton	Bledsoe	Knox	Carter	Davidson
Campbell		Blount		Claiborne	
Clay		Bradley		Cocke	
Cumberland		Loudon		Grainger	
Fentress		McMinn		Greene	
Jackson		Meigs		Hamblen	
Morgan		Monroe		Hancock	
Overton		Polk		Hawkins	
Pickett		Rhea		Jefferson	
Putnam		Sequatchie		Johnson	
Roane		Sevier		Sullivan	
Scott		Van Buren		Unicoi	
White				Union	
				Washington	

RULES
OF
TENNESSEE DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

CHAPTER 0800-3-2
PREVAILING WAGE COMMISSION RULES

TABLE OF CONTENTS

0800-3-2-.01 DEFINITIONS.

(1) The terms below shall have the following clarifying definitions in addition to those contained in T.C.A. §12-4-402 of the Prevailing Wage Act, for the purpose of construing the Act and these rules and regulations:

(a) "Apprentices" means those persons registered individually under a bona fide apprenticeship program registered with the Bureau of Apprenticeship and Training of the United States Department of Labor. The state agency contracting officer shall require the contractor or subcontractor using the apprentice to submit evidence of his indenture and/or apprenticeship registration when the apprentice's name first appears on a submitted payroll.

(b) "Commission" means the Prevailing Wage Commission or its administrative delegate, the Tennessee Department of Labor and Workforce Development.

(c) "Covered Worker" means all workers employed on State construction projects as defined by T.C.A. §12-4-402(6).

(d) "Subcontractor" means one who performs part of the job called for in the prime contract. This term shall include materialmen whose employees engage in the substantial operations at the project site, provided the employees of the materialmen devote as much as 20 percent of their work time on the construction premises.

(e) "Contract" means any contract within the scope of the Act (Tennessee Code Annotated § 12-4-401 et seq.), and which is entered into for the erection, remodeling, alteration, repairing, demolition, or making any additions to any building or buildings or for the purpose of building, rebuilding, locating or relocating or repairing any streets, highways, or bridges, or any type of building and construction work wherein any state funds may be appropriated or expended for such building or construction.

Authority: *T.C.A. §12-4-415.* ***Administrative History:*** *Original Rule filed June 14, 1976; effective July 14, 1976. Repeal and new rule filed March 12, 1987; effective April 26, 1987. Repeal and new rule filed June 30, 2006; effective September 13, 2006.*

0800-3-2-.02 CLASSIFICATION OF COVERED WORKERS.

(1) All contractors and subcontractors must classify covered workers in the contract and payroll records in conformity with the schedule of classifications issued by the Commission.

(a) The Commission hereby issues the following classifications of crafts of workers to be used for workers employed by building contractors and subcontractors. Pursuant to T.C.A. §12-4-

405(3)(A), each such craft shall only be assisted by qualified apprentices of the crafts as defined in subparagraph (a) of paragraph (1) of Rule 0800-3-2-.01.

1. "Boilermaker" means one who assembles, analyzes defects in, and repairs boilers, pressure vessels, tanks, and vats in field, following blueprints and using hand tools and portable power tools and equipment; locates and marks reference points for columns or plates on foundation, using a master straightedge, squares, transit, and measuring tape, and applying knowledge of geometry; attaches rigging or signals crane operator to lift parts to a specified position; aligns structures or plate sections to assembly boiler frame, tanks, or vats, using plumb bobs, levels, wedges, dogs, or turnbuckles; hammers, flame cuts, files, or grinds irregular edges of sections or structural parts to facilitate fitting edges together; bolts or arc-welds structures and sections together; positions drums and headers into supports and bolts or welds supports to frame; aligns watertubes and connects and expands ends to drums and headers, using a tube expander; bells, beads with a power hammer, or welds tube ends to ensure leak proof joints; bolts or welds casing sections, uptakes, stacks, baffles, and such fabricated parts as chutes, air heaters, fan stands, feeding tubes, catwalks, ladders, coal hoppers, and safety hatches to frames, using wrenches; installs manholes, handholes, valves, gauges, and feedwater connection in drums to complete assembly of watertube boilers; assists in testing assembled vessels by pumping water or gas under specified pressure into vessels and observing instruments for evidence of leakage; repairs boilers or tanks in field by unbolting or flame cutting defective sections or tubes, straightening plates, using torches or jacks, installing new tubes, fitting and welding new sections and replacing worn lugs or bolts; may rivet and caulk sections of vessels using pneumatic riveting and caulking hammers; may line firebox with refractory brick and asbestos rope and blocks; may fabricate such parts as stacks, uptakes, and chutes to adapt boiler to premises in which it is installed; assembles boilers, tanks, vats and pressure vessels according to blueprint specifications, using power tools and hand tools; reads blueprints to determine location and relationship of parts; connects firetubes to heads or watertubes to drums and headers of boilers, by expanding and belling ends, using a tube expander and beading ends, using a power hammer; drills and taps holes for installation of studs, using a portable drill; tightens bolts to assemble frames, using hand or power wrenches; mounts casings of watertube boilers, or attaches davit heads, burners or furnace casings to firetube boilers, using wrenches; bolts or screws accessories, such as manholes, handholes, fans, gauges, and valves to vessels, using hand tools or power wrenches; replaces defective parts, using power wrenches, prying bars or hand tools; may install and repair refractory brick; may thread and install stay bolts, using pipe wrenches and dies; may remove and replace rivets and caulk seams to repair riveted shells and structures, using a pneumatic chisel, riveter, and caulking hammer; and may cut out defective parts, using an acetylene torch.

2. "Bricklayer" means one who performs duties in the following areas:

   (i) "Construction" means one who lays building materials, such as brick, structural tile, concrete block, glass, gypsum, and terra cotta block (except stone) to construct or repair walls, partitions, arches, sewers, and other structures; measures distance from reference points and marks guidelines on working surface to lay out work; spreads soft bed (layer) of mortar that serves as a base and binder for block, using a trowel; applies mortar to end of block and positions block in mortar bed; taps block with a trowel to level, align, and embed in mortar, allowing specified thickness of joint; removes excess mortar from face of block, using a trowel; finishes mortar between brick with pointing tool or trowel; breaks brick to fit spaces too small for whole brick, using the edge of a trowel or brick hammer; determines vertical and horizontal alignment of courses, using a plumb bob, gaugeline (tightly stretched cord), and level; fastens brick or terra cotta veneer to

face of structures, with tie wires embedded in mortar between bricks, or in anchor holes in veneer brick; may weld metal parts to structural-steel members; and may apply plaster to walls and ceiling, using a trowel to complete repair work.

(ii) "Firebrick and Refractory Tile" means one who lays firebrick and refractory tile to build, rebuild, reline, or patch high-temperature or heating equipment, such as boilers, ovens, furnaces, converters, cupolas, ladles, and soaking pits, according to job orders and blueprints; lays out work, using chalklines, plumb bobs, tapes, squares, and levels; calculates angles and courses for building walls, arches, columns, corners and bottoms; removes burned or damaged brick and cleans surface of setting, using a sledgehammer, pry bar, pneumatic chipping gun, scraper and wire brush; cuts brick to size, using a brick hammer or powered abrasive saw; spreads fire-clay mortar over brick with a trowel and lays brick in place; spreads or sprays refractories over exposed bricks to protect bricks against deterioration by heat, using a trowel or spray gun; positions or bends special frame or hanger over casings to lay arches; cuts, notches, or drills openings to provide outlets, pyrometer mountings, brackets and heating elements, using hand tools; patches or replaces firebrick linings of ladles and furnace tap holes; constructs refractory forms for controlling quantity and flow of molten materials from furnace to rolling machines; may replace bolts, brackets, and heating elements, repair coke oven doors, weld cracks or holes in shells, or perform other repairs; and may pack insulation into shells and frames to insulate heating equipment, such as furnaces, boilers and ovens.

(iii) "Marble Finisher" means one who supplies and mixes construction materials for marble setter; applies grout, and cleans installed marble; moves marble installation materials, tools, machines, and work devices to work areas; mixes mortar, plaster, and grout, as required, following standard formulas and using manual or machine mixing methods; moves mixed mortar or plaster to installation area, manually or using a wheelbarrow; selects marble slabs for installation, following numbered sequence or drawings; drills holes and chisels channels in edges of marble slabs to install metal wall anchors, using a power drill and chisel; bends wires to form metal anchors, using pliers; inserts anchors into drilled holes of marble slab, and secures anchors in place with wooden stake and plaster; moves marble slabs to installation site, using a dolly, hoist, or portable crane; fills marble joints and surface imperfections with grout, using a grouting trowel or spatula, and removes excess grout, using a wet sponge; grinds and polishes marble, using abrasives, chemicals, and manual or machine grinding and polishing techniques; cleans installed marble surfaces, work and storage areas, installation tools, machinery, and work aids, using water and cleaning agents; stores marble, installation materials, tools, machinery, and related items; may modify mixing, material moving, grouting, polishing, and cleaning methods and procedures, according to type of installation or materials; may repair and fill chipped, cracked, or broken marble pieces, using a torch, spatula, and heat sensitive adhesive and filler; may secure marble anchors to studding, using pliers, and cover ends of anchors with plaster to secure anchors in place; may assist marble setter to saw and position marble; and may erect scaffolding and related installation structures.

(iv) "Marble Setter" means one who cuts, tools, and sets marble slabs in floors and walls of buildings and repairs and polishes slabs previously set in buildings; trims, faces and cuts marble to specified size, using power sawing, cutting, and facing equipment and hand tools; drills holes in slabs and attaches brackets; spreads mortar on bottom of slabs and on sides of adjacent slabs; sets block in position, tamps it into place, and anchors bracket attachment with wire; fills joints with

grout; removes excess grout from marble with a sponge; cleans and bevels cracks or chips on slabs, using hand tools and power tools; heats cracked or chipped area with a blowtorch and fills defect with composition mastic that matches grain of marble; and polishes marble and other ornamental stone to a high luster, using power tools or by hand.

(v) "Stonemason" means one who sets stone to build stone structures, such as piers, walls and abutments, or lays walks, curbstones, or special types of masonry, such as alberene (acid-resistant soapstone for vats, tanks, and floors), using a mason's tools; shapes stone preparatory to setting, using a chisel hammer, and other shaping tools; spreads mortar over stone and foundation with a trowel and sets stone in place by hand or with the aid of a crane; aligns stone with plumbline and finishes joints between stone with a pointing trowel; may spread mortar along mortar guides to ensure joints of uniform thickness; may clean surface of finished wall to remove mortar, using muriatic acid and a brush; and may set cut and dressed ornamental and structural stone in buildings.

(vi) "Terrazzo Finisher" means one who supplies and mixes construction materials for terrazzo worker; applies grout, and finishes surface of installed terrazzo; moves terrazzo installation materials, tools, machines, and work devices to work areas, manually or using a wheelbarrow; measures designated amounts of ingredients for terrazzo or grout, using graduated containers and a scale, following standard formulas and specifications, and loads portable mixer, using a shovel; mixes materials according to experience and requests from terrazzo worker and dumps mixed materials that form base or top surface of terrazzo into prepared installation site, using a wheelbarrow; applies curing agent to installed terrazzo to promote even curing, using a brush or sprayer; grinds surface of cured terrazzo, using power grinders to smooth terrazzo and prepare for grouting; spreads grout across terrazzo to fill surface imperfections, using a trowel; fine grinds and polishes surface of terrazzo when grout has set, using power grinders; washes surface of polished terrazzo, using a cleanser and water, and applies sealer, according to manufacturer's specifications, using a brush; installs grinding stone in power grinders, using hand tools; cleans installation site, mixing and storage areas, tools, machines, and equipment, using water and various cleaning devices; stores terrazzo installation materials, machines, tools, and equipment; may modify mixing, grouting, grinding, and cleaning procedures according to type of installation or material used; may assist terrazzo worker to position and secure moisture membrane and wire mesh prior to pouring base materials for terrazzo installation; may spread marble chips or other material over fresh terrazzo surface and press into terrazzo, using a roller; may cut divider and joint strips to size as directed; and may cut grooves in terrazzo stairs, using a power grinder, and fill grooves with nonskid material.

(vii) "Terrazzo Worker" means one who applies cement, sand, pigment and marble chips to floors, stairways, and cabinet fixtures to attain durable and decorative surfacing according to specifications and drawings; spreads roofing paper on surface of foundation; spreads mixture of sand, cement, and water over surface with a trowel to form a terrazzo base; cuts metal division strips and presses them into terrazzo base so that top edges form desired design or pattern and define level of finished floor surface; spreads mixture of marble chips, cement, pigment, and water over terrazzo base to form a finished surface, using a float and trowel; scatters marble chips over finished surface; pushes roller over surface to embed chips; allows surface to dry, and pushes electric-powered surfacing machine over floor to grind and polish terrazzo surface; grinds curved surfaces and areas

inaccessible to surfacing machine, such as stairways and cabinet tops, with a portable hand grinder; and may precast terrazzo blocks in wooden forms.

(viii) "Tile Finisher" means one who supplies and mixes construction materials for tile setter; applies grout, and cleans installed tile; moves tiles, tile setting tools, and work devices from storage area to installation site manually or using a wheelbarrow; mixes mortar and grout according to standard formulas and requests from tile setter, using a bucket, water hose, spatula, and portable mixer; supplies tile setter with mortar, using a wheelbarrow and shovel; applies grout between joints of installed tile, using a grouting trowel; removes excess grout from tile joints with a wet sponge and scrapes corners and crevices with a trowel; wipes surface of tile after grout has set to remove grout residue and polish tile, using nonabrasive materials; cleans installation site, mixing and storage areas, and installation machines, tools, and equipment, using water and various cleaning tools; stores tile setting materials, machines, tools, and equipment; may apply caulk, sealers, acid steam, or related agents to caulk, seal, or clean installed tile, using various application devices and equipment; may modify mixing, grouting, grinding, and cleaning procedures according to type of installation or material used; may assist tile setter to position and secure metal lath, wire mesh, or felt paper prior to installation of tile; and may cut marked tiles to size, using a power saw or tile cutter.

(ix) "Tile Setter" means one who applies tile to walls, floors, ceilings and promenade roof decks, following design specifications; examines blueprints, measures and marks surfaces to be covered, and lays out work; measures and cuts metal lath to size for walls and ceilings with tin snips; tacks lath to wall and ceiling surfaces with a staple gun or hammer; spreads plaster base over lath with a trowel and levels plaster to specified thickness, using a screed; spreads concrete on subfloor with a trowel and levels it with a screed; spreads mastic or other adhesive base on a roof deck using a serrated spreader to form the base for promenade tile; cuts and shapes tile with tile cutters and biters; and positions tile and taps it with a trowel handle to affix tile to plaster or adhesive base.

3. "Carpenter" means one who constructs, erects, installs and repairs structures and fixtures of wood, plywood, and wallboard, using a carpenter's hand tools and power tools, and conforming to local building codes; studies blueprints, sketches, or building plans for information pertaining to type of material required, such as lumber or fiberboard, and dimensions of structure or fixture to be fabricated; selects specified type of lumber or other materials; prepares layout, using a rule, framing square, and calipers; marks cutting and assembly lines on materials, using a pencil, chalk and marking gauge; shapes materials to prescribed measurements, using saws, chisels, and planes; assembles cut and shaped materials and fastens them together with nails, dowel pins, or glue; verifies trueness of structure with a plumb bob and carpenter's level; erects framework for structures and lays subflooring; builds stairs and lays out and installs partitions and cabinet work; covers subfloor with building paper to keep out moisture and lays hardwood, parquet, and wood-strip-block floors by nailing floors to subfloor or cementing them to mastic or asphalt base; applies shock-absorbing, sound-deadening, and decorative paneling to ceilings and walls; fits and installs prefabricated window frames, doors, door frames, weather stripping, interior and exterior trim, and finish hardware, such as locks, letterdrops, and kick plates; assembles scaffolding and seals off work area, using plastic sheeting and duct tape; positions a mobile decontamination unit or portable showers at entrance of work area; builds a connecting walkway between a mobile unit or portable showers and work area, using hand tools, lumber, nails, plastic sheeting, and duct tape; constructs forms and chutes for pouring concrete; erects

scaffolding and ladders for assembling structures above ground level; may weld metal parts to structural-steel members; when specializing in particular phase of carpentry, is designated according to specialty as combination window installer (construction); when specializing in finish carpentry, such as installing interior and exterior trim, building stairs, and laying hardwood floors, is designated finish carpenter (construction); when erecting frame buildings and performing general carpentry work in residential construction, is designated house carpenter (construction); may remove and replace sections of structures prior to and after installation of insulating materials and be designated building-insulating carpenter (construction; retail trade); may perform carpentry work in construction of walk-in freezers and environmental test chambers and be designated carpenter, refrigerator (service industry machinery); and may be designated: door hanger (construction), finished-hardware erector (construction), garage-door hanger (construction), hardwood-floor installer (construction), jalousie installer (construction), stair builder (construction), trim setter (construction), weather stripper (construction), wood strip-block installer (construction), pile driver, or dock builder. A carpenter may work on resilient floors, computer floors, pedestal floors, carpet installations, siding, acoustical ceilings, metal and wood framing, furniture installation, lathing, scaffold erecting, metal partitions, the disassembly of forms for concrete, counter tops of all materials, plastic laminates, solid surface materials, and toilet partitions.

4. "Cement Finisher, Plasterer" means one who smoothes and finishes surfaces of poured concrete floors, walls, sidewalks, or curbs to specified textures, using hand tools or power tools, including floats, trowels, and screeds; signals concrete deliverer to position truck to facilitate pouring concrete; moves discharge chute of truck to direct concrete into forms; spreads concrete into inaccessible sections of forms, using a rake or shovel; levels concrete to a specified depth and workable consistency, using a hand held screed and floats to bring the water to the surface to produce a soft topping; smoothes and shapes surfaces of freshly poured concrete, using a straightedge and float or power screed; finishes concrete surfaces, using a power trowel, or wets and rubs concrete with abrasive stone to impart finish; removes rough or defective spots from concrete surfaces, using a power grinder or chisel and hammer, and patches holes with fresh concrete or epoxy compound; molds expansion joints and edges, using edging tools, jointers, and straightedge; may sprinkle colored stone chips, powdered steel, or coloring powder on concrete to produce prescribed finish; may produce rough concrete surface, using a broom; may mix cement, using a hoe or concrete-mixing machine; may direct sub-grade work, mixing of concrete, and setting of forms; may specialize in finishing steps and stairways and be designated a step finisher (construction); and may break up and repair old concrete surfaces, using pneumatic tools, and be designated a cement mason, maintenance (any industry).

5. "Class A Operator" means one who operates a wide variety of heavy equipment such as but not limited to: backhoes, drag lines, cranes, winches with booms, motor patrols, trenching machines (18" and over), pile drivers, tug boats, mechanics (heavy), central mixing plants, locomotives, straddle carriers, earth freezing equipment, 3-drum hoists, side booms, dredges, mucking machines, cableways, central compressor plants, derrick boats, concrete pumps, well point systems, self-propelled sweepers, bulldozers, forklifts, and front end loaders; adjusts hand-wheels, depresses pedals and moves levers to drive equipment and control attachments such as blades, buckets, scrapers and swing booms; turns valves to control air and water output of compressors and pumps; and repairs, maintains and services equipment as needed. Various equipment operating engineers may also operate steel and stone handling equipment in connection with erections, machine-handling machinery, cable spinning machines, conveyor loaders, keystones, all types of shovels, derricks, trench shovels, pippin type backhoes, hoists, pavers, milling

machines, gradalls, tandem scrapers, drills (self-contained drillmaster type), batch plants with mixer, scrapers and tournapulls, rollers, spreaders, tractors, conveyors, pressure boilers, well drillers, ditch witch type trenchers, concrete breaking machines, fine grade machines, seamen pulverizing mixers, form line graders, road finishing machines, power booms, seed spreaders, grease trucks, compressors, pumps and machines similar to above. Included in this definition are tiremen on power equipment, asphalt plant engineers, maintenance engineers (power boat), firemen, oilers and deck hands (personnel boats), and grease truck helpers.

6. "Class B Operator" means one who operates a wide variety of equipment such as: trenching machines (less than 18"), tandem rollers, pavers, mobile mixers (rubber tired mobile, mixed on job), back fillers, blade graders, dinkeys (over 10 tons), elevating graders, winches (operated from trucks or tractors without booms and powered other than by the trucks), bituminous distributors, 1 and 2 drum hoists, grout pumps, motor boats, self-propelled earth compactors, finishing machines, and mixers; adjusts hand-wheels, depresses pedals and moves levers to drive equipment and control attachments such as blades, buckets, scrapers and swing booms; turns valves to control air and water output of compressors and pumps; and repairs, maintains and services equipment as needed. Included in this definition are switchmen, brakemen, and firemen.

7. "Class C Operator" means one who operates a wide variety of equipment such as: air compressors, earth drills, scales, tractors (40 horse power and less), pumps (larger than 4"), and dinkeys (less than 10 tons); adjusts hand-wheels, depresses pedals and moves levers to drive equipment and control attachments; turns valves to control air and water output of compressors and pumps; and repairs, maintains and services equipment as needed. Included in this definition are motor crane drivers and oilers.

8. "Electrician" means one who plans layout, installs, and repairs wiring, electrical fixtures, apparatus, and control equipment; plans new or modified installations to minimize waste of materials, provide access for future maintenance, and avoid unsightly, hazardous, and unreliable wiring, consistent with specifications and local electrical codes; prepares sketches showing location of wiring and equipment, or follows diagrams or blueprints, ensuring that concealed wiring is installed before completion of future walls, ceilings, and flooring; measures, cuts, bends, threads, assembles, and installs electrical conduit, using tools, such as hacksaw, pipe threader, and conduit bender; pulls wiring through conduit; splices wire by stripping insulation from terminal leads, using a knife or pliers, twisting or soldering wires together, and applying tape or terminal caps; connects wiring to lighting fixtures and power equipment, using hand tools; installs control and distribution apparatus, such as switches, relays, and circuit-breaker panels, fastening in place with screws or bolts, using hand tools and power tools; connects power cables to equipment, such as electric range or motor, and installs grounding leads; lays polyvinyl chloride (PVC) pipe for main feed electric line; and tests continuity of circuit to ensure electrical compatibility and safety of components, using testing instruments, such as ohmmeter, battery and buzzer, and oscilloscope.

9. "Elevator Constructor" means one who assembles and installs electric and hydraulic freight and passenger elevators, escalators, and dumbwaiters, determining layout and electrical connections from blueprints; studies blueprints and lays out location of framework, counterbalance rails, motor pump, cylinder, and plunger foundations; drills holes in concrete or structural-steel members with portable electric drill; secures anchor bolts or welds brackets to support rails and framework, and verifies alignment with a plumb bob and level; cuts prefabricated sections of framework, rails, and other elevator components to specified dimensions, using an acetylene torch, power saw, and disc grinder; installs cables, counterweights, pumps, motor foundations, escalator drives,

guide rails, elevator cars, and control panels, using hand tools; connects electrical wiring to control panels and electric motors; installs safety and control devices; positions electric motor and equipment on top of elevator shaft, using hoists and cable slings; and may be designated according to type of equipment installed as elevator constructor, electric (construction), elevator constructor, hydraulic (construction), or escalator constructor (construction).

10. "Glazier" means one who installs glass in windows, skylights, store fronts, and display cases, or on surfaces, such as building fronts, interior walls, ceilings, and tabletops; marks outline or pattern on glass, and cuts glass, using a glasscutter; breaks off excess glass by hand or with notched tool; fastens glass panes into wood sash with glazier's points, and spreads and smoothes putty around edge of panes with knife to seal joints; installs mirrors or structural glass on building fronts, walls, ceilings, or tables, using mastic, screws, or decorative molding; bolts metal hinges, handles, locks, and other hardware to prefabricated glass doors; sets glass doors into frames and fits hinges; may install metal window and door frames into which glass panels are to be fitted; may press plastic adhesive film to glass or spray glass with tinting solution to prevent light glare; may install stained glass windows; may assemble and install metal-framed glass enclosures for showers and be designated shower-enclosure installer (construction); and may be designated according to type of glass installed as glazier, structural glass (construction), or plate-glass installer (construction).

11. "Insulation Worker for Mechanical Trades/Asbestos Worker" means one who applies insulating material* to exposed surfaces of structures, such as air ducts, hot and cold pipes, storage tanks, and cold storage rooms; reads blueprints and selects required insulation material (in sheet, tubular, or roll form) such as fiberglass, foam rubber, styrofoam, cork, or urethane, based on material's heat retaining or excluding characteristics; brushes adhesives on or attaches metal adhesive-backed pins to flat surfaces as necessary to facilitate application of insulation material; measures and cuts insulation material to specified size and shape for covering flat or round surfaces, using a tape measure, knife, or scissors; fits, wraps, or attaches required insulation material around or to structure, following blueprint specifications; covers or seals insulation with preformed plastic covers, canvas strips, sealant, or tape to secure insulation to structure, according to type of insulation used and structure covered, using a staple gun, trowel, paintbrush, or caulking gun; removes asbestos**from ceilings, walls, beams, boilers, and other structures, following hazardous waste handling guidelines; positions portable air evacuation and filtration system inside work area; sprays chemical solution over asbestos covered surfaces, using a tank with an attached hose and nozzle, to soften asbestos; cuts and scrapes asbestos from surfaces, using a knife and scraper; shovels asbestos into plastic disposal bags and seals bags, using duct tape; cleans work area of loose asbestos, using a vacuum, broom, and dust pan; places asbestos in disposal bags and seals bags, using duct tape; dismantles scaffolding and temporary walkway, using hand tools, and places plastic sheeting and disposal bags into transport bags; and seals bags, using duct tape, and loads bags into truck. (*Note: Installation of insulation is also found in other classifications relating to other trades. **Note: Whenever asbestos is removed on any State construction project, all contractors and subcontractors must comply with the Tennessee Occupational Safety and Health Regulations in 29 Code of Federal Regulations 1926.1101.)

12. "Ironworker" means one who performs any combination of the following duties to raise, place, and unite girders, columns, and other structural-steel members to form completed structures or structure frameworks, working as a member of a crew; sets up hoisting equipment for raising and placing structural-steel members; fastens steel members to cable of hoist, using a chain, cable, or rope; signals worker operating hoisting equipment

to lift and place steel members; guides steel members using a tab line (rope) or rides on steel members in order to guide them into position; pulls, pushes, or pries steel members into approximate positions while steel members are supported by hoisting device; forces steel members into final positions, using turnbuckles, crowbars, jacks, and hand tools; aligns rivet holes in steel members with corresponding holes in previously placed steel members by driving drift pins or handle of wrench through holes; verifies vertical and horizontal alignment of steel members, using a plumb bob and level; bolts aligned steel members to keep them in position until they can be permanently riveted, bolted, or welded in place; catches hot rivets tossed by rivet heater (heat treating) in bucket and inserts rivets in holes, using tongs; bucks (holds) rivets while pneumatic riveter uses air-hammer to form heads on rivets; cuts and welds steel members to make alterations, using oxyacetylene welding equipment; may specialize in erecting or repairing specific types of structures and be designated bridge-maintenance worker (construction), chimney builder, reinforced concrete (construction), metal building (construction), or structural-steel equipment erector (construction); positions and secures steel bars in concrete forms to reinforce concrete; determines number, sizes, shapes, and locations of reinforcing rods from blueprints, sketches, or oral instructions; selects and places rods in forms, spacing and fastening them together, using wire and pliers; cuts bars to required lengths, using a hacksaw, bar cutters, or acetylene torch; may bend steel rods with hand tools or rod bending machine; may reinforce concrete with wire mesh; may weld reinforcing bars together, using arc-welding equipment; welds deck pans on a bridge, reinforcing supports for the concrete structure; installs wire, cable, steel and other materials used for the purpose of pre-stressing and post-stressing concrete girders, beams, columns, etc.; loads, unloads, hoists, handles, signals, places and erects all pre-stressed and post-stressed pre-cast material including grouting of post tension cables, glass fiber reinforced concrete panels, including the securing by bolting and/or welding and the installation of steeltex and wire mesh of any type when used for reinforced concrete construction; erects, trims, and fits together by means of bolts and clamps, iron grills, grating, and special stairways; erects ornamental enclosures and other ironwork not included in structural ironwork; fastens ironwork to walls of buildings by means of bolts, brackets, and anchors; fastens newel posts, balusters, and other parts of stairways by fastening to supports or embedding them in sockets; and forges, welds, drills, and cuts as needed.

13. "Laborer (Class A)" means one who performs any combination of the following duties on construction projects, usually working in a utility capacity, by transferring from one task to another where demands require a worker with varied experience and ability to work without close supervision. Laborers may not assist mechanics in the performance of mechanics' work using tools peculiar to an established trade. Their work is to be confined to the following tasks and operation of various power tools such as but not limited to: jackhammers, air tampers, vibrators, cat-crawlers, chipping hammers, motorized wheel-barrows, concrete saws, motorized posthole diggers, chain saws, air tools, power-driven tools, and mortar mixers. Laborers may have duties as mason tenders, asphalt rakers, form setters, strippers, and tool-room attendants. Included in this definition is one who performs a variety of tasks involving dextrous use of hands and tools such as demolishing buildings, sawing rough lumber, dismantling forms, removing projections from concrete, and mounting pipe hangers (work that is usually performed with other workers); uses a cutting torch for demolition work on steel or other metal structures; on utility projects, lays tile, concrete, or corrugated metal pipe, receiving pipe lowered from top of trench, inserting spigot end of pipe into bell end of last laid pipe, adjusting pipe to line and grade and sealing joints with cement or other sealing compound; assists in the pouring of concrete by spreading concrete, cleaning and caring of cement mason's tools, mixing mortar used in the patching of concrete, and performing other tasks as may be directed by cement mason or plasterer; mixes mortar for working; sets up scaffolding as directed by foreman; assists brickmasons, stonemasons, and

blockmasons by preparing mortar mix, either by hand or machine, delivering material to masons on scaffolds, and operating small material moving equipment such as power buggies, hoists, mortar mix pumps and other similar equipment; erects and dismantles bricklayer scaffolds according to directions of mason; mixes plaster to be used in a machine designed to apply plaster to surfaces by means of a hose; handles and maintains hose, placing and moving machine; may service and maintain machine, as necessary; and may also be in charge of cleaning and caring for tools and equipment used in the preparation and application of plaster.

14. "Laborer (Class B) Unskilled" means one who may not assist mechanics in the performance of mechanics' work using tools peculiar to an established trade. Their work is to be confined to the following manual tasks: digging and filling holes and trenches; loading, unloading and stockpiling materials; cleaning and sweeping; driving stakes; stripping forms; ripping out material which is to be discarded; ground cleanup of roof removal work; roof removal work for demolitions; clearing and grubbing; flagging; operating chippers and/or stump grinders; cleaning, screening and feeding sand to hopper or pot of sandblasting machines; cleaning and preparing surfaces by the use of sandblasting equipment; assisting in setting up drill, assorting drill steels, and inserting drill steel into drill chuck (as wagon, air track, drill and diamond drillers' tender - outside); lubricating drills; cleaning and washing windows; performing landscaping duties including site development, soil preparation, fertilizing, the building of garden accessories, preparation for the installation of garden sprinkler systems, and operating small walking type farm equipment. Their duties shall not include electrical work, fencing, concrete retaining walls, or other work which is generally performed by skilled craftsmen.

15. "Millwright" means one who installs machinery and equipment according to layout plans, blueprints, and other drawings in an industrial establishment, using hoists, lift trucks, hand tools, and power tools; reads blueprints and schematic drawings to determine work procedures; dismantles machines, using hammers, wrenches, crowbars and other hand tools; moves machinery and equipment, using hoists, dollies, rollers, and trucks; assembles and installs equipment, such as shafting, conveyors, and tram rails, using hand tools and power tools; constructs foundations for machines, using hand tools and building materials, such as wood, cement, and steel; aligns machines and equipment, using hoists, jacks, hand tools, squares, rules, micrometers, and plumb bobs; assembles machines, and bolts, welds, rivets, or otherwise fastens them to foundations or other structures, using hand tools and power tools; may operate engine lathe to grind, file, and turn machine parts to dimensional specifications; may repair and lubricate machines and equipment; may install robot and modify its program, using a teach pendant; and may perform installation and maintenance work as part of team of skilled trades workers.

16. "Painter/Plaster" means one who applies coats of paint, varnish, stain, enamel, or lacquer to decorate and protect interior or exterior surfaces, trimmings, and fixtures of buildings and other structures; reads work orders or receives instructions from supervisor regarding painting; smoothes surfaces, using sandpaper, brushes, or steel wool, and removes old paint from surfaces (to include lead based paint), using paint remover, scraper, wire brush, or blowtorch to prepare surfaces for painting; fills nail holes, cracks, and joints with caulk, putty, plaster, or other filler, using a caulking gun and putty knife; selects premixed paints, or mixes required portions of pigment, oil, and thinning and drying substances to prepare paint that matches specified colors; removes fixtures, such as pictures and electric switchcovers from walls prior to painting, using a screwdriver; spreads dropcloths over floors and room furnishings, and covers surfaces, such as baseboards, door frames, and windows with masking tape and paper to protect surfaces during painting; paints surfaces, using brushes, spray guns, or paint rollers; simulates

wood grain, marble, brick, or tile effects; applies paint with cloth, brush, sponge, or fingers to create special effects; erects scaffolding or sets up ladders to perform tasks above ground level; may be designated according to type of work performed as: painter, interior finish (construction); painter, maintenance (any industry); or according to type of material used as calciminer (construction); or varnisher (construction); may also hang wallpaper and fabrics; may wash surfaces prior to painting with mildew remover, using a brush; may apply drywall finish to work which will include, but not be limited to the preparation or leveling of any surface or substrate which is to receive a coating, finish and/or wall covering for all levels of finishing and/or spackling of all surfaces, including gypsum wallboard taping and finishing, fire taping and all firestopping systems, glaze coatings, skim coating or any other finishing system, spotting of nails, finishing of corner beads/flex beads, patching and sanding that is within the system of preparing surfaces for finishes, and all stucco and dryvit systems; applies coats of plaster to interior walls, ceilings, and partitions of buildings, to produce finished surface, according to blueprints, architect's drawings, or oral instructions, using hand tools and portable power tools; directs workers to mix plaster to desired consistency and to erect scaffolds; spreads plaster over lath or masonry base, using a trowel, and smoothes plaster with a darby and float to attain uniform thickness; sprays fireproof insulation onto steel beams; applies scratch, brown, or finish coats of plaster to wood, metal, or board lath successively; roughens undercoat with scratcher (wire or metal scraper) to provide bond for succeeding coats of plaster; creates decorative textures in finish coat by marking surface of coat with a brush and trowel or by spattering surface with pebbles; may install lathing; may mix mortar; may install guide wires on exterior surface of buildings to indicate thickness of plaster to be applied; may install precast ornamental plaster pieces by applying mortar to back of pieces and pressing pieces into place on wall or ceiling; molds and installs ornamental plaster panels and trim, and runs (casts) ornamental plaster cornices and moldings by either of the following methods: spreads freshly mixed plaster on table or in forms with a trowel when molding and installing ornamental trim; shapes plaster by hand, using a template and cuts trim to size after plaster has hardened; applies coat of plaster to wall and presses trim into position; nails wooden strips to wall and ceiling to serve as guide for template when casting (running) cornices or moldings; applies plaster to wall or ceiling, using a trowel, or pushes template over plaster striking off excess plaster until desired shape and smoothness of molding is obtained; applies weatherproof, decorative covering of portland cement or gypsum plaster to outside building surfaces, using hand tools; decorates final or finish coat by marking coat with sand, or with a brush or trowel, or by spattering with small stones; may nail wire mesh, lath, or similar material to outside surfaces to serve as binding device to hold stucco in place; may apply stucco, using a spray gun; and may install guide wires on surface of buildings to indicate thickness of stucco to be applied.

17. "Plumber/Pipe Fitter/Steam Fitter/Sprinkler Fitter" means one who lays out, assembles, installs, and maintains pipe systems, pipe supports, and related hydraulic and pneumatic equipment for steam, hot water, heating, cooling, lubricating, sprinkling, and industrial production and processing systems, applying knowledge of system operation, and following blueprints; selects type and size of pipe, and related materials and equipment, such as supports, hangers, and hydraulic cylinders, according to specifications; inspects work site to determine presence of obstructions and to ascertain that holes cut for pipe will not cause structural weakness; plans installation or repair to avoid obstruction and to avoid interfering with activities of other workers; cuts pipe, using saws, pipe cutter, hammer and chisel, cutting torch and pipe cutting machine; threads pipe, using a pipe threading machine; bends pipe, using pipe bending tools and pipe bending machine; assembles and installs a variety of metal and nonmetal pipes, tubes, and fittings, including iron, steel, copper, and plastic; connects pipes, using threaded, caulked, soldered, brazed, fused, or cemented joints and hand tools; secures pipes to structure

with brackets, clamps, and hangers, using hand tools and power tools; installs and maintains hydraulic and pneumatic components of machines and equipment, such as pumps and cylinders, using hand tools; installs and maintains refrigeration and air-conditioning systems, including compressors, pumps, meters, pneumatic and hydraulic controls, and piping, using hand tools and power tools, and following specifications and blueprints; increases pressure in pipe system and observes connected pressure gauge to test system for leaks; may weld pipe supports to structural-steel members; may operate machinery to verify repair; may modify programs of automated machinery, such as robots and conveyors, to change motion and speed of machine, using a teach pendant, control panel, or keyboard and display screen of robot controller and programmable controller; may be designated steam fitter when installing piping systems that must withstand high pressure; assembles, installs, and repairs pipes, fittings, and fixtures of heating, water, and drainage systems, according to specifications and plumbing codes; studies building plans and working drawings to determine work aids required and sequence of installations; inspects structure to ascertain obstructions to be avoided to prevent weakening of structure resulting from installation of pipe; locates and marks position of pipes and pipe connections and passage holes for pipes in walls and floors, using a ruler, spirit level, and plumb bob; cuts openings in walls and floors to accommodate pipe and pipe fittings, using hand tools and power tools; cuts and threads pipe, using pipe cutters, cutting torch, and pipe-threading machine; bends pipe to required angle by use of pipe-bending machine or by placing pipe over block and bending it by hand; assembles and installs valves, pipe fittings, and pipes composed of metals, such as iron, steel, brass, lead, and nonmetals, such as glass, vitrified clay, and plastic, using hand tools and power tools; joins pipes by use of screws, bolts, fittings, solder, plastic solvent, and caulks joints; fills pipe system with water or air and reads pressure gauges to determine whether system is leaking; installs and repairs plumbing fixtures, such as sinks, commodes, bathtubs, water heaters, hot water tanks, garbage disposal units, dishwashers, and water softeners; repairs and maintains plumbing by replacing washers in leaky faucets, mending burst pipes, and opening clogged drains; may weld holding fixtures to structural-steel members; tests, adjusts and balances heating and cooling pipe systems in commercial and industrial buildings, using specialized tools and equipment to attain performance standards specified in system design; adjusts flow control valves in piping to balance system, using hand tools such as pliers, screwdrivers, and wrenches; works with balancing personnel to perform tests to see if the heating and cooling systems are operating to specifications and to detect malfunctions in piping system component parts; as a sprinkler fitter, installs and maintains all fire protection and fire control systems including the unloading, handling by hand power equipment and installation of all piping or tubing, appurtenances and equipment pertaining thereto, including both overhead and underground water mains, fire hydrants and hydrant mains, standpipes and hose connections to sprinkler systems, sprinkler tank heaters, air lines and thermal systems used in connection with sprinkler and alarm systems, also all tanks and pumps connected thereto, also included shall be carbon dioxide (CO2) and cardox systems, dry chemical systems, foam systems, halon and all other fire protection systems, the locating of and cutting or coring of all holes for piping and the setting of all sleeves and inserts required for the installation of the work.

18. "Roofer" means one who covers roofs with roofing materials other than sheet metal, such as composition shingles or sheets, wood shingles, or asphalt and gravel, to waterproof roofs; cuts roofing paper to size, using a knife, and nails or staples it to roof in overlapping strips to form base for roofing materials; aligns roofing material with edge of roof, and overlaps successive layers, gauging distance of overlap with chalkline, gauge on shingling hatchet, or by lines on shingles; fastens composition shingles or sheets to roof with asphalt, cement, or nails; punches holes in slate, tile, terra cotta, or wooden shingles, using a punch and hammer; cuts strips of flashing and fits them into

angles formed by walls, vents, and intersecting roof surfaces; when applying asphalt or tar and gravel to roof, mops or pours hot asphalt or tar onto roof base; applies alternate layers of hot asphalt or tar and roofing paper until roof covering is as specified; applies gravel or pebbles over top layer, using a rake or stiff-bristled broom; may construct and attach prefabricated roof sections to rafters; may attach shingles to exterior walls and apply roofing paper and tar to shower pans, decks, and promenades to waterproof surfaces; installs insulation in connection with roofer's work; sprays roofs, sidings, and walls with urethane or polyurethane foam to bind, seal, insulate, or soundproof sections of structures; flips switches to start generator, air compressor, and heaters; turns nozzle on spray gun to obtain specified consistency of mixture; directs foam onto surfaces, and determines thickness of foam, using a probe; and connects hose of nitrogen tank to spray compound supply tank when spraying is completed, and turns valves to inject nitrogen into supply tank to prevent crystallization of compounds in tank.

19. "Sheet Metal Worker" means one who plans, lays out, fabricates, assembles, installs, and repairs sheet metal parts, equipment, and products, utilizing knowledge of working characteristics of metallic and nonmetallic materials, machining, and layout techniques using hand tools, power tools, machines, and equipment; reads and interprets blueprints, sketches, or product specifications to determine sequence and methods of fabricating, assembling, and installing sheet metal products; selects gauge and type of sheet metal, such as galvanized iron, copper, steel, aluminum, or nonmetallic materials such as plastics or fiberglass, according to product specifications; lays out and marks dimensions and reference lines on material, using scribers, dividers, squares, and rulers, applying knowledge of shop mathematics and layout techniques to develop and trace patterns of products or parts or using templates; sets up and operates fabricating machines, such as shears, brakes, presses, forming rolls, and routers, to cut, bend, block and form, or straighten materials; shapes metal material over anvil, block, or other form, using hand tools; trims, files, grinds, deburrs, buffs, and smoothes surfaces, using hand tools and portable power tools; welds, solders, bolts, rivets, screws, clips, caulks, or bonds component parts to assemble products, using hand tools, power tools, and equipment; installs assemblies in supportive framework according to blueprints, using hand tools, power tools, and lifting and handling devices; inspects assemblies and installation for conformance to specifications, using measuring instruments, such as calipers, scales, dial indicators, gauges, and micrometers; repairs and maintains sheet metal products; may operate computer-aided-drafting (CAD) equipment to develop scale drawings of product or system; may operate laser-beam cutter or plasma arc cutter to cut patterns from sheet metal; installs sheet metal duct work to facilitate the movement of air; and frequently specializes in such areas as ventilation and air-conditioning, restaurant equipment, and architectural sheet metal work.

20. "Truck Driver (3 or More Axles)" means one who operates trucks with 3 or more axles, dump trucks over 6 yards, dumpsters, semi-trailers, tandems escort and pilot vehicles, flat body material trucks, form trucks, greasers and steamers, rubber tired towing and pushing vehicles, A-grames, agitators or mixers, asphalt distributors, low-boys, batch trucks, euclid type or similar off-highway equipment, off-highway tandem back-dumps, specialized earth moving equipment, twin engine equipment, double-hitched equipment, and equipment similar to above.

21. "Truck Driver (2 Axles, Over 1 Ton)" means one who operates trucks with 2 axles over 1 ton, and 5 yard dump trucks.

22. "Truck Driver (2 Axles, 1 Ton and Less)" means one who operates small trucks such as panel trucks and pickups.

(Rule 0800-3-2-.02, continued)

(b) The Commission hereby issues the following classifications of crafts of workers and helpers to be used for workers employed by highway contractors and subcontractors.

1. "Bricklayer" means one who lays out work from plans; sets up templates and guide lines; lays bricks, concrete blocks, tiles or other materials in the construction of manholes, catch basins, drop inlets, sidewalks, retaining walls, and other incidental structures; and may perform other related duties.

2. "Carpenter" means one who lays out work from plans or sketches; builds wooden structures, such as concrete forms, falsework, pouring chutes, scaffolds, etc.; builds in place to line and grade, or prefabricates in units to be erected later; builds forms for bridges, drainage structures, walls, etc.; and may perform other related duties.

3. "Class A Operator" means one who operates a backhoe/hydraulic excavator (¾ yard and over), crane, end loader (3 yards and over), motor patrol (rough), tractor (crawler/ utility), scraper, shovel, or trenching machine; and is further defined as follows:

(i) "Backhoe Operator" means one who operates boom-type equipment to hoist and move materials, raise and lower heavy weights, and perform other related operations; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The equipment is used for such work as excavations and may be used for other miscellaneous tasks for which crane or stick-type equipment is required.)

(ii) "Crane Operator" means one who operates boom-type equipment to hoist and move materials, raise and lower heavy weights and perform other related operations; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The equipment is used for such work as pouring concrete and setting steel. This work is subjected to strict inspection and must conform closely to specifications. The equipment may also be used for other miscellaneous tasks for which crane or stick-type equipment is required which may include hoist operations and pile driving operations.)

(iii) "End Loader Operator" means one who operates a rubber tired or crawler-type tractor with an attached bucket on the front end; moves levers to raise and lower to dump contents of bucket; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The machine is used to load materials from stockpiles, excavations, charging batch plants, and loading trucks.)

(iv) "Motor Crane Driver" means one who drives a heavy or medium-duty gasoline or diesel truck upon which is mounted a crane for picking up various objects; positions and levels truck at object to be lifted, fastens cables, operates levers or controls in lifting of objects in accordance with signals from designated worker on ground; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(v) "Motor Patrol Operator (Finish)" means one who rides in a control cab of a motor grader to move levers and hand-wheels to guide the machine and to regulate the scraper blade; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The blade is mounted on a carrying and turning circle at the front of the machine. The equipment is used to level dirt to a fine grade and to lay asphalt and flexible

base materials. This work is subjected to strict inspection and must conform closely to specifications.)

4. "Class B Operator" means one who operates a backhoe/hydraulic excavator (less than ¾ yard), bulldozer or push dozer, end loader (less than 3 yards), motor patrol (rough), tractor (crawler/utility), scraper, shovel, or trenching machine; and is further defined as follows:

   (i) "Bulldozer or Push Dozer Operator" means one who operates a large tractor with a concave steel blade or push block mounted in front of the chassis; regulates heights of blades or push blocks from the ground; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The equipment is used to level, distribute and push earth. The work is subjected to strict inspection and must conform closely to specifications. The equipment may also be used as a pusher to load earth-carrying equipment. At times a ripper attachment is used for ripping the earth prior to loading the scraper.)

   (ii) "Motor Patrol Operator (Rough)" means one who rides in a control cab of a motor grader to move levers and hand-wheels to guide the machine and to regulate the scraper blade; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The blade is mounted on a carrying and turning circle at the front of the machine. The equipment is used to level dirt to a rough grade and to lay asphalt and flexible base materials.)

   (iii) "Scraper Operator" means one who operates a self-propelled rubber tired or tractor drawn unit known as a scraper, pan, etc. to excavate, transport, and deposit materials moved in normal grading operations; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

   (iv) "Shovel Operator (Dragline)" means one who operates boom-type equipment to hoist and move materials, raise and lower heavy weights, and perform other related operations; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The equipment is used for such work in excavations to load haulage equipment with material. Equipment may be used for other miscellaneous tasks for which crane or stick-type equipment is required. It may include hoist operations and pile driving operations.)

   (v) "Tractor Operator (Crawler or Utility)" means one who operates a gasoline or diesel powered crawler tread or rubber tired tractor to haul heavier implements such as large root plows, heavy sheepfoot rollers, large pneumatic rollers, water tanks, trailers, etc. used in heavy ground clearing operations; uses miscellaneous attachments such as a post-hole digger; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

   (vi) "Trenching Machine Operator" means one who moves levers to operate a power-driven machine that digs trenches for sewers, water, drainage, oil, or gas pipelines; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The trenching machine is mounted on crawler treads or rubber tires with the digging equipment usually

(Rule 0800-3-2-.02, continued)

consisting of an endless chain or wheel of edged buckets that excavate and deposit the material on a conveyor belt that in turn discharges the material at the side of the trench.)

5. "Class C Operator" means one who operates an asphalt paver, concrete finishing machine, concrete paver, scale, spreader (self-propelled), concrete grinder, asphalt milling machine, or boring machine (horizontal); and is further defined as follows:

   (i) "Asphalt Milling Machine Operator" means one who uses a specialized machine to mill asphalt for use in resurfacing highways, etc.; and may perform other related duties.

   (ii) "Asphalt Paver Machine Operator" means one who manipulates hand or foot levers to control movements of a paving machine that spreads and levels asphalted concrete on the sub-grade of a highway; turns hand-wheels to raise or lower screeds, and regulates width of screeds; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

   (iii) "Concrete Finishing Machine Operator" means one who operates a self-propelled machine which travels on concrete paving forms; levels fresh concrete to an approximate grade and contour by pushing and pulling two (2) screeds over the surface; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

   (iv) "Concrete Grinder Operator" means one who uses a self-propelled machine to grind out concrete surfaces; and may perform other related duties.

   (v) "Concrete Paver Operator" means one who operates a paving machine that travels on forms or in slipform operation; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

   (vi) "Scale Operator" means one who weighs materials in trucks prior to deliveries; records net and gross weights, truck numbers, and kinds of materials; may weigh empty trucks on the truck scale in order to compute net weights; may issue weight tickets on certain types of scale equipment since the job is clerical in nature; and may perform other related duties.

   (vii) "Spreader Operator (Self-Propelled)" means one who drives a self-propelled vehicle, consisting primarily of a hopper mounted on pneumatic-tired wheels, used to spread crushed aggregate on bituminous roadway material; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

6. "Class D Operator" means one who operates a bobcat, central mixing plant, concrete pump, concrete saw, curb machine (automatic or manual), dozer or loader (stockpile), drill (piling), mulcher or seeder, rock drill (truck mounted), roller (asphalt), roller (compaction self-propelled), soil stabilization machine, tractor (boom and hoist), bituminous distributor machine, pump, track drill, or striping machine; and is further defined as follows:

(Rule 0800-3-2-.02, continued)

(i) "Bituminous Distributor Machine Operator" means one who operates a machine that spreads and levels hot-mix bituminous paving material on the sub-grade of highways and streets; and may perform other related duties.

(ii) "Bobcat Operator" means one who uses small tractor-type equipment for excavations, backfill trenching or smoothing with a blade-lift, scoop or bucket; and may perform other related duties.

(iii) "Boring Machine Operator (Horizontal)" means one who sets up and operates a drilling mechanism that drills holes horizontally; levels a machine by placing timbers under wheels or tracks; inserts and fastens drill steel in chuck; adjusts angles of drill towers and bolts into position; controls drilling and speed of drill by moving levels; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(iv) "Central Mix Plant Operator (Asphalt or Concrete)" means one who operates a stationary or portable batching plant in mixing concrete materials or asphaltic materials and aggregates to produce asphaltic or concrete paving materials; adjusts controls for required mixture of the materials; operates controls that admit materials separately from storage hoppers or mixing bins; observes indicators that show when proper amounts of materials have been made; discharges materials from bins into trucks or other carriers or mixers; and may perform other related duties.

(v) "Concrete Saw Operator" means one who operates a water-cooled power saw with either a diamond or an abrasive blade to saw expansion and contraction joints in concrete paving or asphaltic pavements; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(vi) "Curb Machine Operator (Automatic)" means one who operates a self-propelled machine which finishes fresh concrete to a contour by pushing and pulling two (2) screeds over the surface; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(vii) "Curb Machine Operator (Manual)" means one who operates a manual curb machine which by auger action forces compacted fresh concrete or asphalt through a tube to form an extruded curb along a contour to a grade; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(viii) "Distributor Operator (Bituminous)" means one who drives a truck equipped with a tank and controls for regulating distribution of bituminous materials for highway surfacing; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(ix) "Ditch Paver Machine Operator" means one who operates a self-propelled machine in pouring concrete ditch paving; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(x) "Dozer or Loader (Stock Pile Only)" means one who operates a rubber tired or crawler-type tractor with an attached bucket on the front end; moves levers to raise and lower to dump contents of bucket; may oil, grease or otherwise service

and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The machine is used to load materials from stockpiles, charging batch plants, and loading trucks.)

(xi) "Drill Operator (Piling)" means one who sets up and operates a drill mechanism for driving piling; levels and positions drill; adjusts angle of drill; controls drilling and speed of drill by moving controls; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(xii) "Mulcher or Seeder Operator" means one who operates a mulching machine for the placement of mulched materials; operates a gun for distribution; feeds machine as required; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(xiii) "Pile Driver Operator" means one who operates a machine either crane or skid mounted with leads and hammer or jets for driving piling; assists other workers in setting up pile drive leads; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(xiv) "Pump Operator" means one who operates a concrete, fuel, or other fluid pump; sets up pump and lays pipes or flexible lines; operates power unit of pump; takes pipelines apart to clean and store; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(xv) "Roller Operator (Asphalt)" means one who operates a self-propelled machine with either two or three steel flat wheels, which is used to compact plant mix asphalt pavement; rides on the platform of a machine and moves levers, pedals, or throttles to control and guide the machine; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(xvi) "Roller Operator (Other than Asphalt)" means one who operates a crawler tread tractor to pull a grid, sheepfoot, or extra-heavy pneumatic roller, which is used to compact earth fills, flexible bases, etc.; operates a tractor by manipulating the throttle, levers, and pedals and steers tractor by working levers or pedals that individually control both crawler treads; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(xvii) "Soil Stabilization Machine Operator" means one who operates a self-propelled rubber tired or crawler-type equipment to mix and spread road materials for soil stabilization with cement, asphalt, lime, fly ash, etc.; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(xviii) "Striping Machine Operator" means one who rides the back of a paint truck and uses a specialized machine on pavement to apply paint or thermo plastic; aligns lower carriages as necessary; and may perform other related duties.

(xix) "Track Drill Operator" means one who operates a drilling machine, such as a wagon drill, air trac, well driller, etc. for the purpose of drilling rock, shale, or

other materials; starts, stops and services portable air compressors; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

(xx) "Tractor Operator (Boom and Hoist)" means one who operates a rubber tired or crawler-type tractor with an attached boom and hoist; moves levers to raise and lower materials and miscellaneous items in trenches and excavations; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

7. "Concrete Finisher" means one who finishes wet surfaces to grade with hand tools, floats, trowels, screeds, templates and straight edges on all types of concrete work requiring a fine finish; and may perform other related duties.

8. "Drill Operator (Caisson)" means one who sets up and operates a drill mechanism for caissons; levels and positions drill; adjusts angle of drill; controls drilling and speed of drill by moving controls; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

9. "Electrician" means one who plans and executes the layout of electrical conduits; installs wiring systems, switch-panels, and buss bars; works on overhead distribution systems and underground distribution systems; and may perform other related duties.

10. "Farm Tractor Operator (Power Broom)" means one who operates a small gasoline or diesel powered four-wheel, rubber tired tractor of the farm type; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The tractor is used to pull pneumatic rollers and is operated by steering with the wheel and brake clutch.)

11. "Ironworker - Reinforcing" means one who performs layout work of rods within area to be paved; fastens rods in place with wire or fasteners and bends or adjusts as required; selects and places steel bars or spirals in concrete forms to reinforce concrete; may cut rods with hack-saw or oxyacetylene torch; may bend rods, using a rod-bending machine; may prefabricate reinforcement assembly for placement complete in forms; and may perform other related ironwork duties.

12. "Ironworker - Structural" means one who works as a member of a group that raises and places fabricated structural-steel members, such as girders, plates, and columns to unite them permanently to form a completed structural-steel framework; heats rivets, signals erection cranes, splices cables, and rigs equipment which may include dismantling and erecting large units of equipment; may spin suspension bridge cables; and may perform other related ironwork duties.

13. "Mechanic - Class I (Heavy Duty)" means one who assembles, sets up, adjusts, maintains and repairs all types of construction equipment, such as internal combustion engines, air compressors, pumps, concrete mixers, heavy earth moving equipment, rock crushers, and paving equipment; may perform the duties of a welder in repair of equipment; and may perform other related duties.

14. "Mechanic - Class II (Light Duty)" means one who assembles, sets up, adjusts, maintains and repairs all types of construction equipment, such as internal combustion engines, air compressors, pumps, concrete mixers, heavy earth moving equipment, rock crushers, and paving equipment; may perform the duties of a welder in repair of equipment; and may

perform other related duties and periodically needs and receives assistance from a mechanic - class I.

15. "Painter or Sandblaster" means one who sandblasts surfaces of structures, stone, etc. by currents of air or steam carrying sand at a high velocity in painting preparation; paints sign posts, signs, bridges and structures, etc. with either a brush, roller or spray; and may perform other related duties.

16. "Powder Person (Blaster)" means one who supervises and assists in locating, loading, and firing blast holes for breaking up hard materials; enlarges bottom of drilled holes by discharging small quantities of explosives; inserts detonator in a charge of explosive, attaching a fuse or electrical wires, the stick and detonator forming a primer, the discharge of which effects the discharge of the remainder of the explosive; charges hole by placing explosive, including stick that contains detonator, in hole and tamping lightly with a pole; depresses handle of blasting machine or lights fuse to fire explosive; may use prima-cord or delay caps; and may perform other related duties.

17. "Skilled Laborer" means one who is an air tool operator, asphalt raker, chain saw operator, concrete mixer operator (less than 1 yard), concrete rubber, edger, fence erector, form setter (steel road), guard rail erector, mechanics helper (tire changer or oiler), mortar mixer, nozzleman or gun operator (gunite), pipelayer, sign erector, or survey helper/rodman; and is further defined as follows:

    (i) "Air Tool Operator" means one who is a semi-skilled laborer who uses a tool driven by compressed air to perform such work as breaking old pavement, loosening or digging hard earth, trimming bottoms and sides of trenches, breaking large rocks, chipping concrete, trimming or cutting stone or compaction of earthen backfill; and may perform other related semi-skilled duties.

    (ii) "Asphalt Raker" means one who distributes asphalted road-building materials evenly over a road surface by raking and brushing material to correct thickness; directs asphalt shovelers when to add or take away material to fill low spots or to reduce high spots; and may perform other related duties.

    (iii) "Chain Saw Operator" means one who operates a chain saw with employer fuel or current for power; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

    (iv) "Concrete Mixer Operator (Less Than 1 Yard)" means one who operates a small portable concrete mixing machine to mix sand, gravel, cement and water to make concrete; starts power units and does loading of materials; controls mixing by levers to discharge concrete from drums; rises drums with water to remove adhering concrete; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The small machines are sometimes charged by operators shoveling in the proportions of materials directly into the mixing drums, and some others have a skip into which materials are shoveled or dumped before being hoisted into the mixing drums.)

    (v) "Concrete Rubber" means one who uses tools on exposed surfaces of concrete masonry after the forms have been removed to patch holes with fresh concrete; rubs surfaces with abrasive stone to remove rough spots; and may perform other related duties.

(Rule 0800-3-2-.02, continued)

(vi) "Fence Erector" means one who digs holes for posts, drives posts, attaches fences, and pours incidental concrete; and may perform other related duties.

(vii) "Form Setter (Steel Road)" means one who fits together, aligns and grades metal road forms for holding concrete in place on road and street surfaces; dismantles, moves and cleans forms after concrete hardens; and may perform other related semi-skilled duties.

(viii) "Guard Rail Erector" means one who digs holes for posts, drives posts, attaches guard rails, pours incidental concrete, and paints guard rails; and may perform other related duties.

(ix) "Nozzleman or Gunman (Gunite)" means one who handles the equipment and directs the placing of concrete or mortar that is moved by pneumatic equipment such as gunite; may fine-grade and place wire mesh at times; and may perform other related semi-skilled duties.

(x) "Pipelayer" means one who lays, connects, inspects and tests water lines, force mains, gas lines, sanitary or storm sewers and drains, underground telephone and electric ducts or other utilities manufactured from clay, concrete, steel, plastic, cast iron pipe, or other similar materials; may smooth bottom of trench to proper elevation by scooping with a shovel; receives pipe lowered from top of trench; inserts spigot end of pipe into bell end of last laid pipe; adjusts pipe to line and grade; caulks and seals joint with cement or other sealing compound; may connect threaded or flanged joint pipe; may assemble and place corrugated metal or plastic pipe; and may perform other related duties.

(xi) "Sign Erector" means one who reads plans; makes layouts for erection of signs; cuts, ties, and sets reinforcing steel; sets forms for concrete; pours concrete; sets anchor bolts; erects wood or metal structures; places clamps, brackets, or other required hardware on structures; and may perform other related duties.

(xii) "Welder's Helper (Any Class to Which the Work Is Incidental)" means one who is a learner or worker semi-skilled in welding who assists the welder in electric arc and acetylene welding; assists in oxyacetylene cutting and layout; and may perform other related duties.

18. "Survey Instrument Operator" means one who obtains data pertaining to angles, elevations, points, and contours used for construction, mapmaking, mining, or other purposes, using an alidade, level, and transurveying instruments; compiles notes, sketches, and records of data obtained and work performed; directs work of subordinate members of survey team; and performs other duties relating to surveying work as directed by chief of party.

19. "Sweeping Machine (Vacuum) Operator" means one who drives a sweeping machine that cleans streets of trash and other accumulations; fills water tank of machine from hydrant; drives sweeper along street near curbs; moves controls to activate rotary brushes and water spray so that machine automatically picks up dust and trash from paved streets and deposits it in a dirt trap at the rear of the machine; and pulls lever to dump refuse in piles at curbs for removal.

20. "Truck Driver (2 Axles)" means one who drives a multi-rear axle truck for transporting construction materials; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties. (Note: The

truck may have various kinds of bends attached, such as a dump, flat bed, water tank, etc. The truck may be a water wagon, service truck, hoist truck, etc.)

21. "Truck Driver (3 or 4 Axles)" means one who may pull a semi-trailer or trailer to transport construction equipment and materials.

22. "Truck Driver (5 or More Axles/Heavy Duty Off-the-Road)" means one who operates heavy duty off-road or rock moving equipment, such as, but not limited to a Koehring dumpster, Euclid either back or bottom dump, International Payhauler, etc.; may oil, grease or otherwise service and make necessary adjustments to equipment as needed; and may perform other related duties.

23. "Unskilled Laborer" means one who works in construction covering many unskilled occupations; works with all crews doing everything from pick and shovel work to cleaning up lumber, and hammering, shoveling and placing concrete; applies coats of oil to inside face of forms; strips forms; works on rock crushers to feed traps; opens cement sacks to batch plant; lowers pipes into ditches for pipelayers; works with dirt crew to move construction layout stakes; serves as dump man; spreads hot asphaltic material over roadbeds with shovel; operates hand concrete buggy or wheelbarrow; helps painter to prepare surfaces for painting and cleans paint equipment; carries rods to forms or attaches them to cable of hoisting machines; and may perform other related duties; and is further defined as follows:

    (i) "Mortar Mixer (Hand)" means one who mixes proportions of material in skip; may do or oversee loading of materials in skip by shoveling; and may perform other related duties.

    (ii) "Survey Helper/Rodman" means one who performs any of the following duties to assist in surveying land: holds level or stadia rod at designated points to assist in determining elevations and laying out stakes for mapmaking, construction, mining, land, and other surveys; calls out reading or writes station number and reading in notebook; marks points of measurement with elevation, station number, or other identifying mark; measures distance between survey points, using a steel or cloth tape or surveyor's chain; marks measuring points with keel (marking crayon), paint sticks, scratches, tacks, or stakes; places stakes at designated points and drives them into the ground at specified elevations, using a hammer or hatchet; and cuts and clears brush and trees from the line of survey, using a brush hook, knife, ax, or other cutting tools.

24. "Worksite Traffic Coordinator" means one who supervises and coordinates activities of workers engaged in installing and repairing traffic signals, and erecting signs or devices, such as traffic islands and barriers; and may perform other related duties.

Authority: *T.C.A. §§12-4-405(3)(A), 12-4-405(3)(B), 12-4-411, and 12-4-415.* ***Administrative History:*** *Original Rule filed June 14, 1976; effective July 14, 1976. Repeal and new rule filed March 12, 1987; effective April 26, 1987. Repeal and new rule filed June 30, 2006; effective September 13, 2006.*

0800-3-2-.03 EFFECTIVE DATES.

Pursuant to the Prevailing Wage Act of 1975 this Commission shall determine and establish the prevailing wage rate biennially for covered workers of building contractors and annually for covered workers of highway contractors on state construction projects. The highway wage rate promulgated by the Commission will be effective from January 1 to December 31 of each year. The building wage rate promulgated by the Commission will be effective from the first day of January after the building rate is set and will remain in effect for two (2) years ending on

(Rule 0800-3-2-.03, continued)

December 31 of the second year. No contract shall be let by any state agency or by any municipality, county, or other political subdivision for a state construction project not in compliance with the prevailing wage rates as established by this Commission.

Authority: *T.C.A. §§12-4-406, 12-4-405(4), 12-4-408.* ***Administrative History:*** *Original Rule filed June 14, 1976; effective July 14, 1976. Repeal and new rule filed March 12, 1987; effective April 26, 1987.*

0800-3-2-.04 CONSTRUCTION WAGES.

The bid specifications issued by the contracting agency for a state construction project shall include the prevailing wage rates that are in effect on the date the bid is advertised. The same rates that are contained in the bid specifications shall be made a part of the contract awarded pursuant to the bid.

Authority: *T.C.A. §§12-4-407, 12-4-408, 12-4-415.* ***Administrative History:*** *Original Rule filed June 14, 1976; effective July 14, 1976. Repeal and new rule filed March 12, 1987; effective April 26, 1987.*

0800-3-2-.05 REGULATIONS FOR CONTRACTORS AND CONTRACTS.

(1) All State construction project contracts between the contracting state agency and the building or highway contractors or subcontractors shall include the following:

(a) All contractors and subcontractors shall:

1. Classify all covered workers in conformity with the schedule of classifications issued by the Commission in accordance with Rule 0800-3-2-.02.

2. Post the prevailing wage rates at the site of construction in a prominent place and make these rates available to all covered workers employed on the project at all reasonable times.

3. Pay overtime compensation as required by any applicable federal or state laws, rules, or regulations or as may be required by the contract with the state agency.

4. Make only those deductions from wages authorized by law.

5. Submit weekly a copy of all payrolls to the contracting state agency. The contractor or subcontractor shall certify that the payrolls are correct and complete, and that the wage rates paid to covered workers during the reporting period equal or exceed those determined by the Commission, and that the classifications set forth for each covered worker conform with the work s/he performs. The contracting state agency shall promptly submit the contractor's or subcontractor's weekly payroll statements to the Commission. The contractor or subcontractor shall make its employment records available for inspection by representatives of the contracting state agency, the Commission, and the Tennessee Department of Labor and Workforce Development, and will permit such representative to visit construction projects at all reasonable times.

6. Incorporate into each awarded contract a bonding provision in accordance with T.C.A. §12-4-409.

7. Pay the rate of wages established by the Commission on all classifications of work that may be used by the contractor or subcontractor in carrying out the contractual agreement between the contractor or subcontractor and the contracting state agency.

(Rule 0800-3-2-.05, continued)

8. The Commission or any employee of any contractor or subcontractor whose wages are determined pursuant to the Act may maintain an action against any contractor or subcontractor for the breach of any condition of any performance bond given under the provisions of the Act, and, in case of breach of any provision of such bond, the particular state agency which awarded the contract may advertise the work and relet the contract in the same manner as the original letting.

Authority: *T.C.A. §§12-4-403, 12-4-405(1)(B), 12-4-405(4), 12-4-408, 12-4-409, 12-4-410, 12-4-411, 12-4-412, 12-4-413, and 12-4-415.* ***Administrative History:*** *Original Rule certified filed June 10, 1974. Repeal and new rule filed March 12, 1987; effective April 26, 1987. Repeal and new rule filed June 30, 2006; effective September 13, 2006.*

0800-3-2-.06 REGULATIONS FOR STATE AGENCIES.

State agencies entering into contracts governed by T.C.A. §12-4-401 et seq., shall submit the names of the project, address of the project site, and name and address of the successful bidder to the Commission within ten (10) working days of execution of the contract.

Authority: *T.C.A §§12-4-408, 12-4-413.* ***Administrative History:*** *Original Rule certified filed June 10, 1974. Repeal and new rule filed March 12, 1987; effective April 26, 1987.*

0800-3-2-.07 REGULATIONS FOR COMMISSION.

The Commission shall:

(1) Check the weekly payrolls submitted by contractors and subcontractors together with conditions at the job site in order to determine that workers have been properly classified in accordance with the work performed by them.

(2) Ascertain whether the wage rate schedule has been posted at the site in a prominent place.

(3) Make inquiry of a number of workers sufficient to indicate whether full wages earned have been paid.

(4) Examine the weekly payrolls submitted by contractors and subcontractors in order to determine whether hourly rates equal to or exceeding those determined by the Commission have been paid for the classifications of covered workers being employed.

Authority: *T.C.A. §§12-4-408, 12-4-410, 12-4-411, 12-4-412, 12-4-413, 12-4-414, and 12-4-415.* ***Administrative History:*** *Original Rule certified filed June 10, 1974. Repeal and new rule filed March 12, 1987; effective April 26, 1987.*

0800-3-2-.08 PREVAILING WAGE SURVEY.

(1) Subcontractors who elect to respond to the Prevailing Wage Survey shall submit the data required in T.C.A. §12-4-405 on the portion of any construction projects on which they worked. No other contractor may submit data on behalf of a subcontractor.

(2) The term "immediately preceding calendar quarter" referred to in T.C.A. §12-4-405(1)(A) and (B) means the months of July, August, and September.

(3) Contractors, who pursuant to T.C.A. §12-4-405 furnish payroll data to the Commission for its prevailing wage determination, shall provide straight time hourly wage rates. Fringe benefits or overtime rates shall not be included in the hourly rates submitted.

(Rule 0800-3-2-.08, continued)

(4) In each prevailing wage determination, the Commission shall have the authority to designate the classifications of crafts of workers subject to the Prevailing Wage Act. The Commission is not restricted to the use of the classifications enumerated in T.C.A. §12-4-405, and it may from time-to-time combine or group classifications, add new classifications, and delete classifications.

(5) If the Commission rejects payroll documentation submitted by a contractor pursuant to the survey conducted under T.C.A. §12-4-405, the Commission shall notify the affected contractor or his representative, as soon as possible, of the reasons for not considering the documentation in the Commission's prevailing wage rate determination. The affected contractor or his representative shall be advised of the right to appear and testify at the public hearing relative to the prevailing wage determination. Incomplete surveys received by the Commission may be completed by the contractor or subcontractor providing the information within a reasonable time after submission, but in no case later than the date of the public hearing setting the rates.

(6) Contractors who furnish payroll documentation to the Commission in response to the prevailing wage survey shall provide such data to the Commission by October 31 of the survey year. Documentation which is sent by mail must be postmarked no later than October 31 and must be received by the Commission by the 3rd state business day following October 31.

(7) In any classification of a craft of workers listed on the prevailing wage survey form where four (4) or fewer separate survey responses are received, these responses may be excluded from establishing the rates. Where the data is excluded, the Commission may continue the rate in existence at the time of the survey or adjust it pursuant to T.C.A. §12-4-405(4).

Authority: *T.C.A. §§12-4-405, 12-4-406.* ***Administrative History:*** *Original rule certified filed June 10, 1974. Repeal and new rule filed March 12, 1987; effective April 26, 1987.*

0800-3-2-.09 REPEALED.

Authority: *T.C.A. Title 12, chapter 4.* ***Administrative History:*** *Original rule certified filed June 10, 1974. Amendment filed March 12, 1987; effective April 26, 1987.*

0800-3-2-.10 REPEALED.

Authority: *Chapter 368, Tennessee Public Acts of 1975.* ***Administrative History:*** *Original rule certified filed June 10, 1974. Amendment filed March 12, 1987; effective April 26, 1987.*

TECHNICAL SPECIFICATIONS

Technical Specifications
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PART 1 General

1.01 Scope

A. The Project consists of the installation of a Cured-In-Place liner into approximately 350 linear feet of 48-inch diameter storm sewer pipe, 72 linear feet of 30-inch diameter storm pipe, 585 linear feet of 24-inch diameter storm pipe, 95 linear feet of 18-inch diameter storm pipe, and 500 linear feet of 15-inch diameter storm pipe. The scope of the project will include all bypass pumping, pipe preparation, pre-lining, and any necessary tools or equipment required to complete the jobs according to the specifications. The allotted time for construction is 120 calendar days.

B. The equipment and materials to be furnished will be installed at the locations shown on the Drawings.

1.02 Description of Work

A. The OWNER reserves the right to substitute, add, delete, increase, decrease in any form or fashion as necessary, the scope of work under the provisions of this Contract.

B. Each project shall be assigned a unique project number by the ENGINEER. The CONTRACTOR shall execute each of these unique projects in complete compliance with the requirements of this contract, as a standalone contract. Where more than one (1) project is being executed under this contract at the same time, the CONTRACTOR shall execute each one of them independent of the others. All records of the CONTRACTOR shall conspicuously identify them to be associated with the unique project number assigned by the ENGINEER.

C. The work covered under each of these projects shall consist of furnishing all materials, equipment, and labor for the installation of the stormwater systems, including but not limited to any pavement or sidewalk replacement, erosion control, sheeting and shoring, topsoil, sodding, seeding, and site cleanup.

D. The CONTRACTOR shall be responsible for documenting existing field conditions prior to construction. A copy of photos and videos will be made available to the ENGINEER upon request.

1.03 Items Regulating the Execution of the Work

A. Attention to Work

For each one of the unique projects, the CONTRACTOR shall give his personal attention to and shall supervise the work to the end that it shall be prosecuted faithfully; and, when he is not personally present on the work, he shall at all times be represented by a competent superintendent or foreman who shall be present at the work and who shall receive and obey all instruction or orders given under this Contract, and who shall have full authority to execute the same, and to supply materials, tools and labor without delay, and who shall be the legal representative of the CONTRACTOR. The CONTRACTOR shall be liable for the faithful observance of any instructions delivered to him or to his authorized representatives.

B. Access to Work

The CONTRACTOR shall at all times provide proper facilities for access and inspection of the work by representatives of the OWNER and of such official Governmental agencies as may be designated by the OWNER as having jurisdictional rights to inspect the work.

C. Work in Streets and Alleys

The CONTRACTOR shall secure the approval and obtain operation procedures from the OWNER and/or the Tennessee Department of Transportation (TDOT) as necessary before closing or starting construction within the right-of-way of any street or alley. All Work areas shall conform to the *Manual on Uniform Traffic Control Devices* (MUTCD).

Throughout the performance of the work or in connection with this Contract, the CONTRACTOR shall construct and adequately maintain suitable and safe crossing over the trench and such detours as are necessary to care for public and private traffic. The material excavated from trenches shall be compacted and deposited along the sides of the trench or elsewhere in such a manner as shall give as little inconvenience as possible to the CONTRACTORs or to the OWNER.

D. Work in Vicinity of Existing Sewers or Water Mains

Where the work on this project is in the vicinity of existing Public or Private Sewers or Water Mains, the CONTRACTOR shall schedule his operations in such a manner that all existing sewer service made be adequately maintained.

Where existing sanitary sewers are to be removed from service permanently or temporarily, the CONTRACTOR shall convey, in a manner acceptable to the ENGINEER, and without bypassing to the environment, all sewage and drainage which may be received by those sewers until the existing sewers are returned to service or replaced.

The CONTRACTOR shall not use any existing sanitary sewer to divert or dispose of storm or surface water. After a connection has been made to any existing sanitary sewers, the CONTRACTOR shall plug the nearest opening to said connection and make such provisions that are necessary for pumping, bypassing, and conducting storm or surface water, to insure the above until the acceptance of the project.

Where existing water mains or other water distribution equipment (pumps, tanks, etc.) must be temporarily taken out of service, the CONTRACTOR shall give the OWNER a minimum of forty-eight (48) hours written notice, unless otherwise specified elsewhere in these specifications. If otherwise specified, the more stringent requirement shall take precedence.

The CONTRACTOR shall not operate any valve or other water system appurtenance without express written consent of the OWNER.

The CONTRACTOR shall be responsible for the identification of all active service lines for the purpose of reinstatement. All damages caused by the blocking of service lines or active service lines not reinstated shall be the sole responsibility the CONTRACTOR for a period of one (1) year from the contract completion date.

E. Work on State Highway

Where the work on this project encroaches upon the right-of-way of any State or Interstate Highway right-of-way, the OWNER will execute a contract with proper authorities for the installation of the proposed sewers or water mains.

The CONTRACTOR shall notify the proper authorities prior to entering upon such right-of-way and shall be responsible for all damage and for satisfying the requirements of these authorities.

F. Work on Private Property

Where the work on this project encroaches upon private property, the OWNER shall provide easements and/or right-of-entry in or beneath which pipes and structures will be constructed by the CONTRACTOR under this contract.

The CONTRACTOR will be responsible for complying with all easement conditions as shown on the signed easement agreement. If no signed easement agreement exists, then an easement of prescription shall be implemented allowing a fifteen foot (15') wide work area over the centerline of the existing sewer pipe.

The CONTRACTOR shall be responsible for obtaining any additional area which may be deemed necessary for the construction of this project. The CONTRACTOR shall obtain a written agreement between the CONTRACTOR and Land OWNER and forward it to the ENGINEER prior to use of said property.

The CONTRACTOR shall be responsible for the preservation of and shall use every precaution to prevent damage to all trees, shrubbery, fences, culverts, bridges, pavements, driveways, sidewalks, houses, or buildings, and all water, sewer, gas, telephone, and electric lines thereto and all other private and public property along or adjacent to the work.

Any damage that occurs will be restored to a like condition as existed prior to construction, in the Contract Documents, unless otherwise indicated or specified.

Forty-eight (48) hours prior to construction in any easement or streets, the CONTRACTOR shall notify in writing the affected property OWNERS in the area. This notification shall include the CONTRACTOR's name, and the name and phone number of the contact person.

G. Contract Working Hours

All work at the site shall be performed during regular working hours and the CONTRACTOR will not permit overtime work or the performance of work on Sunday or any legal holiday without the OWNER's written consent given after prior twenty-four (24) hour notice to the ENGINEER. Saturday work shall also require prior twenty-four (24) hour notice. Regular working hours are Monday through Friday from 8:00 a.m. to 5:00 p.m. The actual costs of the OWNER's and ENGINEER's inspection of the work performed outside of regular working hours

will be billed to the CONTRACTOR and deducted from the CONTRACTOR's application for payment as they occur.

1.04 Quantities

The Owner reserves the right to alter the quantities of work to be performed or to extend or shorten the improvements at any time when and as found necessary, and the Contractor shall perform the work as altered, increased or decreased. Payment for such increased or decreased quantity will be made in accordance with the Instructions to Bidders. No allowance will be made for any change in anticipated profits nor shall such changes be considered as waiving or invalidating any conditions or provisions of the Contract and Bond

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Partial Occupancy by Owner

Whenever, in the opinion of the ENGINEER, any section or portion of the work or any structure is in suitable condition, it may be put into use upon the written order of the ENGINEER and such usage will not be held in any way as an acceptance of said work or structure, or any part thereof, or as a waiver of any of the provisions of these Specifications and the Contract.

Pending final completion and acceptance of the Work, all necessary repairs and replacements, due to defective materials or workmanship or operations of the CONTRACTOR, for any section of the work so put into use shall be performed by the CONTRACTOR at CONTRACTOR's own expense.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

A. The bid lists each item of the Project for which payment will be made. No payment will be made for any items other than those listed in the bid.

B. Related Work:

1. Section 330130.11 – Television Inspection of Sewers

2. Section 330130.72 – Cured-in-Place Pipe Lining

C. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the bid, and which are not specified in this Section to be measured or to be included in one of the items listed in the bid, shall be considered as incidental to the work. All costs thereof, including CONTRACTOR's overhead costs and profit, shall be considered as included in the lump sum or unit prices for the various bid items. The CONTRACTOR shall prepare the bid accordingly.

D. Work includes furnishing all plant, labor, equipment, tools, and materials, which are not furnished by the OWNER and performing all operations required to complete the work satisfactorily, in place, as specified and as indicated on the Drawings and Specifications.

1.02 Descriptions

A. Measurement of an item of work will be by the unit indicated in the bid.

B. Final payment quantities shall be determined from the documented field measurements. The precision of final payment quantities shall match the precision shown for that item in the bid.

C. Payment will include all necessary and incidental related work not specified to be included in any other item of work listed in the bid.

D. Unless otherwise stated in individual Sections of the Specifications or in the bid, no separate payment will be made for any item of work, materials, parts, equipment, supplies, or related items required to perform and complete the work. The costs for

all such items required shall be included in the price Bid for item of which it is a part.

E. Payment will be made by extending unit prices multiplied by quantities provided, and then summing the extended prices to reflect actual work. Such price and payment shall constitute full compensation to the CONTRACTOR for furnishing all plant, labor, equipment, tools and materials not furnished by the OWNER and for performing all operations required to provide to the OWNER the entire Project, complete in place, as specified and as indicated on the Drawings.

F. "Products" shall mean materials or equipment permanently incorporated into the work.

1.03 Storm Sewers and Accessories

A. Existing Utilities and Obstructions

1. Horizontal Conflict: Payments for conflicts with existing utilities shall be made only where additional catch basins and/or additional lengths of pipe are approved by the Engineer. Said payment shall be made at the unit prices in the Bid. No other payment will be made for any delay or extra cost encountered by the Contractor due to protection, avoidance, or relocation of existing utilities, mains, or services, or changing the horizontal alignment of the storm sewer.

2. Vertical Conflict: Where authorized by the Engineer, payment for additional depth of cut required to avoid vertical conflicts shall be made at the unit prices bid for storm sewer. No payment will be made for relocation of existing utilities.

B. Location and Grade: No separate payment shall be made for survey work performed by or for the Contractor in the establishment of reference points, bench marks, cut sheets, limits of right-of-way or easement, including their restoration, as well as centerline or baseline points.

C. Construction Along Highways, Streets, and Roadways: No separate payment shall be made for traffic control or maintaining highways, streets, roadways, and driveways.

D. Laying and Jointing Pipe and Accessories

1. Measurement for payment at the unit price for storm sewer shall be made

from centerline of catch basin to centerline of catch basin. Depth of cut shall be measured from pipe invert to ground level at pipe centerline. Cut sheets prepared by the Contractor and approved by the Engineer shall be the basis for payment.

2. Payments for point repairs and sectional replacement of storm sewer will be made at the unit price for each repair. No additional payments will be made for varying means of installation, the use of erosion controls, bypass pumping, clearing and access work, or any other unique work that an individual repair may require.

3. Payments for point repair footage beyond that listed in the bid tab shall be paid at the unit price indicated for open cut replacement of pipe.

4. No additional payment will be made for replacement of defective materials.

5. No additional payment will be made for maintaining flow while placing the new storm sewer in service.

6. No separate payment shall be made for detection tape or tracing wire.

7. No payment will be made for cutting and beveling pipe.

E. All costs related to the implementation of the easement and permit stipulations shall be included in the unit price bid for the item to which it pertains.

F. Clean-up and Testing: No separate payment will be made for clean-up and testing. Any cost for labor, materials, and equipment required for clean-up shall be included in the price bid for the item to which it pertains.

1.04 Rehabilitation of Storm Sewer Pipe by Cured-In-Place (CIPP) Methods

A. Cured-In-Place (CIPP) Installation

1. Payment will be made at the unit price bid for each diameter and CIPP thickness constructed. Quantities shall be determined from field measurements verified in writing by the Engineer.

2. Horizontal measurement shall be to the actual dimension of the work.

3. Payment will be based on the actual footage of pipe rehabilitated. Additional work items required to rehabilitate and test the lines to the level specified in *Section 330130.72 – Cured-in-Place Pipe* will not be counted for payment purposes.

4. No separate or additional payment will be made for any special or unique method, means, techniques, or equipment necessary for the Contractor's compliance with these Specifications, regulatory requirements, permits, laws, or regulations which govern this Project.

5. If during the course of pre-CCTV inspection operations, the CONTRACTOR believes a pipeline will require "heavy cleaning" prior to rehabilitation, the CONTRACTOR shall inform the ENGINEER prior to conducting "heavy cleaning" operations. Visual evidence in the form of a CCTV image or digital image of the pipeline shall be provided by the CONTRACTOR to the ENGINEER to justify heavy cleaning operations. After reviewing the evidence, the ENGINEER shall make a determination if the evidence provided meets the definition of "heavy cleaning". “Heavy Cleaning” shall be defined as the pipe being more than 25% full of debris or requiring the use of apparatus or nozzles other than normal high-pressure jetting equipment and nozzles (i.e. buckets, “pigs”, power-rod machines, grinders, cutters, dolphin nozzles, or dragging devices). If it is determined that "heavy cleaning" is required, the ENGINEER shall provide written authorization to the CONTRACTOR to proceed with "heavy cleaning" operations at the rate set forth in the Bid for the pipe or pipes determined to require "Heavy Cleaning”. The CONTRACTOR shall be paid for “Heavy Cleaning” on the basis of the distance loosened debris is moved to the nearest point of extrication from the sewer. Payment shall be calculated on a lineal foot basis.”

6. Post-inspection videos complying with *Section 330130.11 – Television Inspection of Sewers* shall be submitted and reviewed by the Engineer and/or Owner’s Representative prior to submission of payment requests. No separate payment will be made for post inspection videos. Payment will not be considered without video documentation.

7. No separate payment will be made for heavy cleaning and/or root cutting in performing CCTV inspection or pipe preparation for the installation of CIPP.

8. No separate payment will be made for preconditioning lines in preparation

for post-installation video.

1.05 Bypass Pumping

No separate or additional payment will be made for any special or unique method, means, techniques, or equipment necessary for the Contractor's compliance with these Specifications, regulatory requirements, permits, laws, or regulations which govern this Project.

1.06 Clearing and Sewer Easement Access

A. No separate payment shall be made for clearing and constructing access roads to sewer easements.

B. The cost of moving and reestablishing landscape features, including labor and materials, shall be included in the unit price bid for the item to which it pertains.

1.07 Cash Allowances

A. The CONTRACTOR shall include in the Bid Total all allowances stated in the Contract Documents. These allowances shall cover the net cost of the services provided by a firm selected by the OWNER. The CONTRACTOR's handling costs, labor, overhead, profit, and other expenses contemplated for the original allowance shall be included in the items to which they pertain and not in allowances.

B. Should the net cost be more or less than the specified amount of the allowance, the Contract will be adjusted accordingly by change order. The amount of change order will not recognize any changes in handling costs at the site, labor, overhead, profit, and other expenses caused by the adjustment to the allowance.

C. Documentation

1. Submit copies of the invoices with each periodic payment request from the firm providing the services.

2. Submit results of services provided which verify required results.

D. Schedule of Cash Allowances

1. Soils and Concrete Testing: Allow the amount provided in the Bid for the

services of a geotechnical engineering firm and testing laboratory to verify soils conditions including trench excavation and backfill, and similar issues and for the testing of concrete cylinders for poured in place concrete and manhole lining materials.

2. Cured-In-Place-Pipe Testing Laboratory Services: Allow the amount provided in the Bid for the services of a laboratory testing firm and testing laboratory, when ordered by the ENGINEER to verify physical properties of the cured in place pipe materials.

1.08 Erosion Control

No separate payment shall be made for temporary and/or permanent erosion and sedimentation controls or replacement of landscaping disturbed by inspection, replacement, or rehabilitation activities.

1.09 Pre-rehabilitation video inspection

No more than forty-eight (48) hours prior to rehabilitation, the condition of the storm sewer pipeline shall be verified by use of television inspections, performed one section of the storm sewer pipeline at a time. The inspection shall be conducted in such a manner as to determine that the line is clean and the location is free of any conditions which may prevent the proper rehabilitation of the pipeline.

1.10 Trench Excavation and Backfill

A. No separate or additional payment will be made for any special or unique method, means, techniques or equipment necessary for the CONTRACTOR's compliance with these Specifications, regulatory requirements, permits, laws, or regulations which govern this Project.

B. Trench Excavation: No separate payment will be made for trench excavation. All costs shall be included in the unit price bid for the item to which it pertains at the appropriate depth.

C. Dewatering Excavations: All costs of equipment, labor and materials required for dewatering shall be included in the price bid for the item to which it pertains.

D. Trench Foundation and Stabilization

1. No payment for trench stabilization shall be authorized until after the trench has been dewatered. If the pipe is installed in an inadequately prepared trench bottom, the ENGINEER shall notify the CONTRACTOR in writing of the deficiency and will not authorize payment for that portion of that length of pipe which was improperly installed.

2. Payment for filter fabric shall be at the unit price bid for Filter Fabric under trench stabilization. Payment shall include all costs for the placement of filter fabric.

E. Bedding and Haunching

1. The unit price bid for pipe for gravity mainline and lateral sewer shall include excavation of the trench to the depth below the pipe necessary to provide specified bedding and to lay the sewer to grade.

2. No additional payment will be made for additional trench depth.

3. No separate payment will be made for material used to provide specified bedding. The cost of all bedding and haunching materials shall be included in the unit price bid for the item to which it relates, except forand should also include any required materials for trench stabilization .

4. No additional payment will be made for improved bedding required to compensate for over excavation of the trench.

F. Initial Backfill

1. No separate payment shall be made for initial backfill.

2. No separate payment shall be made for drying out the initial backfill material in order to meet the compaction requirements.

3. No separate payment shall be made for the adding of moisture to the initial backfill materials in order to meet the compaction requirements.

4. No separate payment shall be made for providing select material if the *in situ* material cannot meet the compaction requirements.

G. Concrete Encasement: Payment for concrete encasement shall be included in the

unit price in the Bid for the specific pipe segments listed in the Bid by Station. No separate payment shall be made for concrete encasement.

H. Final Backfilling

1. No additional payment will be made for additional material when excavated materials are used.

2. No separate payment shall be made for drying out the final backfill material in order to meet the compaction requirements.

3. No separate payment shall be made for the adding of moisture to the final backfill materials in order to meet the compaction requirements.

4. No additional payment will be made for providing select material if the *in situ* material cannot meet the compaction requirements.

I. Additional Material: No separate payment will be made for additional earth or fill materials imported to the Project site.

1.11 Removing and Replacing Pavement or Infrared Pavement Restoration

A. Payment for removing and replacing pavement will be made as a separate item, based on the measured quantity replaced at the unit price in the Bid. The unit price bid shall include all costs associated with removing and replacing pavement, including providing select backfill, traffic control, and temporary measures for maintaining traffic.

B. Payment shall be made only for that length for which the pipe is constructed by open cut and the pipe centerline is constructed within four feet of the edge of pavement as shown on the Drawings and only where asphalt or concrete pavement is required by the ENGINEER to be placed.

C. Payment for soils testing shall be made from the "Soils and Concrete Testing" Cash Allowance. No payment shall be made for tests which fail to verify required results.

D. No additional payment will be made for removing and replacing curb and gutter.

E. No additional payment will be made for removing and replacing damaged adjacent

pavement.

F. Payment for concrete sidewalks, driveways, curb, and gutter shall be paid at the unit price bid and shall include all associated costs with removal and replacement necessary to complete the task and shall include any special measures necessary, including proving select backfill and traffic control.

1.12 Additional Work if Ordered

Payment shall be made at the unit price bid as shown in the Bid for Unit Price Contract. No separate or additional payment will be made for completing this work.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

PART 1 – GENERAL

1.01 Scope

A. This Section outlines the restrictions and requirements for substitutions, product and manufacturer options, and construction method options.

B. Related Requirements:

1. Section 013000 – Administrative Requirements

1.02 Definitions

A. For the purposes of these Contract Documents, a “substitute item” shall be defined as one of the following:

1. A product or manufacturer offered as a *replacement* to a specified product or manufacturer.

2. A product or manufacturer offered *in addition* to a specified product or manufacturer.

B. For the purposes of these Contract Documents, a “substitute construction method” shall be defined as one of the following:

1. A means, method, technique, sequence, or procedure of construction offered as a *replacement* for a specified mean, method, technique, sequence, or procedure of construction.

2. A means, method, technique, sequence, or procedure of construction offered *in addition* to a specified mean, method, technique, sequence, or procedure of construction.

1.03 General

A. An item or construction method, which is offered where no specific product, manufacturer, mean, method, technique, sequence, or procedure of construction is specified or shown on the Drawings, shall not be considered a substitute and

shall be at the option of the CONTRACTOR, subject to the provisions in the Contract Documents for that item or construction method.

B. For products specified only by a referenced standard, the CONTRACTOR may select any product by any manufacturer, which meets the requirements of the Specifications, unless indicated otherwise in the Contract Documents.

C. If the manufacturer is named on the Drawings or in the Specifications as an acceptable manufacturer, products of that manufacturer meeting all requirements of the Specifications and Drawings are acceptable.

D. Whenever the ENGINEER's design is based on a specific product of a particular manufacturer, that manufacturer will be shown on the Drawings and/or listed first in the list of approved manufacturers in the Specifications. Any Bidder intending to furnish products of other than the first listed manufacturer, or furnish substitute items, shall:

1. Verify that the item being furnished will fit in the space allowed, perform the same functions, and have the same capabilities as the item specified,

2. Include in its Bid the cost of all accessory items which may be required by the other listed substitute product,

3. Include the cost of any architectural, structural, mechanical, piping, electrical, or other modifications required, and

4. Include the cost of required additional work by the ENGINEER, if any, to accommodate the item.

E. Whenever a product specification includes minimum experience requirements which the manufacturer selected by the CONTRACTOR cannot meet, the manufacturer shall furnish the OWNER with a cash deposit or bond acceptable to the OWNER in an amount equal to the cost of the product, which shall remain in effect until the experience requirement has been met.

1.04 Approvals

A. Approval, of a substitution as an acceptable manufacturer, of the ENGINEER is dependent on determination that the product offered:

1. Is essentially equal in function, performance, quality of manufacture, ease of maintenance, reliability, service life, and other criteria to that on which the design is based, and

2. Will require no major modifications to structures, electrical systems, control systems, or piping systems.

1.05 Substitutions and Options

A. No substitutions will be considered for the manufacturers listed in the Bid.

B. After Notice to Proceed

1. Substitute items will be considered only if the term “equal to” precedes the names of acceptable manufacturers in the Specification.

2. Where items are specified by referenced standard or specified as indicated above in Article 1.03, Paragraph A, such items shall be submitted to the ENGINEER for review.

3. The CONTRACTOR shall submit shop drawings on the substitute item for the ENGINEER's review in accordance with the *Section 013000 – Administrative Requirements*.

C. Prior to Opening of Bids

1. No consideration or approvals will be made for products specified by a referenced standard, or specified as indicated in Article 1.03, Paragraph A, above. Such consideration may occur only after the Notice to Proceed.

2. No consideration or approvals will be made for products being offered where the term “equal to” precedes the name of an approved product. Such substitution consideration may occur only after the Notice to Proceed.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

Part 1 General

1.01 Equipment Delivery and Construction Schedule

CONTRACTOR shall provide a tentative schedule of work at the pre-construction conference in the form of a Gantt Chart outlining individual work tasks, the anticipated start date, the anticipated finish date, and pertinent associated details.

Not later than ten (10) consecutive calendar days after the issuance of the "Notice to Proceed", the CONTRACTOR shall submit to the ENGINEER for review a detailed schedule of major equipment delivery and installation and general construction operations, indicating the sequence of the work, the estimated dates of starting each task, and the estimated time of completion of each task. The schedule shall be broken down with respect to individual structures and facilities, indicating when existing structures or equipment would be taken out of service (if applicable). The form and content of the schedule shall be satisfactory to the ENGINEER.

1.02 Shop Drawings and Product Data

A. The CONTRACTOR shall submit to the ENGINEER for review, for design concept, electronic submittals in PDF format and shall include successive page numbers for each page of the PDF file. In lieu of electronic PDF copies, six (6) copies of complete drawings and engineering data for all equipment, materials, and products to be incorporated into the work shall be submitted to ENGINEER. Final reviewed submittals will be posted by ENGINEER on a ShareFile site hosted by ENGINEER and made available to both CONTRACTOR and OWNER. Otherwise, hard copies that have been reviewed by ENGINEER will be distributed.

Shop drawings shall be submitted to ENGINEER for review no later than fifteen (15) days after a fully executed contract has been received by CONTRACTOR. CONTRACTOR shall not mobilize to the site without first providing all required submittals. CONTRACTOR will be held to the contract time as indicated in the Notice-to-Proceed regardless of whether submittals have been provided to ENGINEER.

Shop drawings and engineering data shall be provided and the ENGINEER 'S review will be conducted in accordance with the requirements of the General Provisions. Shop drawings and/or engineering data, as appropriate, shall be submitted for the following items, including, but not limited to:

1. All piping, pipe fittings, pipe supports, hangers, couplings, and insulation including mill tests if requested by the ENGINEER.

2. Hatches, valve boxes, manhole frames and covers, PVC riser connections, miscellaneous iron castings and gratings, manhole frames and covers, curb inlets, manhole steps.

3. All concrete and masonry accessories and steel reinforcement, including bending diagrams and bar schedules, ties, spreaders, chairs, and inserts.

4. Form coatings, waterstops, curing and sealing compounds, and epoxy bonding agents.

5. Premixed grouts and mortars.

6. All paints and protective coatings.

7. Grass seed, fertilizer, and commercial mulches.

8. Precast concrete manhole and/or wet well structures.

9. Precast concrete drop inlets, grates and covers, steps, junction boxes, etc., inclusive of pipe connection boots, and joint material, etc.

10. Septic tank top replacement concrete design information.

11. New septic tank precast concrete design information.

12. Any pumping equipment and associated control panel units and other associated ancillary items.

13. Any septic field equipment and associated ancillary items.

14. Electrical System components and associated materials.

15. Portland Cement Concrete design mix for Class A and Class B Concrete.

16. All equipment and ancillary mechanical and electrical components.

17. Paving mix design inclusive of sieve analysis and bituminous content.

B. Shop drawings and engineering data for equipment supplied as a pre-engineered or pre-assembled system shall include complete shop drawings and engineering data on each component of that system. In all cases, the information provided shall be sufficient to determine if the material or product conforms with the requirements of the specifications.

C. Shop drawings and engineering data shall be prepared by the original equipment vendors or fabricators, as applicable. Purchased specifications by the CONTRACTOR or his Supplier shall not be acceptable as a substitute for actual vendor drawings and data.

D. All shop drawings shall include a legend or other suitable means to identify all symbols and abbreviations used on the drawing. Where an accepted, industry-wide drafting symbol or standard has been established for a particular item, information depicted on the shop drawings shall conform to that standard.

E. Shop drawings shall be dimensioned using the U.S. standard unit of measurement (feet and/or inches). Size of drawing shall not exceed twenty-four inches (24”) by thirty-six inches (36”). All scaled drawings and details shall have the scale clearly noted on the drawing or detail. All information shall be clear and legible.

F. Each shop drawing and each item of engineering data shall bear the CONTRACTOR's APPROVED stamp indicating that the CONTRACTOR has reviewed the drawing or data for conformance with the Contract Documents.

G. All design calculations and drawings for foundation and footings, sheeting and shoring, and concrete formwork shall bear the signed and dated stamp of a licensed professional ENGINEER.

1.03 Miscellaneous Submittals

A. The CONTRACTOR shall submit to the ENGINEER miscellaneous information, procedures, test data, samples, etc., in the manner and at the time specified in these Specifications and Contract Documents. Miscellaneous submittals shall include, but not be limited to, the following:

1. Procedures for handling and disposing of sewage flows during construction.

2. Factory test data and results where specified for specific items of equipment.

3. Preliminary concrete mix design reports.

4. Satisfactory written evidence in the form of laboratory or mill test reports indicating that all cement, aggregate, masonry, structural steel, fencing, castings, steel reinforcement, conduit, pipe, grout, waterproof materials, grass seed, and other items incorporated into the work are in compliance with the requirements of these Specifications.

5. Project record documents.

6. Copies of original invoices of all equipment delivered to the site.

7. When requested, analysis and design data on concrete formwork and sheeting and shoring.

8. Drawings and details of erosion and sediment control structures, if significantly different from Drawings.

9. Written evidence of equipment warranties.

1.04 Schedule of Work

CONTRACTOR shall submit a SCHEDULE OF WORK in sequential order by dates in which he expects to perform the contract specifying the areas or locations in the order the work is anticipated beginning with work commencement date. "The Work" may include related sections or items (individually or grouped) such as clearing and grubbing, gradework (cut & fill), structure installation, rehabilitation of storm sewer pipelines, manholes, catch basins, and related construction, erosion control, base, paving, etc., as examples.

1.05 Samples

At the ENGINEER's request, the CONTRACTOR shall furnish certified samples of materials utilized in the fabrications or production of equipment, materials, and products supplied under these Contract Documents. Cost of all such samples shall be borne by the CONTRACTOR. The samples will be tested by a qualified, independent, testing laboratory selected by the OWNER to determine if the mechanical and chemical properties of the materials supplied are in accordance with the requirements of these Specifications and Contract Documents.

The OWNER shall pay for the laboratory testing of material samples provided by the CONTRACTOR. The CONTRACTOR shall pay for all retests made necessary by the failure of materials to conform to the requirements of these Specifications and Contract Documents.

1.06 Schedules, Reports, and Records

A. The CONTRACTOR shall submit to the ENGINEER such schedule of quantities and costs, progress schedules, reports, estimates, records and other data where applicable as are required by the CONTRACT DOCUMENTS for the Work to be performed.

B. Prior to the first partial payment estimate, the CONTRACTOR shall submit construction schedules showing the order in which the CONTRACTOR proposes to carry on the Work, including dates, at which the various parts of the Work will be started, estimated date of completion of each part, and, as applicable:

1. The dates on which special detail drawings will be required. Submittal must allow sufficient time for review by the ENGINEER. Final approval must be obtained prior to commencement of construction of that portion of work to which they pertain.

2. Respective dates for submission of shop drawings, the beginning of manufacture, the testing and the installation of materials, supplies, and equipment.

C. The CONTRACTOR shall also submit a schedule of payments that the CONTRACTOR anticipates will be earned during the course of the Work.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

PART 1 General

1.01 Scope

A. This section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Pre-Construction Conference.

2. Pre-Installation Conferences.

3. Coordination Meetings.

4. Progress Meetings.

B. Construction schedules are specified in another Division 1 section.

1.02 Related Documents

A. Drawings and General Provisions of the Contract and other Division 1 specification sections apply to this section.

1.03 Pre-Construction Conference

A. Attend and participate in a pre-construction conference and organizational meeting at the project site or other convenient location no later than fifteen (15) days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees – The OWNER, ENGINEER, their consultants, the CONTRACTOR and its superintendent, major subcontractors, manufacturers, suppliers, and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.

C. Agenda – Discuss items of significance that could affect progress including such topics as:

1. Tentative construction schedule.

2. Critical work sequencing.

3. Designation of responsible personnel.

4. Procedures for processing field decisions and Change Orders.

5. Procedures for processing Applications for Payment.

6. Distribution of Contract Documents.

7. Submittal of shop drawings, product data, and samples.

8. Preparation of record documents.

9. Use of the premises.

10. Office, work, and storage areas.

11. Equipment deliveries and priorities.

12. Safety procedures.

13. First aid.

14. Security.

15. Housekeeping.

16. Working hours.

1.04 Pre-Installation Conferences

A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the ENGINEER of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:

    a. Contract Documents.

    b. Options.

    c. Related Change Orders.

    d. Purchases.

    e. Deliveries.

    f. Shop drawings, product data, and quality control samples.

    g. Possible conflicts.

    h. Compatibility problems.

    i. Time schedules.

    j. Weather limitations.

    k. Manufacturer’s recommendations.

    l. Compatibility of materials.

    m. Acceptability of substrates.

    n. Temporary facilities.

    o. Space and access limitations.

    p. Governing regulations.

    q. Safety.

    r. Inspection and testing requirements.

    s. Required performance results.

t. Recording requirements.

u. Protection.

2. Record significant discussions and agreements and disagreements at each conference, along with approved schedule. Distribute a record of the meeting to everyone concerned, promptly, including the OWNER and ENGINEER.

3. Do not proceed if the conference cannot be successfully conducted. Initiate whatever actions are necessary to resolve impediment performance of work and reconvene the conference at the next feasible date.

1.05 Coordination Meetings

A. Conduct project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

B. Request representation at each meeting party currently involved in coordination or planning for the construction activities involved.

C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.06 Progress Meetings

A. Conduct progress meetings at the project site at regularly scheduled intervals but not less than monthly. Notify the OWNER and ENGINEER of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees – In addition to representatives of the OWNER and ENGINEER, each CONTRACTOR, subcontractor, supplier, representative of governmental or other regulatory agency, or other entity concerned with current progress, or involved in planning, coordination, or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda – Review and correct or approve minutes of the previous progress meeting. Minimum agenda shall include:

1. Review work progress since last meeting.

2. Note observations of work in progress, problems and decisions.

3. Identify problems which impede planned progress.

4. Review fabrication problems.

5. Develop corrective measures and procedures to regain planned schedule.

6. Revise construction schedule as indicated.

7. Coordinate projected progress with other CONTRACTORS and Suppliers.

8. Review submittal schedules and expedite as required to maintain schedule.

9. Maintain quality and work standards.

10. Complete other current business.

D. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the project.

1. CONTRACTOR's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the CONTRACTOR's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the contract time.

2. CONTRACTOR's Submittal Schedule: Review progress since the last meeting. Determine where each activity is in relation to the CONTRACTOR's Submittal Schedule, whether on time or ahead or behind schedule. Determine how submittals behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether

schedule revisions are required to ensure that current and subsequent activities will be completed within the contract time.

3. Review the present and future needs of each entity present, including such items as:

   a. Interface requirements.

   b. Time.

   c. Sequences.

   d. Deliveries

   e. Off-site fabrication problems.

   f. Access.

   g. Site utilization.

   h. Temporary facilities and services.

   i. Hours of work.

   j. Hazards and risks.

   k. Housekeeping.

   l. Quality and work standards.

   m. Change Orders.

   n. Documentation of information for payment requests.

E. Reporting – No later than three (3) days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

F. The ENGINEER will schedule and administer progress meetings and shall:

1. Prepare agendas.

2. Distribute written notice and agendas of called meetings two (2) days in advance of meeting date.

3. Make physical arrangements for meetings.

4. Preside at meetings.

5. Record minutes, including significant proceedings and decisions.

6. Furnish copies of minutes to participants within seven (7) days after meetings.

7. Distribute copies of minutes to participants within seven (7) days after meetings.

G. The ENGINEER will attend meetings to ascertain that work is expedited consistent with construction schedule and with Contract Documents.

H. The CONTRACTOR shall attend progress meetings, as specified, during and until final acceptance of the work described under these Contract Documents.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

A. The work under this Section includes preparing, furnishing, distributing, and periodic updating of the construction schedules as specified herein.

B. The purpose of the schedule is to demonstrate that the CONTRACTOR can complete the overall Project within the Contract Time and meet all required interim milestones.

1.02 Submittals

A. Overall Project Schedule (OPS)

1. Submit the schedule within ten (10) days after date of the Notice to Proceed.

2. The ENGINEER will review the schedule and return it within ten (10) days after receipt.

3. If required, resubmit within ten (10) days after receipt of a returned copy.

B. Near Term Schedule (NTS)

1. Submit the first Near Term Schedule within ten (10) days of the Notice to Proceed.

2. The ENGINEER will review the schedule and return it within ten (10) days after receipt.

C. Submit an update of the OPS and NTS with each progress payment request.

D. Submit the number of copies required by the CONTRACTOR, plus four (4) copies to be retained by the ENGINEER.

1.03 Approval

Approval of the CONTRACTOR's detailed construction program and revisions thereto shall in no way relieve the CONTRACTOR of any of CONTRACTOR's duties and obligations under the Contract. Approval is limited to the format of the schedule and does not in any way

indicate approval of, or concurrence with, the CONTRACTOR's means, methods and ability to carry out the Work.

1.04 Overall Project Schedule (OPS)

A. The CONTRACTOR shall submit to the OWNER for approval a detailed Overall Project Schedule (OPS) of the CONTRACTOR's proposed operations for the duration of the Project. The OPS shall be in the form of a Gantt/Bar Chart.

B. Gantt/Bar Chart Schedule

1. Each activity with a duration of five (5) or more days shall be identified by a separate bar. Activities with a duration of more than twenty (20) days shall be sub-divided into separate activities.

2. The schedule shall include activities for shop drawing preparation and review, fabrication, delivery, and installation of major or critical path materials and equipment items.

3. The schedule shall show the proposed start and completion date for each activity. A separate listing of activity start and stop dates and working day requirements shall be provided unless the information is shown in text form on the Gantt/Bar Chart.

4. The schedule shall identify the Notice to Proceed date, the Contract Completion date, major milestone dates, and a critical path.

5. The schedule shall be printed on a maximum 11x17 inch size paper. If the OPS needs to be shown on multiple sheets, a simplified, one page, summary bar chart showing the entire Project shall be provided.

6. The schedule shall have a horizontal time scale based on calendar days and shall identify the Monday of each week.

7. The schedule shall show the precedence relationship for each activity.

1.05 Near Term Schedule (NTS)

A. The CONTRACTOR shall develop and refine a detailed Near Term Schedule (NTS) showing the day to day activities with committed completion dates which must be

performed during the upcoming thirty (30) day period. The detailed schedule shall represent the CONTRACTOR's best approach to the Work which must be accomplished to maintain progress consistent with the Overall Project Schedule (OPS).

B. The NTS shall be in the form of Gantt/Bar chart and shall include a written narrative description of all activities to be performed and describe corrective action to be taken for items that are behind schedule.

C. If regular working hours are to be exceeded, a week advance to the ENGINEER shall be given and shall be reflected in the NTS

1.06 Updating

A. Show all changes occurring since previous submission of the updated schedule.

B. Indicate progress of each activity and show actual completion dates.

C. The CONTRACTOR shall be prepared to provide a narrative report at the Project Coordination Meetings. The report shall include the following:

1. A description of the overall Project status and comparison to the OPS.

2. Identify activities which are behind schedule and describe corrective action to be taken.

3. A description of changes or revisions to the Project and their effect on the OPS.

4. A description of the Near Term Schedule of the activities to be completed during the next thirty (30) days. The report shall include a description of all activities requiring participation by the ENGINEER and/or OWNER.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

A. The CONTRACTOR shall furnish all equipment and labor materials required to provide the OWNER with digital construction videos and photographs of the Project. Videos shall be recorded on a compact disc in *DVD Minus R* (DVD-R) format, or on a hard disk drive in a media format deemed acceptable by the ENGINEER.

B. Photo and video files shall become the property of the OWNER and none of the videos or photographs herein shall be published without express permission of the OWNER.

1.02 Pre- and Post-Construction Videos and Photographs

A. Prior to the beginning of any work, the CONTRACTOR shall take project videos and photographs of the work area to record existing conditions. The pre-construction videos and photographs shall be submitted to the ENGINEER within thirty (30) calendar days after the date of receipt by the CONTRACTOR of Notice to Proceed.

B. Following completion of the work, another recording and photos shall be made showing the same areas and features as in the pre-construction videos and photographs. Post-construction videos on each segment shall not be completed any earlier than thirty (30) days following the repairs on each associated segment.

C. Post-construction videos and photographs shall be provided prior to final acceptance of each pipe in the Project scope. Post-construction videos on each segment shall not be completed any earlier than thirty (30) calendar days following the repairs on each associated segment.

D. All conditions which might later be subject to disagreement shall be shown in sufficient detail to provide a basis for decisions.

1.03 Progress Photographs

A. Photo files shall be provided in *.jpeg* format on compact discs (CD's) or on a portable USB drive, as requested by the ENGINEER/OWNER.

B. The photographs shall include the date and time marking of the recording. All

photographs shall be labeled on a tab connected to the bottom of the photo to indicate date and description of work shown.

1.04 Submittals

A. Construction photographs shall be submitted with each payment request.

B. Videos shall be submitted with a log of the items video-taped and referenced to stations and property numbers.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

A. Permits and Responsibilities: The CONTRACTOR shall, without additional expense to the OWNER, be responsible for obtaining all necessary licenses, and permits, including building permits, and for complying with any applicable federal, state, county, and municipal laws, codes, and regulations, in connection with the prosecution of the Work.

B. The CONTRACTOR shall take proper safety and health precautions to protect the Work, the workers, the public, and the property of others.

C. The CONTRACTOR shall also be responsible for all materials delivered and work performed until completion and acceptance of the Work, except for any completed unit of construction thereof which may heretofore have been accepted.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Description

A. Whenever reference is made to conforming to the standards of any technical society, organization, body, code, or standard, it shall be construed to mean the latest standard, code, specification, or tentative specification adopted and published at the time of advertisement for Bids. This shall include the furnishing of materials, testing of materials, fabrication, and installation practices. In those cases where the CONTRACTOR's quality standards establish more stringent quality requirements, the more stringent requirement shall prevail. Such standards are made a part hereof to the extent which is indicated or intended.

B. The inclusion of an organization under one category does not preclude that organization's standards from applying to another category.

C. In addition, all work shall comply with the applicable requirements of local codes, utilities, and other authorities having jurisdiction.

D. All material and equipment, for which a UL Standard, an AGA, or NSF approval or an ASME requirement is established, shall be so approved and labeled or stamped. The label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.

E. The standards which apply to this Project are not necessarily restricted to those organizations which are listed in Article 1.02.

1.02 Standard Organizations

A. Piping and Valves

ACPA	American Concrete Pipe Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
AWWA	American Water Works Association
CISPI	Cast Iron Soil Pipe Institute
DIPRA	Ductile Iron Pipe Research Association
FCI	Fluid Controls Institute

MSS	Manufacturers Standardization Society
NCPI	National Clay Pipe Institute
NSF	National Sanitation Foundation
PPI	Plastic Pipe Institute
Uni-Bell	PVC Pipe Association

B. Materials

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials

C. Painting and Surface Preparation

NACE	National Association of Corrosion Engineers
SSPC	Steel Structures Painting Council

D. Electrical and Instrumentation

AEIC	Association of Edison Illuminating Companies
AIEE	American Institute of Electrical Engineers
EIA	Electronic Industries Association
ICEA	Insulated Cable Engineers Association
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	The Instrumentation, Systems, and Automation Society
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
REA	Rural Electrification Administration
TIA	Telecommunications Industries Association
UL	Underwriter's Laboratories
VRCI	Variable Resistive Components Institute

E. Aluminum

AA	Aluminum Association
AAMA	American Architectural Manufacturers Association

F. Steel and Concrete

ACI	American Concrete Institute
AISC	American Institute of Steel Construction, Inc.
AISI	American Iron and Steel Institute
CRSI	Concrete Reinforcing Steel Institute
NRMA	National Ready-Mix Association
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute

G. Welding

ASME	American Society of Mechanical Engineers
AWS	American Welding Society

H. Government and Technical Organizations

AIA	American Institute of Architects
APHA	American Public Health Association
APWA	American Public Works Association
ASA	American Standards Association
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASQC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
CFR	Code of Federal Regulations
CSI	Construction Specifications Institute
EDA	Economic Development Administration
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FmHA	Farmers Home Administration
FS	Federal Specifications
IAI	International Association of Identification
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic ENGINEERs
NBFU	National Board of Fire Underwriters
(NFPA)	National Fluid Power Association
NBS	National Bureau of Standards
NISO	National Information Standards Organization

OSHA	Occupational Safety and Health Administration
SI	Salt Institute
SPI	The Society of the Plastics Industry, Inc.
USDC	United States Department of Commerce
WEF	Water Environment Federation

I. General Building Construction

AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AITC	American Institute of Timber Construction
APA	American Parquet Association, Inc.
APA	American Plywood Association
BHMA	Builders Hardware Manufacturers Association
BIFMA	Business and Institutional Furniture Manufacturers Association
DHI	Door and Hardware Institute
FM	Factory Mutual Fire Insurance Company
HPMA	Hardwood Plywood Manufacturers Association
HTI	Hand Tools Institute
IME	Institute of Makers of Explosives
ISANTA	International Staple, Nail and Tool Association
ISDSI	Insulated Steel Door Systems Institute
IWS	Insect Screening Weavers Association
MBMA	Metal Building Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers
NAGDM	National Association of Garage Door Manufacturers
NCCLS	National Committee for Clinical Laboratory Standards
NFPA	National Fire Protection Association
NFSA	National Fertilizer Solutions Association
NKCA	National Kitchen Cabinet Association
NWMA	National Woodwork Manufacturers Association
NWWDA	National Wood Window and Door Association
RMA	Rubber Manufacturers Association
SBC	SBCC Standard Building Code
SDI	Steel Door Institute
SIA	Scaffold Industry Association
SMA	Screen Manufacturers Association
SPRI	Single-Ply Roofing Institute
TCA	Tile Council of America
UBC	Uniform Building Code

J. Roadways

AREA	American Railway Engineering Association
DOT	Department of Transportation

K. Plumbing

AGA	American Gas Association
NSF	National Sanitation Foundation
PDI	Plumbing Drainage Institute
SPC	SBCC Standard Plumbing Code

L. Refrigeration, Heating, and Air Conditioning

AMCA	Air Movement and Control Association
ARI	American Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
CGA	Compressed Gas Association
CTI	Cooling Tower Institute
HEI	Heat Exchange Institute
IIAR	International Institute of Ammonia Refrigeration
NB	National Board of Boilers and Pressure Vessel Inspectors
PFMA	Power Fan Manufacturers Association
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SMC	SBCC Standard Mechanical Code
TEMA	Tubular Exchangers Manufacturers Association

M. Equipment

AFBMA	Anti-Friction Bearing Manufacturers Association, Inc.
AGMA	American Gear Manufacturers Association
ALI	Automotive Lift Institute
CEMA	Conveyor Equipment Manufacturers Association
CMAA	Crane Manufacturers Association of America
DEMA	Diesel Engine Manufacturers Association
MMA	Monorail Manufacturers Association
OPEI	Outdoor Power Equipment Institute, Inc.
PTI	Power Tool Institute, Inc.

RIA	Robotic Industries Association
SAMA	Scientific Apparatus Makers Association

1.03 Symbols

Symbols and material legends shall be as scheduled on the Drawings.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

A. This Section includes testing which the OWNER may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.

B. This work also includes all testing required by the OWNER to verify work performed by the CONTRACTOR is in accordance with the requirements of these Specifications, i.e., concrete strength and slump testing, soil compaction, etc.

C. This work does not include materials testing required in various sections of these Specifications to be performed by the manufacturer, e.g., testing of pipe.

D. The testing laboratory or laboratories will be selected by the OWNER. The testing laboratory or laboratories will work for the OWNER.

1.02 Payment for Testing Services

A. The cost of testing services required by the Contract to be provided by the CONTRACTOR shall be paid for by the OWNER through the CASH ALLOWANCE, *i.e.*, concrete testing, soil compaction, and asphalt testing.

B. The cost of additional testing services not specifically required in the Specifications, but requested by the OWNER or ENGINEER, shall be paid for by the OWNER through the CASH ALLOWANCE.

C. The cost of material testing described in various sections of these Specifications or as required in referenced standards to be provided by a material manufacturer, shall be included in the price bid for that item and shall not be paid for by the OWNER.

D. The cost of retesting any item that fails to meet the requirements of these Specifications shall be paid for by the CONTRACTOR. Retesting shall be performed by the testing laboratory working for the OWNER.

1.03 Laboratory Duties

A. Cooperate with the OWNER, ENGINEER, and CONTRACTOR.

B. Provide qualified personnel promptly on notice.

C. Perform specified inspections, sampling and testing of materials.

1. Comply with specified standards, ASTM, other recognized authorities, and as specified.

2. Ascertain compliance with requirements of the Contract Documents.

D. Promptly notify the ENGINEER and CONTRACTOR of irregularity or deficiency of work which are observed during performance of services.

E. Promptly submit three (3) copies (two [2] copies to the ENGINEER and one [1] copy to the CONTRACTOR) of report of inspections and tests in addition to those additional copies required by the CONTRACTOR with the following information included:

1. Date issued

2. Project title and number

3. Testing laboratory name and address

4. Name and signature of inspector

5. Date of inspection or sampling

6. Record of temperature and weather

7. Date of test

8. Identification of product and Specification section

9. Location of Project

10. Type of inspection or test

11. Results of test

12. Observations regarding compliance with the Contract Documents

F. Perform additional services as required.

G. The laboratory is not authorized to release, revoke, alter, or enlarge on requirements of the Contract Documents, or approve or accept any portion of the Work.

1.04 Contractor Responsibilities

A. Cooperate with laboratory personnel; provide access to Work and/or manufacturer's requirements.

B. Provide to the laboratory, representative samples, in required quantities, of materials to be tested.

C. Furnish copies of mill test reports.

D. Furnish required labor and facilities to:

1. Provide access to Work to be tested;

2. Obtain and handle samples at the site;

3. Facilitate inspections and tests;

4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory.

E. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.

F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the ENGINEER, and shipped to the laboratory by the CONTRACTOR at CONTRACTOR's expense.

G. Copies of all correspondence between the CONTRACTOR and testing agencies shall be provided to the ENGINEER.

1.05 Quality Assurance

Testing shall be in accordance with all pertinent codes and regulations and with procedures and requirements of the American Society for Testing and Materials (ASTM).

1.06 Product Handling

Promptly process and distribute all required copies of test reports and related instructions to insure all necessary retesting or replacement of materials with the least possible delay in the progress of the Work.

1.07 Furnishing Materials

The CONTRACTOR shall be responsible for furnishing all materials necessary for testing.

1.08 Code Compliance Testing

Inspections and tests required by codes or ordinances or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of, and shall be paid for by the CONTRACTOR, unless otherwise provided in the Contract Documents.

1.09 Contractor's Convenience Testing

Inspection or testing performed exclusively for the CONTRACTOR's convenience shall be the sole responsibility of the CONTRACTOR.

1.10 Schedules for Testing

A. Establishing Schedule

1. The CONTRACTOR shall, by advance discussion with the testing laboratory selected by the OWNER, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be on site to provide the required testing.

2. Provide all required time within the construction schedule.

B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

C. When the testing laboratory is ready to test according to the determined schedule,

but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be back-charged to the CONTRACTOR and shall not be borne by the OWNER.

1.11 Taking Specimens

Unless otherwise provided in the Contract Documents, all specimens and samples for tests will be taken by the testing laboratory or the ENGINEER.

1.12 Transporting Samples

The CONTRACTOR shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

Temporary facilities required for this work include, but are not necessarily limited to:

A Temporary utilities such as water and electricity.

B. First aid facilities.

C. Sanitary facilities.

D. Potable water.

E. Temporary enclosures and construction facilities.

F. Temporary heat.

1.02 General

A. First aid facilities, sanitary facilities, and potable water shall be available on the Project site on the first day that any activities are conducted on site. The other facilities shall be provided as the schedule of the Project warrants.

B. Maintenance: Use all means necessary to maintain temporary facilities in proper and safe condition throughout progress of the Work. In the event of loss or damage, immediately make all repairs and replacements necessary, at no additional cost to the OWNER.

C. Removal: Remove all such temporary facilities and controls as rapidly as progress of the Work will permit.

1.03 Temporary Utilities

A. General

1. Provide and pay all costs for all water, electricity, and other utilities required for the performance of the Work.

2. Pay all costs for temporary utilities until Project completion.

3. Costs for temporary utilities shall include all power, water and the like necessary for testing equipment as required by the Contract Documents.

B. Temporary Water: Provide all necessary temporary piping, and upon completion of the Work, remove all such temporary piping. Provide and remove water meters.

C. Temporary Electricity

1. Provide all necessary wiring for the CONTRACTOR's use.

2. Furnish, locate, and install area distribution boxes such that the individual trades may use, their own construction type extension cords to obtain adequate power, and artificial lighting at all points where required by inspectors and for safety.

1.04 First Aid Facilities

The CONTRACTOR shall provide a suitable first aid station, equipped with all facilities and medical supplies necessary to administer emergency first aid treatment. The CONTRACTOR shall have standing arrangements for the removal and hospital treatment of any injured person. All first aid facilities and emergency ambulance service shall be made available by the CONTRACTOR to the OWNER and the ENGINEER's personnel.

1.05 Sanitary Facilities

Prior to starting the Work, the CONTRACTOR shall furnish, for use of CONTRACTOR's personnel on the job, all necessary toilet facilities which shall be secluded from public observation. These facilities shall be either chemical toilets or shall be connected to the OWNER's sanitary sewer system. All facilities, regardless of type, shall be kept in a clean and sanitary condition and shall comply with the requirements and regulations of the area in which the Work is performed. Adequacy of these facilities will be subject to the ENGINEER's review and maintenance of same must be satisfactory to the ENGINEER at all times.

1.06 Potable Water

The CONTRACTOR shall be responsible for furnishing a supply of potable drinking water for employees, subcontractors, inspectors, ENGINEERS, and the OWNER who are associated with the Work.

1.07 Enclosures and Construction Facilities

Furnish, install, and maintain for the duration of construction, all required scaffolds, tarpaulins, canopies, steps, bridges, platforms, and other temporary construction necessary for proper completion of the Work in compliance with all pertinent safety and other regulations.

1.08 Parking Facilities

Parking facilities for the CONTRACTORS and CONTRACTOR's subcontractors' personnel shall be the CONTRACTOR's responsibility. The storage and work facilities provided by the OWNER will not be used for parking by the CONTRACTOR's or subcontractor's personnel.

1.09 Temporary Heating

A. General

1. All heating required during the progress of the Work, prior to the installation of the permanent heating system, shall be classified “temporary heat”.

2. Prior to the installation of permanent heating equipment, furnish approved heaters and fuel as required.

3. Keep equipment and surroundings in clean, safe condition.

4. When the permanent heating equipment has been installed, it shall be put into operation to assure evenly distributed heat to all portions of buildings.

5. Pay all fuel bills for temporary heat.

B. Temperatures

1. Except as otherwise called for, a minimum temperature of fifty degrees Fahrenheit (50° F) and a maximum temperature of seventy-five degrees Fahrenheit (75° F) in the building shall be maintained during the working hours and above freezing at all other times.

2. See requirements of various other sections of these Specifications for minimum temperature to be maintained for the application of work under the various trades.

C. Millwork: Supply adequate heating and ventilation to dry out buildings before installation of finished millwork and trim is started.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Requirements Included

A. Furnish, install and maintain temporary utilities required for construction, remove on completion of Work.

B. Related Work:

1. Section 011100 – Summary of Work

2. Section 015213 – Field Offices and Sheds

1.02 Requirements of Regulatory Agencies

Comply with Federal, State, and local codes and regulations and with utility company requirements.

Part 2 Products

2.01 Materials - General

Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 Temporary Electricity and Lighting

A. Arrange with utility company, provide service required for power and lighting, and pay all costs for service and for power used.

B. Install circuit and branch wiring, with area distribution boxes located so that power and lighting is available throughout the construction by the use of construction-type power cords.

C. Provide adequate artificial lighting for all areas of work when natural light is not adequate for work and for areas accessible to the public.

2.03 Temporary Heat and Ventilation

A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity.

B. Provide adequate forced ventilation of enclosed areas for curing of installed materials to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.

C. Portable heaters shall be standard approved units complete with controls.

D. Pay all costs of installation, maintenance, operation and removal, and for fuel consumed.

2.04 Temporary Telephone Service

A. Arrange with local telephone service company, provide direct line telephone service at the construction site for the use of personnel and employees. Service required:

1. One (1) direct line instrument in field office.

2. Other instruments at the option of the CONTRACTOR, or as required by regulations.

B. Pay all costs for installation, maintenance and removal, and service charges for local calls. Toll charges shall be paid by the party who places the call.

2.05 Temporary Water

A. Arrange with utility service company to provide water for construction purposes. Pay all costs for installation, maintenance and removal, and service charges for water used.

B. Install branch piping with taps located so that water is available throughout the construction by the use of hoses. Protect piping and fittings against freezing.

C. CONTRACTOR shall take necessary provisions to protect the temporary meter during periods of cold weather.

2.06 Temporary Sanitary Facilities

A. Provide sanitary facilities in compliance with laws and regulations

B. Service, clean and maintain facilities and enclosures.

Part 3 Execution

3.01 General

A. Arrange Maintain and operate systems to assure continuous service.

B. Modify and extend systems as work progress requires.

3.02 Removal

A. Completely remove temporary materials and equipment when their use is no longer required.

B. Clean and repair damage caused by temporary installations or use of temporary facilities.

C. Restore existing facilities, if any, used for temporary services to specified, or to original, condition.

D. Restore permanent facilities, if any, used for temporary services to specified conditions.

END OF SECTION

Part 1 General

1.01 Scope

A. CONTRACTOR shall provide temporary utilities to include electricity, lighting, internet connectivity, heat, ventilation, telephone service, water, and sanitary facilities.

B. CONTRACTOR shall provide temporary controls to include barriers, enclosures and fencing, and water control.

C. CONTRACTOR shall provide temporary facilities to include access roads, parking, and temporary buildings.

D. Restrictions on the use of existing adjacent facilities.

1.02 Temporary Electricity

A. Provide and pay for power service required for construction and testing from local utility source.

B. Provide temporary electric feeder from existing electrical service at location as directed by utility company. Power consumption will not disrupt the electrical provider's need for continuous service. Coordinate with the electrical provider before making taps or disturbing existing service.

C. Provide separate metering and pay for cost of energy used until substantial electric service is turned over to and paid for by the utility prior to substantial completion, reimburse the utility for energy used up to substantial completion.

D. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide Occupational Safety and Health Administration (OSHA) approved flexible power cords as required.

E. CONTRACTOR-installed permanent convenience receptacles may be used during Construction.

1.03 Temporary Lighting

A. Provide and maintain adequate lighting for construction operations to achieve a minimum lighting level of one (1) watt per-square-foot (1) W/ft^2.

B. Provide and maintain two foot-candle (2 FC) lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain 0.25 W/ft^2 High Intensity Discharge (H.I.D.) lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may be used during construction.

1.04 Temporary Heating and Cooling

A. Provide and pay for heating and cooling as required to maintain specified conditions for construction operations or as required for proper conduct of operations included in the Work.

B. Prior to operation of permanent equipment for temporary purposes, verify that installation is approved for operation, equipment is lubricated, and temporary filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

C. Maintain minimum ambient temperature of fifty degrees Fahrenheit (50° F) and maximum relative humidity of fifty percent (50%) in areas where construction is closed in and final finishes are to be placed, unless indicated otherwise in specifications.

1.05 Temporary Ventilation

Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.06 Temporary Water Service

A. Provide, maintain, and pay for suitable quality water service required for Construction operations. Coordinate with the providing utility if water supply is not separately metered. Pay all costs and expenses associated with such use.

B. Extend branch piping with outlets located so that water is available by hoses with threaded connections.

1.07 Temporary Sanitary Facilities

Provide and maintain required facilities and enclosures on-site. Maintain daily in clean and sanitary condition.

1.08 Barriers

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide barricades required by governing authorities for public rights-of-way.

C. Provide protection for plant life designated to remain. Replace damaged plant life.

D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.09 Fencing

A. Unless directed otherwise in other sections of the Contract Documents, provide a six foot (6’) high fence completely around portions of the construction site as needed, with hinged vehicular and pedestrian gates with locks. Fencing will be galvanized, two inch (2”) mesh chain link with solid top rail. Provide line posts and end posts as needed to maintain stretched and uniform fencing with no sags.

B. Fencing plan will be approved by the ENGINEER for each phase of the project. Submit fencing layout diagram (if needed) prior to the Pre-Construction meeting.

1.10 Access Roads

A. Provide and maintain uninterrupted public access to existing buildings. Construction activities will not interfere with access. If CONTRACTOR fails to maintain public access after two (2) written notices within a twenty-four (24) hour period, the OWNER reserves the right to correct such situation and back charge the CONTRACTOR.

B. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.

C. Extend and relocate access roads as work progress requires. Provide detours necessary for unimpeded traffic flow.

D. Provide and maintain access to fire hydrants, free of obstructions.

E. Designated existing on-site roads may be used for construction traffic. Repair or restore any damaged areas caused as a result of construction activity. Such repair will be to a like-new condition.

1.11 Parking

A. Provide temporary surface parking areas to accommodate construction personnel.

B. Do not allow construction vehicle parking on existing pavement unless approved by OWNER.

1.12 Field Office

A. If required as part of the project, the CONTRACTOR will provide and maintain one (1) field office until Substantial Completion.

B. If required, the field office will contain two (2) offices and three (3) desks. The field office structure will be a minimum of ten feet by forty feet (10’ x 40’). The layout of the field office will include adequate space to hold project meetings, with minimum seating for fifteen (15).

C. Installation of the field office will meet all local codes and ordinances. The CONTRACTOR will as a minimum install the structures on a level, well-drained area. Structures will be designed and installed to resist one-hundred-thirty miles-per-hour (130 mph) winds.

D. The field offices will be provided with structurally sound and safe steps and landings for each door. The doors will have secure locks. Construct appropriate walkway and landings. Construct covers over each door that extends three feet (3') from the building and the full width of the landing.

E. The field offices will be designated as a "No Smoking Area."

F. The windows will be arranged for cross ventilation with screens.

G. Provide air conditioning and heating systems with thermostat control.

H. Provide electric power for the duration of the work.

I. The CONTRACTOR will provide the following with the field office, at a minimum:

1. Electric lights of fifty foot-candles (50 FC) at desktop height and power supply outlets.

2. When available, provide high-speed Internet access to all desks for the duration of the work.

3. Acceptable toilet facilities with appropriate signage that meet all of the local and State health codes and regulations.

4. Fire extinguisher: Halon type, minimum four pound (4 lb.) capacity.

5. Water coolers, bottled water, and paper cups.

6. Tables for viewing the Project Drawings.

7. Standard office supplies.

8. Weekly janitorial services.

1.14 Removal of Temporary Utilities, Facilities, and Controls

A. Remove all temporary utilities, equipment, facilities, and materials prior to submitting Final Application for Payment.

B. Remove temporary underground installations to minimum depth of two feet (2') and re-grade site.

C. Clean and repair damage caused by installation or use of temporary work.

C. Restore any existing facilities used during Construction to original condition, unless otherwise directed in other sections of Contract Documents. Restore existing landscaping, drainage, paving, etc. to an "as-was" condition, unless otherwise directed in other sections of Contract Documents.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

Limit blowing dust caused by construction operations by applying water or employing other appropriate means or methods to maintain dust control, subject to the approval of the OWNER. As a minimum, this may require the use of a water wagon two (2) times per day to suppress dusty conditions.

1.02 Protection of Adjacent Property

A. The Bidders shall visit the site and note the buildings, landscaping, roads, parking areas, and other facilities near the Work site that may be damaged by their operations. The CONTRACTOR shall make adequate provision to fully protect the surrounding area and will be held fully responsible for all damages resulting from CONTRACTOR's operations.

B. Protect all existing facilities (indoors or out) from damage by dust, fumes, spray, or spills (indoors or out). Protect motors, bearings, electrical gear, instrumentation, and building or other surfaces from dirt, dust, welding fumes, paint spray, spills, or droppings causing wear, corrosion, malfunction, failure, or defacement by enclosure, sprinkling, or other dust palliatives, masking and covering, exhausting, or containment.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Barricades, Lights, and Signals

A. The CONTRACTOR shall furnish and erect such barricades, fences, lights, and danger signals, and shall provide such other precautionary measures for the protection of persons or property and of the Work as necessary. Barricades shall be painted in a color that will be visible at night. From sunset to sunrise, the CONTRACTOR shall furnish and maintain at least one (1) light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any Work under construction.

B. The CONTRACTOR will be held responsible for all damage to the Work due to failure of barricades, signs, and lights, and whenever evidence is found of such damage, the CONTRACTOR shall immediately remove the damaged portion and replace it at CONTRACTOR's cost and expense. The CONTRACTOR's responsibility for the maintenance of barricades, signs, and lights shall not cease until the Project has been accepted by the OWNER.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

A. Submittals

1. Provide and maintain temporary and permanent erosion and sedimentation controls as shown on the Drawings. This Section also specifies the subsequent removal of temporary erosion and sedimentation controls.

2. Temporary and permanent erosion and sedimentation controls include grassing and mulching of disturbed areas and structural barriers at those locations which will ensure that erosion during construction will be maintained within acceptable limits. Acceptable limits are as established by Section 402 of the Federal Clean Water Act, and applicable codes, ordinances, rules, regulations, and laws of local and municipal authorities having jurisdiction. If a Storm Water Pollution Prevention Plan (SWPPP) is obtained for this project, all erosion and sedimentation controls contained in it shall be followed.

3. Submit product data in accordance with the requirements of *Section 013000 – Administrative Requirements* of these Specifications.

4. At the Preconstruction Conference, submit a written plan for both temporary and permanent grassing. The plan shall include selection of species, dates, and rates of application for seeding, fertilizer, and mulching. No work shall be started until the erosion and sedimentation control schedule and methods of operation have been approved by the ENGINEER.

B. Related Work:

1. Section 013000 – Administrative Requirements

2. Section 329219 – Seeding

C. Basic Principles

1. The CONTRACTOR is responsible for inspecting and maintaining all existing erosion and sedimentation control measures.

2. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type, and condition.

3. Minimize the disturbed area and the duration of exposure to erosion elements.

4. Stabilize disturbed areas immediately.

5. Safely convey run-off from the site to an outlet such that erosion will not be increased off site.

6. Retain sediment on site that was generated on site.

7. Minimize encroachment upon watercourses.

D. Construction Requirements

1. 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.

2. 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 state; 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.

3. 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.

4. 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.

5. Under no condition shall the amount of surface area or erodible earth material exposed at one time be excavation or fill within the project area exceed seven-hundred-fifty-thousand square feet (750,000 ft^2) without prior approval by the ENGINEER.

6. 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, and borrow and fill operations as determined by his analysis of project conditions.

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

E. Implementation

1. The erosion and sedimentation control measures shown on the Drawings are minimal requirements. The CONTRACTOR's methods of operation may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the CONTRACTOR's responsibility to determine and install said measures. The CONTRACTOR's failure to stabilize disturbed areas immediately following intermediate or final grading may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the CONTRACTOR's responsibility to determine and install said measures.

2. The CONTRACTOR shall notify the ENGINEER of any changes and/or additions to the erosion and sedimentation control plan necessary to accommodate the CONTRACTOR's methods of operation. No additional payment shall be made for erosion and sedimentation control measures made necessary by the CONTRACTOR's methods of operation.

3. The CONTRACTOR shall be solely responsible for control of erosion within the Project site and prevention of sedimentation of any adjacent waterways.

4. The CONTRACTOR shall install controls which will ensure that stormwater and drainage from the disturbed area of the Project site shall pass through some type of filter system before being discharged. The filter system must meet the requirements of the Tennessee Department of Environment & Conservation (TDEC).

F. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:

1. Preventing soil erosion at the source.

2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.

3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.

G. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site.

1.02 Quality Assurance

A. General: Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated herein and these Specifications.

B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

Part 2 Products

2.01 Temporary Erosion and Sedimentation Control Materials

A. Silt Fence

1. Silt fence shall be polymer type netting with a built-in cord running throughout the top edge of the fabric. Posts shall be either steel or pressure treated fir, southern pine, or hemlock, and shall be spaced not more than six feet (6') on center. Silt fence shall be provided with netting to provide reinforcing when necessary. Silt fence shall have an Equivalent Opening Size (EOS) of forty (40) to one-hundred (100). Silt fence fabric shall have a maximum permeability of forty gallons per minute per square foot (40 gpm/ft^2).

2. Silt fence fabric shall be equal to Mirafi 100X, Amoco 1380, or Exxon GTF-100 Series.

B. Hay bales shall be clean, seed free, cereal hay type containing five cubic feet (5 ft^3) or more of material. Hay or straw erosion checks shall be embedded in the ground four to six inches (4" to 6") 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 shall be removed after they have served their purpose and the area is stabilized. 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.

C. Netting shall be one-half inch (½") galvanized steel, chicken wire mesh.

D. Filter stone shall be crushed stone conforming to Tennessee Department of Transportation (TDOT) Specifications, mineral aggregate size 57.

E. Concrete block shall be hollow, non-load-bearing type.

F. Plywood shall be three-fourth inch (3/4") thick exterior type.

G. Erosion Control Matting shall be North American Green S-75 or approved equal.

2.02 Riprap

A. Stone Riprap: Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or greater. Riprap shall have less than sixty-six percent (66%) wear when tested in accordance with AASHTO T-96. Unless shown or specified otherwise, stone riprap shall be Type 1 riprap.

1. Type A-1 Machined Riprap: The pieces shall vary in size from two inches (2")

to 1.25 feet, with no more than twenty percent (20%) by weight being less than four inches (4”). The thickness of the stone layer shall be 1.5 feet with a tolerance of three inches (3”). Riprap size shall conform to the Tennessee Department of Transportation (TDOT) Section 709.03-machined riprap, Type A-1.

2. Type A-2 Machined Riprap: Shall be identical to Class A-1 except that hand placed rubble stone riprap placed one foot (1’) thick in accordance with Section 709 of the TDOT Specifications for Roadway Design may be substituted for 1.5 feet of machined riprap.

3. Type A-3 Machined Riprap: Shall vary in size from two inches (2”) to six inches (6”), with no more than twenty percent (20%) by weight being less than four inches (4”).

4. Type B machined riprap shall vary in size from three inches (3”) to twenty-seven inches (27”), with no more than twenty percent (20%) by weight being less than six inches (6”).

5. Type C machined riprap shall vary in size from five inches (5”) to thirty-six inches (36”), with no more than twenty percent (20%) by weight being less than nine inches (9”)

2.03 Filter Fabric

A. The filter fabric for use under riprap shall be a monofilament, polypropylene woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size (EOS) of seventy (70).

B. Filter fabric shall meet the requirements of Trivera Spunbound 011/280, Mirafi 180N, or Amoco 4553.

2.04 Additional Construction of Structures

A. Temporary Berms

A temporary berm shall be constructed of compacted soil, with a minimum width of twenty-four inches (24”) at the top and a minimum height of twelve inches (12”), 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 ten degree (10°) 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 (1) side of the embankment to permit the placement of temporary berms and slope drains on only one (1) side of the embankment.

B. Temporary Slope Drains

1. 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.

2. Fiber matting and plastic sheeting shall not be used on slopes steeper than four-to-one (4:1) except for short distances of twenty feet (20') or less.

3. 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 as well as pick up some sediment. All temporary slope drains shall be removed when 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 where slope drains exit, at the bottom as well as in the ditch lines atop waste sites, and in the ditch lines or borrow pits. Sediment structure 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 two feet (2'). A design is not needed for check dams but some typical designs are available from the ENGINEER.

E. Temporary Seeding and Mulching

Seeding and mulching shall be performed in accordance with the *Section 329219 – 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 three to five feet (3' to 5') and approximate width of five to ten feet (5' to 10'). The embankment shall not be supported by the construction of brush barriers.

G. Riparian Live Stakes

When required, placement of Riparian Live Stakes shall consist of the harvest, transport, maintenance, and installation of live stake materials into the bank from low flow to bank-full at hydraulic structures and locations specified within the Plans or as directed by the ENGINEER

1. Live Stakes for this item shall be a mixture of species specified within the Plans and the ENGINEER. Live cuttings for live stakes shall be 0.5 to 1.5 inches in diameter and two to three feet (2'-3') in length. Side branches shall be removed and the bark left intact prior to installation. Buds on the stakes shall be oriented in an upward position. The basal ends shall be tapered to a point for easy insertion into the soil. The top shall be cut smooth and square to the length of the stake.

2. Source and Supplier Requirements – The source of all live cuttings shall be from purchased stock, located on-site, or within twenty-five (25) miles of the project site. If the CONTRACTOR is unable to locate sufficient harvesting sites for the live stakes, the CONTRACTOR may, upon approval from the ENGINEER, purchase live branch material from a state-certified nursery or other source approved by the ENGINEER. The material shall meet all of the specifications found in this section.

3. Substitutions – Any proposed species substitutions or changes in percent composition of species shall require prior written approval by the ENGINEER. Only specified plant species will be accepted. No cultivated varieties (cultivars) are acceptable.

Part 3 Execution

3.01 General

Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Tennessee Department of Environment & Conservation (TDEC), local enforcing agency guidelines, and these Specifications.

3.02 Temporary Erosion and Sedimentation Control

A. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering the creeks. The preferred method is to provide an undisturbed natural buffer, extending a minimal twenty-five feet (25') from the top of the bank, to filter the run-off. Should this buffer prove infeasible due to construction activities being too close to the creek, or if the amount of sediment overwhelms the buffer, the CONTRACTOR shall place silt fences to filter the run-off and, if necessary, place permanent riprap to stabilize the creek banks.

When excavation activities disturb the previously stated preventative measures, or if they are not maintained, or whenever the construction activities cross the creeks, the check dams shall be installed downstream and within two-hundred feet (200') of the affected area.

B. Silt dams, silt fences, traps, barriers, check dams, appurtenances, and other temporary measures and devices shall be installed as indicated on the approved plans and working drawings, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials. Detention ponds, if constructed, shall be maintained in a condition ensuring that unfiltered water will not leave the pond.

C. Where permanent grassing is not appropriate, and where the CONTRACTOR's temporary erosion and sedimentation control practices are inadequate, the ENGINEER may direct the CONTRACTOR to provide temporary vegetative cover with fast growing seedings. Such temporary vegetative cover shall be provided by the CONTRACTOR in compliance with the Tennessee Department of Environment & Conservation (TDEC), specifically in the selection of species, planting dates, and application rates for seedings, fertilizer, and mulching, with the exception that kudzu shall not be permitted.

D. All erosion and sedimentation control devices, including check dams, shall be inspected by the CONTRACTOR at least weekly and after each rainfall occurrence, and cleaned out and repaired by the CONTRACTOR as necessary.

E. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

3.03 Permanent Erosion Control

A. Permanent erosion control shall include:

1. Restoring the work site to its original contours, unless shown otherwise on the Drawings or directed by the ENGINEER.

2. Permanent vegetative cover shall be performed in accordance with Article 3.04 of this Section.

3. Permanent stabilization of steep slopes and creeks shall be performed in accordance with Article 3.05 of this Section.

B. Permanent erosion control measures shall be implemented as soon as practical after the completion of pipe installation or land disturbance for each segment of the Project. In no event shall implementation be postponed when no further construction activities will impact that portion or segment of the Project. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.

3.04 Riparian Live Stakes

A. Schedule and Conditions – The harvest and installation of live stakes shall be performed only during the dormant season between November 1 and March 31, or as directed by the ENGINEER. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted for approval by the ENGINEER.

B. Harvesting The CONTRACTOR shall notify the ENGINEER seventy-two (72) hours prior to harvesting to review and approve all harvesting sites. The CONTRACTOR shall locate, flag, and code the live cutting sites. Upon approval by the ENGINEER, the CONTRACTOR shall be responsible for harvesting and transporting the cuttings to the job site.

C. Protection During Delivery – Live materials must be protected against drying out and overheating before/during transport (*e.g.*, they shall be covered, transported in unheated vehicles, moistened, kept in soak pits).

D. Inspection – All materials and construction techniques shall be inspected and approved by the ENGINEER prior to installation.

E. Storage - Live materials must be protected against drying out and overheating on-site prior to installation (*e.g.*, by storing in controlled conditions, storing in shade, covering with evergreen branches or plastic, placing in moist soil, or spraying with anti-transparent chemicals). Live materials shall receive continuous shade, shall be sheltered from the wind, and shall be continuously protected from drying by being heeled into moist soils. Where water is available, live cuttings shall be sprayed or immersed. Warm water (over one-hundred-fifty degrees Fahrenheit [150° F]) stimulates growth and should be used only upon the approval of the ENGINEER. Any costs associated with such storage are incidental to the overall unit costs. Live materials shall be installed the same day that the cuttings are harvested. If installation

of live materials cannot be accomplished on the same day and storage is required, live materials shall be stored for a period no longer than two (2) days. Any storage of live materials must be approved by the ENGINEER prior to storing.

F. Installation

1. Planting Area – Live stakes shall be installed in areas specified by the Plans and the ENGINEER. In general, live stakes are planted on stream banks at an elevation no higher than bankfull and no lower than the low-flow water surface. Live stakes shall not be planted on the inside bank of meander bends.

2. Installation – Drive live stakes through the erosion control fabric and into the ground so that eighty percent (80%) of the stake is below the ground surface. The CONTRACTOR shall use a dead-pan hammer for driving the stake directly into the ground or drive a pilot hole, smaller in diameter then the live stake, and then driving the live stake into the pilot hole. Stagger the live stakes in a random pattern throughout the specified planting area at the density specified by the Plans and the ENGINEER. Live stakes shall be installed above the low flow water surface and below bankfull elevation. All live stakes split during installation may be left in place, but must be supplemented with a new live stake that remains un-split after installation.

3. Establishment Commencement – The period of care and replacement shall begin after inspection and approval of the initial installation of all live stakes, and continue for one (1) year, with one (1) potential replacement period.

G. Warranty – The CONTRACTOR shall provide a period of care and replacement after inspection and approval of the initial installation of all live stakes, continuing for one (1) year, with one (1) potential replacement period. This shall consist of eighty-five percent (85%) care and replacement warranty for all live stakes. Replacement of live stakes shall be conducted in accordance with the materials and construction methods shown in these specifications. The CONTRACTOR will not be responsible for live stakes that have been damaged by vandalism, fire, flooding, wildlife predation, or other activities beyond the CONTRACTOR'S control.

3.05 Grassing

A. General

1. All references to grassing, unless noted otherwise, shall relate to establishing permanent vegetative cover as specified herein or shown on the Drawings for seeding, fertilizing, mulching, etc.

2. When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched in an effort to restore to a protected condition. Critical areas shall be sodded as approved or directed by the ENGINEER.

3. Specified permanent grassing shall be performed at the first appropriate season following establishment of final grading in each section of the site.

4. Permanent grassing shall be of a perennial species.

B. Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Where sod is removed or damaged, replant such areas using sod of the same species of grass at the first appropriate season. Outside of residential or landscaped areas, grass the entire area disturbed by the work on completion of work in any area. In all areas, promptly establish successful stands of grass.

C. Grassing activities shall comply with the Tennessee Department of Environment & Conservation (TDEC) Specifications, specifically for the selection of species with the exception that kudzu shall not be permitted, planting dates, and application rates for seeding, fertilizer, and mulching. Where permanent vegetative cover (grassing) cannot be immediately established (due to season or other circumstances), the CONTRACTOR shall provide temporary vegetative cover. The CONTRACTOR must return to the site (at the appropriate season) to install permanent vegetation in areas that have received temporary vegetative cover.

3.06 Riprap

A. Unless shown otherwise on the Drawings, riprap shall be placed where ordered by the ENGINEER, at all points where banks of streams or drainage ditches are disturbed by excavation, or at all points where natural vegetation is removed from banks of the streams or drainage ditches. Carefully compact backfill and place riprap to prevent subsequent settlement and erosion. This requirement applies equally to construction alongside a stream or drainage ditch as well as crossing a stream or drainage ditch.

B. When trenching across a creek, place riprap a distance of ten feet (10') upstream and ten feet (10') downstream from the top of the trench excavation. Place riprap across creek bottom, across creek banks, and extend riprap placement five feet (5') beyond the top of each creek bank.

C. Preparation of Foundations: The ground surface upon which the riprap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless at creek banks or otherwise shown or specified, riprap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two feet (2') deep in original ground, and the side next to the fill or cut shall have that same slope. After the riprap is placed, the toe ditch shall be backfilled and the excess dirt spread neatly within the construction easement.

D. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions, and debris. The fabric shall be placed with the long dimension running up the slope, and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of one foot (1') of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within three inches (3") of the centerline of the overlap.

The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give and therefore avoid stretching and tearing during placement of the stones. The stones shall be dropped no more than three feet (3') during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals, or other contaminants. Any contaminated fabric or any fabric damaged during its installation or during placement of riprap shall be removed and replaced with uncontaminated and undamaged fabric at no expense to the OWNER.

E. Placement of Riprap: The riprap shall be placed on a six inch (6") layer of soil, crushed stone or sand overlaying the filter fabric. This six inch (6") layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Riprap shall be placed with its top elevation conforming with the finished grade or the natural slope of the stream bank and stream bottom.

F. Stone Riprap: Stone riprap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course

shall be minus-six inches (-6”) and plus-twelve inches (+12”). If the Drawings or the Bid do not specify a thickness, the course shall be placed to a thickness of not less than eighteen inches (18”).

3.07 Maintenance

A. The temporary erosion control features installed by the CONTRACTOR shall be 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, such work shall be performed by the CONTRACTOR at his own expense.

END OF SECTION

Part 1 General

1.01 Description

A. The work covered in this section consists of implementing Best Management Practices (BMP's) to prevent and minimize erosion and resultant sedimentation in all disturbed areas during and after construction. The CONTRACTOR shall furnish all material, labor, and equipment necessary for the proper installation, maintenance, monitoring, reporting, and removal (where applicable) of erosion prevention and control measures and to cause compliance with the General National Pollutant Discharge Elimination System (NPDES) Permit for Discharges of Storm Water Associated with Construction Activities: Permit No. TNR100000.

B. Related Work:

1. Section 013300 – Administrative Requirements

2. Section 015713 – Erosion and Sediment Control

3. Section 329219 – Seeding

3. Storm Water Pollution Prevention Plan (SWPPP)

1.02 Submittals

A. The following submittals shall be made in accordance with the requirements of this Section and of the NPDES Permit as applicable:

1. Notice of Intent (NOI)

2. Credentials of Certified Personnel

a. Prior to construction activities, the CONTRACTOR shall submit to the OWNER in writing the name(s) of the CONTRACTOR's designated Certified Personnel, and shall provide credentials indicating that the named Certified Person has completed an appropriate erosion and sediment courses that fulfills the requirements of the NPDES Permit.

b. The OWNER reserves the right to reject any candidate it deems unqualified for the position and, furthermore, may require the CONTRACTOR to replace an unqualified individual with a suitable substitute at anytime throughout the life of the Project, at no additional

cost to the OWNER.

3. Inspection Checklists and Reports

4. Monitoring Reports

5. Notice of Termination (NOT)

B. Shop drawings and product data for materials furnished under the ES&PC Plan and this Section shall be submitted to the OWNER in conformance with the requirements of *Section 013300 – Administrative Requirements* of these Specifications.

1.03 References

A. CONTRACTOR shall be familiar with the following referenced documents. These documents shall be complied with as applicable.

1. General NPDES Permit for Discharges of Storm Water Associated with Construction Activities: Permit No. TNR100000.

2. *Tennessee Erosion and Sediment Control Handbook* (latest edition).

3. State of Tennessee Department of Transportation (TDOT) *Standard Specifications for Road and Bridge Construction* (latest edition).

4. Local Issuing Authority's Soil Erosion and Sedimentation Control Ordinances.

5. Storm Water Pollution Prevention Plan (SWPPP), as required by the NPDES Permit.

B. The General NPDES Permit for Discharges of Storm Water Associated with Construction Activities: Permit No. TNR100000 is incorporated into these Specifications by reference. A copy of the permit may be downloaded from the Tennessee Department of Environment & Conservation's (TDEC's) website:

http://www.state.tn.us/environment/permits/conststrm.shtml

1.04 Definitions

A. Design Professional: For the purpose of this Section the term Design Professional is synonymous with consulting ENGINEER, licensed professional, designer, and consultant used in permits, laws, rules, regulations, ordinances, and other soil erosion and sediment control references. For the purposes of this Specification the OWNER

may at any time during the Project provide direction. This direction shall be considered equivalent to direction from the Design Professional.

B. ENGINEER: For the purposes of this Section, the term ENGINEER refers to a person or representative for the OWNER performing construction oversight and managing construction activities and inspections.

C. CONTRACTOR: For the purposes of this Section, the term CONTRACTOR is synonymous with General Contractor, Discharger, Operator, Primary Permittee, and Permittee (permit holder) as used in permits, laws, rules, regulations, ordinances, and other soil erosion and sediment control references.

D. Certified Personnel or Certified Person: For the purposes of this Section, the terms Certified Personnel and Certified Person mean a person who has successfully completed an erosion and sediment controls short course eligible for continuing education units, or an equivalent course approved by Tennessee Department of Environment & Conservation (TDEC).

E. Other Definitions: Definitions as listed in the NPDES Permit shall apply in this Section.

1.05 Regulatory Compliance

A. Land disturbance activities are not authorized to begin until after all required erosion and sediment control permits are obtained from the United States, the State of Tennessee, and/or Local Issuing Authority. The CONTRACTOR is the operator, and therefore a Co-Primary Permittee, under the provisions of the NPDES Permit. As such, CONTRACTOR will be required to sign certain certifications as described in the NPDES Permit.

CONTRACTOR shall comply with requirements specified in the Contract Documents or by the OWNER. CONTRACTOR shall also comply with all other laws, rules, regulations, ordinances, and requirements concerning soil erosion and sediment control established in the United States, the State of Tennessee, and/or Local Issuing Authority. The following documents and the documents referenced therein define the regulatory requirements for this Section.

1. NPDES Permit: The Tennessee General NPDES Permit for Discharges of Storm Water Associated with Construction Activities: Permit No. TNR100000 governs land disturbance or construction activities of one acre or more. On applicable sites, the CONTRACTOR is responsible for complying with terms and conditions of this permit.

2. State of Tennessee *Erosion and Sediment Control Handbook*, (latest edition): CONTRACTOR shall follow Practices and Standards of the State of

Tennessee *Erosion and Sediment Control Handbook*.

B. The CONTRACTOR is responsible for any applicable fees associated with NPDES Permit.

C. Fines resulting from non-compliance with the NPDES permit shall be paid by the CONTRACTOR at no additional expense to the OWNER.

Part 2 Products

As specified in the SWPPP, *Section 015713 – Erosion and Sediment Control*, and *Section 329219 – Seeding*

Part 3 Execution

3.01 Notice of Intent (NOI)

A. The Notice of Intent (NOI) shall be signed by the CONTRACTOR as Co-Primary Permittee in accordance with the Signatory Requirements of the National Pollutant Discharge Elimination System (NPDES) Permit and returned to the OWNER for submission. A copy of the NOI may be downloaded from the Tennessee Department of Environment & Conservation's (TDEC's) website:

http://www.state.tn.us/environment/permits/conststrm.shtml

B. The NOI must be submitted in accordance with the NPDES Permit prior to the start of construction activities. The CONTRACTOR may not start construction activities until written authorization from Tennessee Department of Environment & Conservation (TDEC) is received in the form of a letter of coverage under the terms and conditions of the NPDES Permit.

3.02 Installation

A. Erosion control measures shall be installed as shown on the Contract Drawings and in accordance with *Section 015713 – Erosion and Sediment Control* and *Section 329219 – Seeding*.

B. Rainfall and storm water monitoring equipment shall be installed as identified in the SWPPP and/or as shown on the Contract Drawings.

3.03 Inspections and Reporting

A. The ENGINEER who prepared the SWPPP shall inspect the installation of the erosion control measures within one (1) week after initial construction activities begin. The ENGINEER shall notify the Primary Permittee of any deficiencies. The CONTRACTOR must correct all deficiencies within two business days of receipt of the ENGINEER's inspection report.

B. The CONTRACTOR will designate a Certified Person who shall perform all inspections required by the NPDES Permit and this Specification.

C. Reports

1. All inspections shall be summarized in a report. A sample inspection checklist is included at the end of this Section for the CONTRACTOR's reference and/or use.

2. Reports shall identify any deficiencies and incidents of non-compliance, major observations relating to the SWPPP, and any revisions or amendments to the SWPPP. Where incidents of non-compliance are not identified within the report, the report shall contain a certification that the facility is in compliance with the SWPPP and the NPDES Permit.

3. All inspection reports shall contain a summary of the inspection, the name and signature of the Certified Person making the inspection, and the date of the inspection.

4. All inspection reports shall be submitted to the OWNER or the ENGINEER on a weekly basis for review and retention. The OWNER may withhold payments to the CONTRACTOR if such reports are not submitted in a timely manner.

5. All reports shall contain signed certification statements as required by the NPDES Permit.

6. Inspection documentation will be maintained on site and made available upon request. Inspection reports must be submitted to the Tennessee Department of Environment & Conservation (TDEC) within ten (10) days of the request. Permittees discharging into impaired or high quality waters are required to use the inspection form provided in Appendix C of the NPDES Permit.

3.04 Maintenance

A. Erosion and sediment controls as described in these Contract Documents shall be maintained in good working condition throughout the life of the project. Any part of the erosion and sediment control components found to be damaged or defective shall

be promptly repaired or replaced.

B. After completion of area surfacing, and with the approval of OWNER or ENGINEER, the CONTRACTOR shall remove and dispose off-site all temporary erosion control measures and shall restore the ground to its original condition.

3.05 Monitoring and Reporting

A. The CONTRACTOR shall monitor and record daily (once each twenty-four [24] hour period) rainfall data in accordance with the SWPPP and the NPDES Permit. Rainfall measurements shall be made at the same time each day.

1. The following information shall be recorded for each daily rainfall measurement:

a. Project name and number

b. CONTRACTOR's Certified Person

c. Date and time

d. Reading and name of person taking reading

B. The OWNER reserves the right to use its own resources to duplicate monitoring and verify the work required by the CONTRACTOR in this Section.

3.06 Notice of Termination (NOT)

When all construction activities have ceased, final stabilization has been implemented by the CONTRACTOR, and the site is in compliance with the NPDES permit, the CONTRACTOR shall provide a written statement to the OWNER that the site is in compliance with the NPDES permit and that CONTRACTOR is prepared to sign and submit the Notice of Termination (NOT). The OWNER shall make the final submittal of the NOT to Tennessee Department of Environment & Conservation (TDEC). A copy of the NOT may be downloaded from the TDEC website:

http://www.state.tn.us/environment/permits/conststrm.shtml

END OF SECTION

Part 1 General

1.01 Scope

The CONTRACTOR shall make provisions for transportation of all equipment, materials, and products furnished under these Contracts Documents to the site of the work. In addition, the CONTRACTOR shall provide preparation for shipment and storage, unloading, handling and re-handling, short term storage, extended storage, storage facilities, maintenance, and protection during storage, preparation for installation, and all other work and incidental items necessary or convenient to the CONTRACTOR for the satisfactory prosecution and completion of the work.

1.02 Transportation

A. All equipment shall be suitably boxed, crated, or otherwise protected during transportation.

B. All equipment shall be shipped and delivered in the largest assembled sections practical or permitted by carrier regulations to minimize the number of field connections.

C. The CONTRACTOR shall be responsible for ensuring that the equipment is assembled and transported in such a manner so as to clear buildings, power lines, bridges, and similar structures encountered during shipment or delivery to the site of the work.

D. Where equipment will be installed using existing cranes or hoisting equipment, the CONTRACTOR shall ensure that the weights of the assemble sections do not exceed the capacity of the cranes or hoisting equipment.

E. Small items and appurtenances such as gauges, valves, switches, instruments, and probes which could be damaged during shipment shall be removed from the equipment prior to shipment and packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

F. Temporary shipping braces and supports shall be painted orange or yellow for easy Identification.

1.03 Handling

A. All equipment, materials, and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation. All equipment, materials, and products damaged during transportation or handling shall be repaired or replaced by the CONTRACTOR at no additional cost to the OWNER prior to being incorporated into the work.

B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

C. Under no circumstances shall equipment or products, such as pipe structural steel, casting, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.

D. Items such as nonmetallic pipe, nonmetallic conduit, flagpoles, and lighting poles shall be handled using nonmetallic slings or straps.

E. Plastic pipe and fittings shall not be exposed to direct sunlight for an extended period of time, (if more than one [1] year, see Specifications,) as specified by the manufacturer of these materials.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

Equipment and materials used in the project shall be received inspected, unloaded, handled, stored, maintained, and protected by the CONTRACTOR in a suitable location on or off site, if necessary, until such time as installation is required.

1.02 Storage

A. The CONTRACTOR shall be responsible for providing satisfactory storage facilities which are acceptable to the ENGINEER. In the event that satisfactory facilities cannot be provided on site, a bonded warehouse, acceptable to the OWNER and ENGINEER, will be provided by the CONTRACTOR for such time until the equipment, materials, and products can be accommodated at the site.

B. Original unaltered invoices from manufacturers and suppliers must be presented with the pay request, with no erasures, white-outs or other alterations. Payment will be authorized for no more than the amounts of the invoices (material, freights and taxes). The subcontractor shall submit his requests for payment to the General CONTRACTOR. The General CONTRACTOR will review and, if acceptable, will include the request on the monthly Application for Payment from the General CONTRACTOR to the OWNER submitted through the ENGINEER for review and approval.

Each request for payment which includes amounts for materials or equipment stored off-site in a bonded warehouse in said County of the project, and must have an original Certificate of Insurance attached to the request for payment stating on the face of the original Certificate of Insurance a description of the insured stored material, the name and address of the bonded warehouse, and naming the General CONTRACTOR, the OWNER, and the OWNER's Agents, each as Certificate Holders, each as Additional Insureds and each as Loss Payee for the said material at the said location.

Materials and Equipment that are properly and securely stored: 1) on the project site, or (2) in a bonded warehouse in said County of the project, will be eligible to be included on an application for payment. "Materials" and "Equipment" are defined as items which have been manufactured or fabricated to the point they are

ready for delivery to the Project Site and ready for installation, but the CONTRACTOR has chosen for his own purposes to delay their delivery and installation.

For example: Such Materials and Equipment would include assembled cabinets and casework, but would not include unassembled panels and other components to be used in fabricating cabinets and casework; such Materials and Equipment would also include the structural and miscellaneous steel which has been punched, drilled, fitted, and otherwise uniquely fabricated for this project, but would not include steel shapes which have not been through the fabricator's shop; such Materials and Equipment would not include lumber and plywood for the purpose of constructing formwork, but would include lumber and plywood to be incorporated as part of the building construction as framing and decking.

C. The CONTRACTOR shall be responsible for the maintenance and protection of all equipment, materials, and products placed in storage, and shall bear all costs of storage, preparation for transportation, transportation, re-handling, and preparation for installation.

D. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel, and sheet construction products shall be stored with one end elevated to facilitate drainage.

E. Unless otherwise permitted in writing by the ENGINEER, building products and materials such as cement, grout, plaster, gypsum board, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc. shall be stored indoors in a dry location. Building products such as rough lumber, plywood, concrete block, and structural tile may be stored outdoors under a properly secured waterproof covering.

F. Tarps and other covering shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

1.03 Extended Storage

In the event that certain items of major equipment such as air compressors, pumps, and mechanical aerators have to be stored for an extended period of time, the CONTRACTOR shall provide satisfactory long-term storage facilities which are acceptable to the

ENGINEER. The CONTRACTOR shall provide all special packaging, protection coverings, protective coatings, power, nitrogen purge, desiccants, lubricants, and exercising necessary or recommended by the manufacturer to properly maintain and protect the equipment during the period of extended storage.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

A. Construction staking shall include all of the surveying work required to layout the work and control the location of the finished Project. The CONTRACTOR shall have the full responsibility for constructing the Project to the correct horizontal and vertical alignment, as shown on the Drawings, as specified, or as ordered by the ENGINEER. The CONTRACTOR shall assume all costs associated with rectifying work constructed in the wrong location.

B. Related Work:

Section 017839 – Project Record Documents

C. From the information shown on the Drawings and the information to be provided as indicated under Project Conditions below, the CONTRACTOR shall:

1. Be responsible for setting reference points and/or offsets, establishment of baselines, and all other layout, staking, and all other surveying required for the construction of the Project.

2. Safeguard all reference points, stakes, grade marks, horizontal and vertical control points, and shall bear the cost of re-establishing same if disturbed.

3. Stake out the permanent and temporary easements or the limits of construction to ensure that the work is not deviating from the indicated limits.

4. Be responsible for all damage done to reference points, baselines, center lines, and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, baselines, center lines, and temporary bench marks as a result of the operations.

D. Baselines shall be defined as the line to which the location of the work is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line.

E. Record Drawing surveys shall be performed in accordance with *Section 017839 – Project Record Documents* of these Specifications.

1.02 Project Conditions

A. The Drawings provide the location and/or coordinates of principal components of the Project. The alignment of some components of the Project may be indicated in the

Specifications. The ENGINEER may order changes to the location of some of the components of the Project or provide clarification to questions regarding the correct alignment.

B. The survey points, control points, and baseline to be provided to the CONTRACTOR shall be limited to only that information which can be found on the Project site by the CONTRACTOR.

C. Additionally, the ENGINEER will provide the following:

1. One (1) vertical control point on the Project site with its elevation.

2. A minimum of two (2) horizontal control points on the Project site with their coordinates shown on the Drawings.

1.03 Quality Assurance

A. The CONTRACTOR shall furnish documentation, prepared by a surveyor currently registered in the State in which the Project is located, confirming that staking is being done to the horizontal and vertical alignment shown in the Contract Documents. This requires that the CONTRACTOR hire, at the CONTRACTOR's own expense, a currently registered surveyor, acceptable to the OWNER, to provide ongoing construction staking or confirmation of such.

B. Any deviations from the Drawings shall be confirmed by the ENGINEER prior to construction of that portion of the Project.

C. Construction Surveying Cash Allowance

1. This cash allowance is solely for the use of the ENGINEER for verification of the CONTRACTOR's reference points, centerlines, and work performed, and is not to be used by the CONTRACTOR to provide cut sheets.

2. The presence of this cash allowance in no way relieves the CONTRACTOR of the responsibility of installing reference points, centerlines, temporary bench marks, verifying that the work has been performed accurately, and all other work covered by this Section.

1.04 Site Work

Staking Precision: The precision of construction staking shall match the precision of a component’s location indicated on the Drawings. Staking of utilities shall be done in accordance with generally accepted practice for the type of utility.

1.05 Storm Sewers and Accessories

A. Staking Precision: The precision of construction staking required shall be that which the correct location of the storm sewer can be established for construction and verified by the ENGINEER. Where the location of components of the storm sewer are not dimensioned, the establishment of the location of these components shall be based upon scaling these locations from the Drawings with relation to readily identifiable land marks, – e.g., survey reference points, power poles, manholes, etc.

B. Reference Points

1. Reference points shall be placed, at or no more than three feet (3') from the outside of the construction easement or right-of-way. The location of the reference points shall be recorded in a log with a copy provided to the ENGINEER for use, prior to verifying reference point locations. Distances shall be accurately measured to 0.01 foot.

2. The CONTRACTOR shall give the ENGINEER reasonable notice that reference points are set. The reference point locations must be verified by the ENGINEER prior to commencing clearing and grubbing operations.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

Part 1 General

1.01 Scope

This section covers the general cleaning which the CONTRACTOR shall be required to perform during the construction process and a thorough cleaning before final acceptance of the project unless otherwise shown on the Drawings or specified elsewhere in these Specifications.

1.02 Hazard Control

A. The CONTRACTOR shall store volatile wastes in covered metal containers and remove from premises daily.

B. The CONTRACTOR shall prevent accumulation of wastes which create hazardous conditions.

C. Burning or burying rubbish and waste materials on the site shall not be allowed.

D. Disposal of volatile wastes into sanitary or storm sewers shall not be allowed.

E. CONTRACTORs shall control dust on streets, and remove debris, dust, and etc. from all properties during the construction process.

1.03 Disposal of Surplus Materials

A. Unless otherwise shown on the Drawings specified or directed, the CONTRACTOR shall dispose of all surplus excavated materials and materials and equipment from demolition, legally off the site, and shall provide his own suitable, off-site spoil area, or on a site designated by the OWNER.

B. The OWNER shall have the opportunity to inspect any equipment or materials removed prior to disposal by the CONTRACTOR. If said equipment and/or materials are determined to be salvageable by the OWNER, the CONTRACTOR shall transport said equipment and material to a building or area designated by the OWNER.

1.04 Final Cleaning

A. Schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.

B. Vacuum clean interior building areas when ready to receive finish painting, and continue vacuum cleaning on an as needed basis until building is ready for substantial completion or occupancy.

C. Employ experienced workmen or professional cleaners for final cleaning.

D. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces and of concealed spaces.

E. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.

F. Repair, patch, and touch up marred surfaces to specified finish to match adjacent surfaces.

G. Broom clean paved surfaces. Rake clean other surfaces of ground.

H. Remove snow and ice for access to building.

I. Replace air conditioning filters if units were operated during construction.

J. Clean ducts, blowers, and coils if air conditioning units were operated without filters during construction.

K. Maintain cleaning until project or portion thereof is occupied by OWNER.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Project Maintenance and Warranty

A. Maintain and keep in good repair the Work covered by these Drawings and Specifications until acceptance by the OWNER.

B. The CONTRACTOR shall warrant for a period of one (1) year from the date of OWNER's written final acceptance of the Project, as defined in the Contract Documents, that the completed Work is free from all defects due to faulty products or workmanship and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects. Prior to the end of the warranty period, the OWNER will perform Closed Circuit Television (CCTV) inspection on a percentage of the total footage rehabilitated within the scope of the project, at the expense of the OWNER.

Should the results indicate that greater than twenty percent (20%) of the inspections are found to be defective in any part, the CONTRACTOR shall be required to perform CCTV inspections on the remaining segments where rehabilitation was performed to verify conditions, at no expense to the OWNER, and shall be completed prior to the end of the warranty period.

The OWNER will give notice of observed defects with reasonable promptness. In the event that the CONTRACTOR should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the OWNER may do so and charge the CONTRACTOR the cost thereby incurred. The Performance Bond shall remain in full force and effect throughout the warranty period.

C. The CONTRACTOR shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or as a result of improper work or damage by another CONTRACTOR or the OWNER, or to perform any work which is normally performed by a maintenance crew during operation.

D. In the event of multiple failures of major consequences prior to the expiration of the one (1) year warranty described above, the affected unit shall be disassembled, inspected, and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new twelve (12) month warranty against defective or deficient design, workmanship, and materials shall commence

on the day that the item is reassembled and placed back into operation.

As used herein, multiple failure shall be interpreted to mean two (2) or more successive failures of the same kind in the same item or failures of the same kind in two (2) or more items. Major failures may include, but are not limited to: cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear, or excessive leakage around seals.

Failures which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures, or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over-lubrication or under-lubrication, and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one (1) year warranty. Should multiple failures occur in a given item, all products of the same size and type shall be disassembled, inspected, modified, or replaced as necessary ,and rewarranted for one (1) year.

E. The CONTRACTOR shall, at CONTRACTOR's own expense, furnish all labor, materials, tools, and equipment required, and shall make such repairs and removals and shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship, or faulty materials, in any part of the Work performed by the CONTRACTOR. Such repair shall also include refilling of trenches, excavations, or embankments, which show settlement or erosion after backfilling or placement.

F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility not designated for removal, resulting from the CONTRACTOR's operations, shall be promptly repaired by the CONTRACTOR at no cost to the OWNER.

G. The CONTRACTOR shall be responsible for all road and entrance reconstruction and repairs, and maintenance of same, for a period of one (1) year from the date of final acceptance. In the event the repairs and maintenance are not made immediately and it becomes necessary for the OWNER of the road to make such repairs, the CONTRACTOR shall reimburse the OWNER of the road for the cost of such repairs.

H. In the event the CONTRACTOR fails to proceed to remedy the defects upon notification within fifteen (15) days of the date of such notice, the OWNER reserves the right to cause the required materials to be procured and the work to be done, as

described in the Drawings and Specifications, and to hold the CONTRACTOR and the sureties on CONTRACTOR's bond liable for the cost and expense thereof.

I. Notice to CONTRACTOR for repairs and reconstruction will be made in the form of a registered letter addressed to the CONTRACTOR at CONTRACTOR's home office.

J. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the CONTRACTOR's liability within the law of the place of construction.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

Part 1 General

1.01 Scope

A. The work under this Section includes, but is not necessarily limited to, the compiling, maintaining, recording, and submitting of project record documents as herein specified.

B. The CONTRACTOR shall maintain accurate record documents related to the furnishing and installation of equipment, materials, and products at the site of the Project during the course of the work.

C. CONTRACTOR shall prepare and submit cut sheets for the ENGINEER’s approval prior to starting construction. No separate payment is allowed for this item.

D. Record documents include, but are not limited to:

1. Contract Drawings;

2. Specifications;

3. Change Orders and other modifications to the Contract;

4. ENGINEER field orders or written instructions, including Requests for Information (RFI) and Clarification Memorandums;

5. Reviewed shop drawings, product data, and samples;

6. Test records;

7. Addenda.

E. The CONTRACTOR shall maintain on the Project site throughout the Contract Time an up-to-date set of Record Drawings.

1.02 Maintenance of Documents and Samples

A. Storage

1. Store documents and samples in the CONTRACTOR's field office, apart from

documents used for construction.

2. Provide files and racks for storage of documents.

3. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with format of these Specifications.

C. Maintenance

1. Maintain documents in a clean, dry, legible condition, and in good order.

2. Do not use record documents for construction purposes.

3. Maintain at the site for the OWNER one (1) copy of all record documents.

D. Make documents and samples available at all times for inspection by ENGINEER.

E. Failure to maintain the Record Documents in a satisfactory manner may be cause for withholding of a certificate for payment.

1.03 Quality Assurance

A. Unless noted otherwise, Record Drawings shall provide dimensions, distances, and coordinates to the nearest 0.1 foot.

B. Unless noted otherwise, Record Drawings shall provide elevations to the nearest 0.01 foot for all pertinent items constructed by the CONTRACTOR.

1.04 Recording

A. Label each document “Project Record” in neat, large printed letters. Record Documents shall be kept current and work shall not be permanently concealed until the required information had been recorded

B. Recording

1. Record information concurrently with construction progress.

2. Do not conceal any work until required information is recorded.

1.05 Record Drawings

A. Record Drawings shall be reproducible, shall have a title block indicating that the drawings are Record Drawings, the name of the company preparing the Record Drawings, and the date the Record Drawings were prepared. The CONTRACTOR will be provided paper sepias of the Drawings, or it may elect to provide reproducible drawings via another method. Reproducible shall be defined as being translucent so as to allow a blueline print to be produced.

B. Legibly mark drawings to record actual construction, including:

1. All Construction

a. Changes of dimension and detail.

b. Changes made by Requests for Information (RFI), field order, clarification memorandums or by change order.

c. Details not on original Drawings.

2. Site Improvements, Including Underground Utilities

a. Horizontal and vertical locations of all exposed and underground utilities and appurtenances, both new facilities constructed and those utilities encountered, referenced to permanent surface improvements or mean sea level.

b. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

c. Location of and dimensions of roadways and parking areas, providing dimensions to back of curb when present.

d. The locations shall be referenced to at least two (2) easily identifiable, permanent landmarks (e.g., power poles, valve markers, etc.) or benchmarks.

e. Field changes of dimension and detail, including elevations of foundations.

f. Changes made by Change Order or field order.

g. Details not on original drawings.

1.06 Specifications

A. Legibly mark each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Requests for Information (RFI), field order, clarification memorandums, or by change order.

3. Other matters not originally specified.

1.07 Submittal

A. At the completion of the work and prior to final acceptance by the OWNER, the CONTRACTOR shall deliver the Project Record Documents to the ENGINEER for the OWNER. The Project Record Documents shall be acceptable to the ENGINEER before final payment is made.

With the submittal of the Project Record Documents, the CONTRACTOR shall submit a list of each document submitted and a certification that each document as submitted is complete and accurate.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date

2. Project title and number

3. CONTRACTOR's name and address

4. Title and number of each record document

5. Signature of CONTRACTOR or CONTRACTOR's authorized representative

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

Part 1 General

1.01 Scope

A. This specification section covers all materials, equipment, and methods to be used by the CONTRACTOR in mixing, placing, testing, finishing, and curing cast-in-place concrete. The CONTRACTOR shall furnish all cement, aggregate, water, admixtures, and other materials, and all labor, equipment, and supplies necessary or convenient to him for completing the work described in these Contract documents. Cast-in-place concrete reinforcement and form work shall be as specified in the sections entitled "Concrete Reinforcing" and "Concrete Forming" respectively of these Specifications.

B. Related Work:

1. 013000 – Administrative Requirements

1.02 Classification of Concrete

Concrete shall be either Class A or Class B, as indicated on the Drawings or specified in these Specifications. If the class is not otherwise specified, the CONTRACTOR shall furnish Class A concrete. In general, Class A concrete shall be used for reinforced concrete cast-in-place in forms for slabs, footings, foundations, manholes, and similar reinforced concrete structures coming under the scope of ACI 318. Class B concrete shall be plain concrete and shall be used for pipe cradles, pipe and conduit encasement, bedding, grade correction, anchors, collars, thrust blocks, massive sections, and other non-reinforced concrete.

1.03 General Requirements

All cast-in-place concrete shall be accurately formed and properly placed and finished as shown on the Drawings and specified herein. The materials, aggregate grading, cement content, and placement methods specified herein are intended to provide a concrete that satisfies the minimum strength requirements, exhibits sufficient plasticity and cohesiveness to facilitate placement and reduce honeycombing and porosity, and incorporate a minimum water-to-cement ratio to minimize bleeding and shrinkage and to provide maximum water tightness. However, the CONTRACTOR may submit to the ENGINEER for review and approval alternate material requirements and placement techniques for achieving the desired results. All Class A cast-in-place concrete shall be designed in accordance with the applicable requirements of ACI 318, latest edition.

1.04 Preliminary Mix Design

A. Before starting any concreting operations, the CONTRACTOR shall submit to the ENGINEER for approval a preliminary mix design for each class of concrete and for each size and gradation of aggregate and each consistency within a given class of concrete intended for use in the work. The preliminary mix design submittals shall contain the following information for each (including those items listed in the latest ASTM designations, if different from those specified). Submit written report for each proposed concrete mix design to Engineer at least 15 days prior to start of concrete work. Do not begin concrete production until all concrete mix designs have been reviewed by and are acceptable to Engineer.

B. FINE AGGREGATE (Sample per ASTM D 75)

1. Source and type

2. Sieve analysis per ASTM C 136

3. Magnesium Sulfate soundness per ASTM C 88

4. Deleterious substance per ASTM C 117, C 123, and C 142

5. Saturated surface dry weight per cubic yard of concrete

6. Bulk specific gravity per ASTM 127

7. Fineness modulus as defined in ASTM C 125

C. COARSE AGGREGATE (Sampled per ASTM D 75)

1. Source and type

2. Sieve analysis per ASTM C 136

3. Abrasion loss per ASTM C 535

4. Magnesium Sulfate soundness per ASTM C 88

5. Deleterious substances per ASTM C 117, C 123, AND C 142

6. Saturated surface dry weight per cubic yard of concrete

7. Bulk specific gravity per ASTM 128

D. CEMENT (Sampled per ASTM C 183)

1. Manufacturer, type, and ASTM designation

2. Sacks per cubic yard of concrete

3. Total gallons of water per sack (or cubic foot) of cement

4. Compressive strength at seven (7) days per ASTM C 109

5. Chemical analysis per ASTM C 114

E. SLUMP per ASTM C 143

F. AIR CONTENT per ASTM C 231

G. UNIT WEIGHT per ASTM C 138

H. TIME TO INITIAL SET at 70 Degrees F. per ASTM C 403

I. COMPRESSIVE STRENGTH at seven (7), fourteen (14), and twenty-eight (28) days ages per ASTM C 192, and C 39. A total of nine (9) standard test cylinders shall be prepared and cured in the laboratory for each preliminary mix design, three (3) of which shall be tested each at seven (7), fourteen (14), and twenty-eight (28) day ages.

J. ADMIXTURES

1. Manufacturer, type, and ASTM designation

2. Dosage and point of introduction into the mix.

K. A preliminary mix design shall not be considered acceptable if the concrete resulting from that mix design does not produce an average twenty-eight (28) day compressive strength at least one-thousand-two-hundred pounds-per-square-inch (1,200 psi) higher than that required, unless a standard deviation for compressive strength testing has been established for the concrete supplier using the methods described

in ACI 214.

If a standard deviation has been established, the strength used as a basis for selecting concrete proportions shall exceed the required twenty-eight (28) day strength by the amounts given in ACI 318, Section 4.2.2.1, based on the appropriate value of the standard deviation. If a standard deviation is utilized, the CONTRACTOR or concrete supplier shall furnish written evidence to the ENGINEER that the standard deviation has been determined in accordance with the methods described in ACI 214. A written statement from an independent testing laboratory may be considered satisfactory evidence of compliance.

L. Tests for compressive strength and all sampling and testing of aggregate and cement shall be conducted in accordance with the specified ASTM standards by an independent testing laboratory acceptable to the ENGINEER. Alternately, when approved by the ENGINEER, testing of cement and aggregate may be conducted at the point of manufacture by reputable cement and aggregate suppliers who regularly provide such testing services by experienced, competent personnel.

M. Tests for slump, air content, unit weight, and time to initial set may be conducted by the concrete supplier, providing such tests are performed in accordance with the specified ASTM standards by experienced, competent personnel using proper equipment.

N. The CONTRACTOR shall submit with each preliminary mix design four (4) copies of certified laboratory or mill test reports on all aggregate and cement incorporated in the preliminary mix design and four (4) copies of certified laboratory test reports on the compressive strength of the resulting concrete. Test reports on aggregate and cement shall contain written evidence that clearly indicates that all cement and aggregate covered by the test reports conform in all respects to the applicable material requirements of this specification section.

Approval of the preliminary mix designs shall in no way be interpreted to relieve the CONTRACTOR of any responsibilities, duties, or obligations for providing concrete conform in to the requirements of this specification section. If, during the course of concreting operations, the CONTRACTOR desires to use an alternate mix design differing from the approved mix design in order to obtain a desired workability, density, strength, or uniformity, he shall submit to the ENGINEER for approval the information specified herein on the proposed alternate mix design prior to its use.

If, based on the result of laboratory or field tests conducted during concreting operations, concrete prepared according to an approved mix design fails to satisfy

the requirements of this specification section, the ENGINEER shall have the right to require that the CONTRACTOR develop and submit in the manner specified an alternate mix design that will provide concrete conforming to the requirements of this section.

The need for a change in mix design will be based on the ENGINEER'S statistical analysis and interpretation of laboratory and field tests conducted during concreting operations. Statistical methods and interpretation of test results will be as described in ACI 214, and ACI 318, latest edition. Any increased material costs resulting from changes in mix designs during construction shall be paid for by the CONTRACTOR and no separate payment will be made.

O. The cost of all materials, labor, equipment and all sampling and testing services required for the preliminary mix designs or for alternate mix designs during construction shall be paid for by the CONTRACTOR and no separate payment will be made.

1.05 Quality Control During Construction

A. CERTIFICATION OF MATERIAL COMPLIANCE – During concreting operations, the CONTRACTOR shall furnish the ENGINEER written evidence that clearly indicates that the cement and aggregate used in each batch of concrete delivered to or mixed at the job site conforms in all respects to the applicable material requirements of this specification section. Satisfactory certified mill test reports from the cement or aggregate supplier may be considered as evidence of compliance provided that such testing is performed in accordance with the specified ASTM standards by experienced, competent personnel on a regular basis.

In case of doubt as to the adequacy or accuracy of mill tests, the ENGINEER may require that the CONTRACTOR furnish, at no additional cost to the OWNER, test reports on the cement and aggregate from an independent testing laboratory acceptable to the ENGINEER. Certified reports or certificates indicating compliance of cement and aggregate shall be submitted to the ENGINEER before such materials are incorporated into the work. The CONTRACTOR shall be responsible for any delays in the progress of the work due to delays in testing and reporting.

Certified reports submitted to the ENGINEER for laboratory or mill tests on cement and aggregate shall be based on tests conducted not earlier than ninety (90) days prior to incorporation of these materials into the work. The cost of all sampling and testing of cement and aggregate necessary to furnish satisfactory evidence of

compliance shall be borne by the CONTRACTOR and no separate payment will be made.

B. FIELD SAMPLING AND TESTING - During concreting operations, the ENGINEER will periodically require additional field inspection, sampling, and testing of cement, aggregate, and/or concrete by an independent testing laboratory in order to determine if the requirements of this specification section are being satisfied. Field sampling and testing of cement, aggregate, and concrete will be performed according to the following latest ASTM Standards at a frequency determined by the ENGINEER.

1. AGGREGATE

   a. Sampling - ASTM D 75

   b. Testing - Any test specified in ASTM C 33

2. CEMENT

   a. Sampling - ASTM C 183

   b. Testing - Any test specified in ASTM C 150

3. CONCRETE

   a. Sampling - ASTM C 172

   b. Slump Test - ASTM C 143

   c. Air Content Test - ASTM C 231

   d. Making and Curing Test Cylinders - ASTM C 31

   e. Compression Strength Tests - ASTM C 39

C. Compressive strength testing will consist of making, curing, and testing cylinders of concrete. A total of four (4) test cylinders will be prepared from each sample of concrete to be tested. Two (2) test cylinders will be broken at an age of seven (7) days; two (2) test cylinders will be broken at an age of twenty-eight (28) days. The minimum number of samples and test cylinders to be taken is as follows:

Concrete Class	Total Size of Pour	Number of Samples	Number of Cylinders
Class A	1 to 4 cu. yds.	1	4
Class A or B	4 to 100 cu. yds.	1	4
Class A or B	101 to 200 cu. yds.	2	8
Class A or B	201 to 300 cu. yds.	3	12
Class A or B	Over 300 cu. yds.	1/100 cu. yd.	4/100 cu. yd.

D. Test cylinders will normally be laboratory-cured. However, the ENGINEER may require tests on field-cured specimens to check the adequacy of curing operations. A slump test and an air content test will be performed on each sample of concrete tested for compressive strength.

E. Cement and aggregate will be subject to inspection, sampling, and field testing at the batching plant. Concrete will be subject to inspection, sampling, and field testing at the place of concrete placement. All field sampling, field testing, making, and curing of field test cylinders, and laboratory testing performed during concreting operations for the purpose of determining if the requirements of this specification section are being satisfied shall be conducted by an independent testing laboratory selected by the OWNER and paid for directly by the OWNER and not as a part of this Contract.

F. The CONTRACTOR shall furnish the testing laboratory representative satisfactory samples of cement, aggregate, and concrete for inspection and testing purposes. The CONTRACTOR shall furnish any barrows, shovels, mixing boards, shaded area for preparing test cylinders, and similar equipment required by the testing laboratory representative for securing samples, making test cylinders, and conducting field tests. No materials or concrete which fail to conform to the requirements of this specification section shall be incorporated into the work.

1.06 Shop Drawings and Engineering Data

Complete ENGINEERING and product data shall be submitted to the ENGINEER on all admixtures, curing compounds, hardeners, sealers, and waterstops in accordance with the requirements of *Section 013000 – Administrative Requirements* of these Specifications.

Part 2 Products

2.01 General

Concrete shall be composed of Portland Cement, fine aggregate, coarse aggregate, admixtures as specified herein, and water, so proportioned and mixed as to produce a plastic, workable mixture meeting the requirements of this specification section. Materials and concrete not conforming to the requirements specified herein shall not be incorporated in the work.

2.02 Materials

A. Cement shall be standard Portland Cement, of American manufacture, conforming to ASTM C 150, Type I. Only one brand of commercial Portland cement shall be used in the exposed concrete of the structure. Cement reclaimed by cleaning bags or from leaking containers shall not be used in this work. Each bag shall weigh approximately ninety-four pounds (94 lbs) and contain one cubic foot (1 ft^3).

B. Fine aggregate shall be natural siliceous river sand, consisting of hard, clean, sharp, strong, durable, and uncoated particles, conforming to the requirements of ASTM C 33. The mortar strength developed in such test shall be ninety percent (90%) of that developed by standard Ottawa sand tested under identical conditions. Fine aggregate shall be graded in conformance with the requirements of ASTM C 33, except that it shall have a fineness modulus of 2.40 minimum and 3.00 maximum and the material passing the No. 200 sieve shall not exceed 3.0 percent by weight of the total sample.

Coal and lignite shall not exceed 0.5 percent by weight of the total sample for all concrete. The fineness modulus of fine aggregate incorporated in the work shall not vary more than 0.10 plus or minus from the fineness modulus of the fine aggregate in the appropriate preliminary mix design approved by the ENGINEER. If the locally available sources of fine aggregate will not yield the required grading, the ENGINEER may approve alternate gradations if such deviations do not adversely affect the work. However, the amount retained on any individual sieve size shall not exceed thirty-five percent (35%) of the sample and the amount passing the No. 50 sieve shall not be less than fifteen percent (15%) of the sample.

C. Coarse aggregate shall consist of clean, natural, washed gravel or crushed stone, suitably processed and conforming to the requirements of ASTM C 33, Class Designation 3S. Coarse aggregate as delivered to the mixing plant shall be graded, or individual sizes shall be so combined as to fall within the grading requirements corresponding to the following grading size numbers, as contained in Table 2 of ASTM C 33:

Maximum Aggregate Size (Inches)	**Grading Size No.**
3/4	67
1	57
1 - 1/2	467
2	357

The maximum size of aggregate shall be no larger than one-fifth (1/5) of the narrowest dimension between sides of forms within which concrete is to be cast nor larger than three-fourths of the minimum clear spacing between reinforcing bars, or between bars and forms. Coarse aggregate shall be limited to three-fourth inch (3/4") maximum size for pumped concrete.

D. Water used in mixing concrete shall be fresh, clean, potable water free from injurious amounts of oil, acid, alkali, vegetable, sewage, and/or organic matter. Water shall be considered as weighing 8.36 pounds per gallon.

E. Admixtures – All concrete shall contain an air entraining admixture conforming to ASTM C 260 in order to provide an entrained air content of five percent (5%) plus one percent (1%) by volume. Air entraining admixtures shall be W. R. Grace "Darex AEA", Master Builders "MB-VR", Protex "AES", Sika "AEA", or equal.

All concrete shall contain a chloride-free, water reducing admixture or plasticizer conforming to ASTM C 494, Type A. Water reducing admixtures shall be W. R. Grace "WRDA-HC", Sika "Plastocrete", Gifford-Hill "PSI Normal", Master Builders "Pozzolith Normal", Chem-Masters "WR-77", or equal.

Accelerators and retarders may be used under adverse placement conditions when authorized in writing by the ENGINEER. Accelerators shall be Calcium Chloride conforming to ASTM D 98, dispensed as a solution. Calcium Chloride content shall not exceed one percent (1%) of the cement content by weight. Retarders shall be Chloride-free water reducing and retarding admixtures conforming to ASTM C 494, Type D. Retarders shall be W. R. Grace "Daratard-HC", Sika "Plastiment", Protex "Protard", Gifford-Hill "PSI Retarder", Master Builders "Pozzolith Retarder", or equal.

The admixture content, batching method, and time of introduction into the mix shall be in strict accordance with the manufacturer's recommendations.

F. FORMING MATERIALS

Provide form materials with sufficient strength and stability to withstand the pressure of placed concrete without excessive bow or deflection.

1. Exposed Concrete Surfaces: Materials suitable to project conditions.

2.03 Membrane Curing Compound

Membrane curing compound shall have a one-hundred percent (100%) resin base and shall be of the colorless type with a fugitive dye added conforming to ASTM C 309, Type I, Class B. The membrane curing compound shall contain sufficient dye to produce a definite, distinguishing color. Curing compound shall be compatible with liquid hardeners and epoxy sealers. Membrane curing compound shall be Protex "LR-151", Sonneborn "Hydrocide-309", W. R. Grace "Horncure 30D", Chem-Masters "Kurex 3", or equal.

2.04 Polyethylene Film

Polyethylene film shall conform to Product Standard PS 17 and, unless otherwise specified or shown on the Drawings, shall have a thickness of six (6) mils.

2.05 Epoxy Bonding Agent

Epoxy bonding agents shall be specially formulated to bond fresh concrete to existing concrete. Epoxy bonding agents shall be two (2) component polysulfide or polyamide epoxies containing one-hundred percent (100$) solids. Epoxy bonding agents shall be insensitive to moisture during cure. When cured at a temperature of sixty-three degrees Fahrehnheit (63° F), neat epoxy bonding agent shall have a one (1) day compressive strength of not less than five-thousand pounds-per-square-inch (5,000 psi) and a twenty-eight (28) day compressive strength of not less than twelve-thousand pounds-per-square-inch (12,000 psi), when tested in accordance with ASTM D 695, and shall have a twenty-eight (28) day tensile strength of not less than three-thousand-five-hundred pounds-per-square-inch (3,500 psi), when tested in accordance with ASTM D 638.

2.06 Waterstops

Waterstops shall be manufactured of polyvinyl chloride (PVC) and shall be of the ribbed type with center bulb. Waterstops shall have a nominal width of six inches (6”) and shall be as manufactured by W. R. Meadows, Vulcan Metal Products, W. R. Grace, or equal. Waterstops

placed in concrete shall be continuous. Lapped joints shall not be permitted.

2.07 Chemical Hardener

Unless otherwise specified, all interior concrete floors of shops, garages, and vehicle service areas shall be treated with a liquid hardener composed of Magnesium and Zinc fluorosilicates, combined with an anionic surfactant for improved wetting penetration. Liquid hardener shall be colorless, nontoxic, nonflammable, and compatible with and providing good adhesion for subsequent toppings and/or coatings. Liquid hardener shall be suitable for use on new or old concrete floors and shall comply with Corps of Engineer Specification 204. Liquid hardener shall be Sonneborn "Lapidolith", Protex "Lithoplate", L & M "Fluo Hard", or equal.

2.08 Epoxy Floor Sealer

Epoxy floor sealer shall be a two (2) component, one-hundred percent (100%) solids, epoxy coating that provides a smooth, tough, flexible, wear abrasion, and chemical resistant surface. Epoxy floor sealer shall be applied only where shown on the Drawings. Sealer shall be U.S.D.A. approved for use in food processing plants. Unless otherwise specified, sealer shall be colored gray. Epoxy sealer shall be Chem-Masters "Durakote", Sonneborn "Sonoplex", L&M "Dynaflor", or equal.

2.09 Wet-well and Rectangular Concrete Chamber Interior Coatings

Unless otherwise specified, all interior concrete shall be coated with Sherwin-Williams Hi-Solid Catalyzed Epoxy – white B62W01 epoxy system, or equal, and shall be applied according to Manufacturer’s recommendations.

2.10 Vapor Barrier

Unless otherwise specified, all interior concrete slabs on grade in buildings shall be furnished with an FHA approved vapor barrier under the concrete slab. Vapor barrier shall be constructed of a multi-ply lamination of polyethylene film and glass scrim reinforced paper to form a moisture, scuff, and puncture resistant membrane. Moisture permanence shall not exceed 0.10 perms in accordance with ASTM E96, Procedure A. Vapor barrier shall be St. Regis Paper Company "Moistop", Glas-Kraft "Plybar", or equal.

2.11 Strength

Concrete ingredients shall be selected, proportioned, and mixed in such a manner as will produce a watertight durable concrete that will develop the following minimum compressive strengths at an age of twenty-eight (28) days when sampled, cured, and tested in accordance with the procedures specified in ASTM C 31 and C 39:

Concrete Class	Age	Average of Three Consecutive Samples	Minimum Any One Specimen
Class A	28 days	4,000 psi	3,500 psi
Class B	28 days	2,500 psi	2,000 psi

Should the average compressive strength of three (3) consecutive specimens or the compressive strength of any single specimen fall below the minimum strengths specified above, the ENGINEER shall have the right to order a change in the mix design for the remaining portion of the work. The ENGINEER shall also have the right to order additional curing of the affected concrete followed by cores taken in accordance with ASTM C 42 and ACI 318, all at the expense of the CONTRACTOR.

If the additional curing does not bring the average compressive strength of three (3) cores taken in the affected area to at least the minimum strength specified, the ENGINEER may require that the CONTRACTOR strengthen the structure by means of additional concrete and steel or he may require that the CONTRACTOR replace the affected portions. The cost of all such changes in mix designs and any modifications to or replacement of deficient concrete shall be borne by the CONTRACTOR at no additional cost to the OWNER.

2.12 Consistency

Concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around the reinforcement without excessive spading and without permitting the materials to segregate or free water to collect on the surface. When dropped from the discharge chute, the concrete mass should flatten out at the center and spread out slowly at the edges.

The proportions shall be adjusted to secure the lowest water-cement ratio which is consistent with good workability, a plastic cohesive mixture, and one which is within the following slump range as determined in accordance with ASTM C143:

Concrete Use	Slump in Inches
Wall	2-1/2 to 4

Floors and Slab	2 to 3
Beams	2 to 3
Blocks and Footings	2 to 4

Concrete having a slump greater than one inch (1") over the specified maximum shall be rejected. In pumped concrete, the maximum slump of the concrete at the suction of the pump may be increased above the maximum specified slump by the amount of slump loss in the pumping system up to a maximum of one inch (1"). The amount of slump loss shall be the difference between slump tests made at both ends of pumping system, and shall be limited to a total loss of one inch (1").

If tests indicate a loss greater than one inch (1"), the CONTRACTOR shall take corrective measures acceptable to the ENGINEER. For thin sections and construction with limited clearance between reinforcing steel and when placement conditions preclude the use of vibrators, the ENGINEER may authorize the use of concrete having a slump of five inches (5").

Part 3 Execution

3.01 Storage of Materials

Cement shall be shipped to the site of the mixer plant in bulk or in paper or cloth bags, at the option of the CONTRACTOR. Upon arrival, it shall be stored immediately in a thoroughly dry, weather-tight, and properly ventilated building or enclosure with adequate provisions for the prevention of absorption of moisture. It shall be stored in a manner that will permit easy access for inspection and identification of each shipment. If cement is to be stored at the job site, storage facilities shall be provided by and at the expense of the CONTRACTOR and approved by the ENGINEER, prior to arrival of the first shipment. Cement which has become caked or lumpy shall not be used.

Sand and coarse aggregates shall be stored in separate stockpiles at points selected to provide maximum drainage and to prevent the inclusion of a foreign material during re-handling. Stockpiles of coarse aggregates shall be built in horizontal layers to avoid segregation and breakage. Where concrete volumes require batching of various aggregate sizes, a separate stockpile for each size shall be maintained. The bottom six inches (6") of aggregate piles shall not be used.

3.02 Proportioning

Concrete materials shall be accurately proportioned and mixed to produce a homogeneous and workable mixture having the consistency and minimum compressive strength specified herein. Concrete materials shall be proportioned by weight. The types of equipment and methods used for measuring ingredients shall be acceptable to the ENGINEER. The amount of water and cement used shall be the minimum amount necessary to produce a concrete mixture of the required strength and consistency, but in no case shall the water-to-cement ratio exceed that specified herein nor shall the cement content be less than that specified herein.

Compressive strength may not necessarily be the most critical factor in proportioning concrete mixes since other factors, such as durability and water tightness, may impose lower water-cement ratios than are required to meet strength requirements. In such cases compressive strength will, of necessity, be in excess of that specified. Minimum cement contents and maximum water-to-cement ratios shall be as follows:

Factor	**Class of Concrete**	**Maximum Aggregate Size**			
		2”	**1-1/2”**	**1”**	**3/4"**
Minimum Cement Factor, Sacks /cu yd	A	5.3	5.8	6.2	6.6
	B	5.0	5.5	5.9	6.3
Maximum Water-to-Cement Ratio, lb/lb	A	0.49	0.49	0.49	0.49
	B	0.62	0.62	0.62	0.62
Maximum Water-to-Cement Ratio, gal/sack	A	5.5	5.5	5.5	5.5
	B	7.0	7.0	7.0	7.0

The water content of the mix shall be based on the total amount of water in the mixture, including any free water in the aggregate or adhering to the surface of the aggregate, but not including water absorbed by the aggregate. The total volume of aggregate to be used in each cubic yard of concrete shall be determined by recognized standards for designing concrete mixes, utilizing the actual screen analysis of the aggregates. The proportion of fine and course aggregate shall be such that the ratio of the course to the fine based on weight shall not be less than 1.0 nor more than 2.0, nor shall the amount of coarse material be such as to produce harshness in placing or honeycombing in the structure.

Mix designs may be adjusted when material characteristics, job conditions, weather, test results or other circumstances warrant. Any adjustment shall produce the lowest water-cement ratio which is consistent with good workability and produces a plastic cohesive mixture. Do not use revised mix designs until all revisions have been reviewed by and are

acceptable to Engineer.

Use air-entraining admixtures in all concrete. Provide not less than four percent (4%) nor more than eight percent (8%) entrained air for all concrete exposed to freezing and thawing conditions; and, from two percent (2%) to four percent (4%) for all other concrete.

3.03 Mixing Concrete

The mixing equipment used by the CONTRACTOR shall be capable of combining the aggregates, cement, admixtures, and water within the time specified into a thoroughly mixed and uniform mass. Concrete shall be mixed by one of the three following methods: (1) by the operation of one or more batch-type mixing plants, each with a rated capacity of one-half cubic yard (1/2 CY) or more, installed at the site of the work; (2) by the operation of a proportioning plant installed in the vicinity of the work and the use of transit mixers for mixing concrete and transporting it to the forms; or (3) by the use of ready-mixed concrete from a central mixing and proportioning plant.

The method selected by the CONTRACTOR shall be subject to the approval of the ENGINEER. The mixing and proportioning plants shall be provided with adequate equipment and facilities for accurate measurement and control of the quantities of material and water used in the concrete and for readily changing the proportions to conform to the varying conditions and requirements of the work.

A. STATIONARY MIXED CONCRETE - Stationary mixing shall be done in a batch mixer of approved type which will ensure a uniform distribution of the materials throughout the mass. The equipment at the mixing plant shall be so constructed that all materials including the water entering the drum can be accurately proportioned and be under control. The cement and aggregate shall be proportioned by weight. No volumetric batch shall be allowed.

   The mixer shall be equipped with an automatic timing device made to lock the discharge level before aggregate and cement enter the drum, and to release such level only after the specified mixing time has elapsed. Stationary mixers shall be in accordance with the "Concrete Mixer Standards" adopted by the Mixer Manufacturer's of the Associated General CONTRACTORS of America and shall bear a plate giving the manufacturer’s rated capacity of the mixer.

   The entire batch shall be discharged before recharging. The volume of the mixed material per batch shall not exceed the manufacturer’s rated capacity of the mixer. Mixing of each batch shall continue for the period indicated herein, during which time

the drum shall rotate at a peripheral speed as recommended by the manufacturer.

The mixing time shall be as follows:

Capacity of Mixer	Mixing Time in Minutes
1/2 cubic yards	1-1/4
3/4 to 1-1/2 cubic yards	1-1/2
Larger than 1-1/2 cubic yards	2

The mixing time shall be measured from the time that all cement and aggregates and most of the water are in the mixer. Excessive over mixing, requiring additional water to preserve the required consistency will not be permitted. All of the mixing water shall be introduce before one-fourth (1/4) of the total mixing time has elapsed.

B. TRANSIT MIXED CONCRETE - The type, capacity, and manner of operation of the mixing and transporting equipment for transit ready-mixed concrete shall conform to the current "Standards for Operation of Truck Mixers and Agitators of the National Ready-Mixed Concrete Association," the "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau," and ASTM C94.

Transit mix concrete trucks shall be equipped with an automatic device for recording the number of revolutions of the drum during the mixing period. Each mixer and agitator shall have attached thereto in a prominent place, a metal plate or plates, installed by the manufacturer, on which is plainly marked the capacity of the drum in terms of the volume of mixed concrete and the speed of rotation for the agitating and mixing speeds of the mixing drum or blades. Each mixer shall have identification number painted on the truck in such a location that it can be easily read from the batching platform.

The total volume of materials introduced into the mixer shall not exceed the manufacturer's guaranteed mixing capacity. If the concrete so mixed does not meet the uniformity requirements of this subsection, the amount of materials charged into the mixer shall be reduced. The drum of the mixer shall be completely emptied of any previously mixed load. The proper proportions of aggregate, cement, and water for each load of concrete shall be placed in the mixer and shall be mixed therein for not less than seventy (70) nor more than one-hundred (100) revolutions of the drum or blades at the speed designated by the manufacturer of the equipment as the mixing speed. Additional revolutions of the drum shall be at the speed designated by the manufacturer of the equipment as the agitating speed; however, immediately prior to

discharging the concrete, the drum shall be revolved at the mixing speed for a minimum of three (3) minutes.

The revolving of the drum shall be continuous until the concrete is completely emptied from the drum. When Class A concrete is being placed, all wash water shall be emptied from the mixer before any portion of the succeeding load is placed therein. For Class B concrete the mixer shall be empty or may carry no more than ten (10) gallons of water in the drum. Water added at the point of discharge shall only take place with the approval and in the presence of the ENGINEER. Water so added shall be mixed into the load for a minimum mixing time of three (3) minutes.

Water shall not be added to the load during the transit. The total elapsed time between the addition of water to the cement and aggregate or the addition of cement to the water and aggregate and the placement of the concrete in the forms shall not exceed ninety (90) minutes. During hot weather or conditions contributing to quick setting, the total elapsed time permitted may be reduced at the direction of the ENGINEER to forty-five (45) minutes. When the concrete cannot be delivered to the forms within the time period specified, a water-reducing and retarding admixture may be used subject to the approval of the ENGINEER. Such use of a water reducing retarder will be permitted only as necessary to supplement (not to replace) other acceptable hot weather procedures.

The retarding admixture used shall not interfere with strength development and other properties of the concrete and its use shall be carefully controlled by the concrete supplier. Before any such admixture is permitted, it shall be tested with job site materials under job conditions to determine its compatibility with the other materials and its ability under these conditions to produce the desired properties.

Addition of water at the job site to offset evaporation of mixing water shall be done with the ENGINEER'S approval and in his presence using water in the form of a cement paste having the same water-to-cement ratio as the batch in the transit mixer. Following addition of the cement paste, the mixer drum or blades shall be rotated a minimum of seventy (70) revolutions. Addition of water during transit to offset evaporation losses shall not be permitted.

Prolonged mixing, even at agitating speed, shall be avoided where feasible by stopping the mixer and then agitating intermittently. A legible certified weigh master's certificate shall be prepared for each load of ready-mixed concrete. A legible copy of the certified weigh master's certificate shall be submitted to the ENGINEER by the truck operator at the time of delivery. The weigh master's certificate shall contain the following information:

1. Name of Vendor

2. Name of CONTRACTOR

3. Number of cubic yards in the load

4. Actual weights of cement and of each size of aggregate in the load

5. Amount of water added at the plant

6. Amount of free water in the aggregate

7. Brand and type of cement

8. Brand and amount of admixture

9. Time and date of batching

C. When mix proportions have been approved for a project and are identified by a mix number, the ENGINEER may waive the foregoing and accept a legible certified weigh master's certificate which shall contain the following information:

1. Name of Vendor

2. Name of CONTRACTOR

3. Number of cubic yards in the load

4. Mix designation number

5. Amount of water added at the plant (including free water in aggregate)

6. Time and date of batching.

Space shall be provided on the certificate so that amount of water and cement added on the job may be indicated.

3.04 Conveying Concrete

A. Concrete shall be conveyed from mixer to place of final placement by methods which will prevent separation or loss of the material.

B. If the concrete is to be transported more than fifty feet (50') in carts or buggies, they shall be equipped with pneumatic tires.

C. Concrete delivered to the carts, buggies or conveyors from spouts, troughs, or mixer trucks shall not have a free fall of more than three feet (3'). Separation or loss of ingredients shall be prevented while transporting the concrete.

D. Delivery carts, buggies, conveyor trucks or barrows shall be kept on temporary runways built over the floor system. Runway supports shall not bear upon reinforcing steel or fresh concrete.

3.05 Placing Concrete

A. GENERAL – Prior to placing concrete, the CONTRACTOR shall ensure that all reinforcement is securely and properly fastened in position and protected against displacement, that all items to be embedded in the concrete are in place and securely anchored in position, that all forms have been thoroughly coated or wetted, that all form ties at construction joints have been retightened, that concrete surfaces to be covered have had all free water, form coating, loose concrete, and debris removed, and that all conveyances, buggies, and barrows are clean and wetted.

The CONTRACTOR shall inform the ENGINEER at least twenty-four (24) hours in advance of the times and places at which he intends to place concrete. The ENGINEER will make a final inspection of forms, reinforcing steel, screeds, construction joints, openings, anchors, pipe sleeves, conduit, and inserts. No concrete pour shall be started until the condition of the forms and place of pouring has been inspected and approved by the ENGINEER.

Accurately position, support and secure reinforcing against displacement. Support reinforcing with non-corrosive or plastic coated metal chairs, runners, bolsters, spacers and hangers located at sufficient frequency to limit reinforcing deflection between supports to a maximum of three-eighth inches (3/8").

Install welded wire fabric in as long lengths as practicable, lapping at least eight inches (8") with transverse wires overlapping by at least two inches (2").

Concrete shall not be placed when the sun, wind, heat, or humidity prevents proper

placement and consolidation. No water or cement shall be added to the mix without the ENGINEER'S approval or in his absence. No partially hardened concrete shall be deposited.

B. PLACING CONCRETE – Comply with ACI 318, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.

Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, in continuous vertical motions, so that concrete is worked around reinforcing and other embedded items and into forms.

Do not transport any concrete within forms by using vibration equipment. Transport of concrete within forms shall be performed only by hand spading as necessary.

Protect concrete from physical damage or reduced strength due to hot or cold weather extremes during mixing, placement and curing.

Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces, free from water, and never upon soft mud, dry absorbent earth or rock, or upon fills that have not been subjected to approved tamping to provide ultimate settlement. Groundwater shall be kept below subgrade until the concrete has set. When subgrade is dry earth, it shall be thoroughly dampened with water to ensure that no moisture will be absorbed from fresh concrete.

Where concrete is placed against gravel or crushed rock which does not contain at least twenty-five percent (25%) of the material passing a No. 4 sieve or where shown on the Drawings or directed by the ENGINEER, surfaces against which concrete is cast shall be covered with polyethylene film to protect the concrete from loss of water. Joints in the film shall be lapped at least twelve inches (12”) and taped. The polyethylene film shall be protected against puncture from the underlying crushed rock by a cushion of natural or imported sand meeting the requirements of ASTM D 1073 placed on top of the crushed rock. Where concrete is placed against rock, all loose pieces of rock shall be removed and the exposed surface cleaned with a high pressure hose.

Place vapor barrier under designated interior concrete slabs on grade. Sheeting shall extend the full area of the slab and shall be turned up or down to footings as indicated. Lap all seams at least twelve inches (12”) and seal per manufacturer's instructions. Install reinforcement with care so as not to puncture vapor barrier. Tape all cuts, tears, punctures, and pipe penetrations before pouring concrete.

To prevent segregation of the mix, concrete shall be deposited in its final position in batches without being moved laterally in the forms more than five feet (5'). A crane and a bottom dump concrete bucket shall be used wherever possible. Unless authorized by the ENGINEER, no concrete shall be dropped freely into place from a height of greater than five feet (5'). Concrete shall be deposited in walls by means of prefabricated, rectangular tremies, constructed in short sections and spaced laterally not over five feet (5') apart.

Special care shall be observed to avoid slopping concrete over forms when placing. The limits of each concrete pour shall be predetermined by the CONTRACTOR and shall be acceptable to the ENGINEER. All concrete within such limits shall be placed in one continuous operation. After the concrete has been deposited, it shall be distributed over the entire area within the forms in approximately horizontal layers of not more than eighteen inches (18") in depth and shall be brought up evenly in all parts of the form.

Each layer of concrete shall be plastic when covered with the following layer and the forms shall be filled at a rate of vertical rise of not less than two feet per hour (2'/hr) nor more than six feet per hour (6'/hr). Should a layer of concrete reach its initial set before the next lift can be placed or should more than sixty (60) minutes elapse between placement of successive concrete lifts, the CONTRACTOR shall cease placement of concrete until the surface of the previous lift is prepared in accordance with the procedures specified in Part 3.08, Construction Joints, of this specification section.

Workmen shall not walk on concrete during placing or finishing with any earth or foreign matter on footgear. Hand spreading shall be done with forks and shovels, not rakes. Concrete shall be placed and compacted in wall or column forms before any reinforcing steel is placed in the structural system to be supported by such walls or columns. The portion of any wall or column placed monolithically with a floor or roof slab shall not exceed six feet (6') of vertical height. Concrete in walls or columns shall set at least two 2) hours before concrete is placed in the structural systems to be supported by such walls or columns. Brackets, haunches and fillets shall be poured monolithic with the floor or roof slab system.

C. COMPACTION - During and immediately after placement, concrete shall be thoroughly compacted and worked into all corners and angles, and around reinforcement and embedded fixtures in a manner to fill all voids, prevent honeycombing against the forms and avoid segregation of coarse aggregate. This operation shall be performed by the use of spades or forks and internal vibrators.

Vibration shall be transmitted directly to the concrete and in no case shall it be transmitted through the forms. Vibrator driving mechanisms shall revolve at not less than seven-thousand revolutions-per-minute (7,000 rpm).

The vibration shall be sufficiently intense to cause the concrete to flow and settle readily into place and to visibly affect the concrete over a radius of at least eighteen inches (18”). Vibration shall be supplemented by manual forking or spading adjacent to the forms on exposed faces in order to secure smooth, dense surfaces. Special care shall be taken to ensure consolidation around reinforcement, pipes and other shapes built into the work. Vibrators shall be kept in motion at all times to prevent excessive vibration in one spot. The operation shall be continuous and all concrete shall be in final position before initial set has started. In addition to the vibrators in actual use while concrete is being placed, the CONTRACTOR shall have on hand at least one operable vibrator as a spare in case of equipment failure.

No concrete shall be placed until all vibrating equipment, including spares, is at the placement site. Concrete shall be thoroughly compacted prior to top finishing. All laitance, debris, and surplus water shall be removed from concrete surfaces at tops of forms by screeding, scraping, or other effective means. Wherever the top of a wall will be exposed to weathering, the forms shall be overfilled and after the concrete has been compacted, the excess shall be screeded off.

D. PLACEMENT SEQUENCE - Unless otherwise indicated on the Drawings or directed by the ENGINEER, the following placement sequence shall be followed to reduce the effect of shrinkage in producing cracking:

1. BOTTOM SLAB - A center section (as outlined by the construction joints shown on the Drawings) shall be placed first. Not less than seventy-two (72) hours after the center section has been placed, the Contractor may proceed with the placement of an adjoining section. Sections shall be placed alternately, first on one side and then on the other side of previously placed sections. Pours shall be scheduled so that two (2) adjacent sides of each section are free, except at closures.

2. WALLS - Walls shall be divided into sections by the construction joints shown on the Drawings. A section near the center of each wall shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of the previously placed section. Pours shall be schedule so that one (1) end of each section is free, except at corner closures.

3. FOOTINGS - Footings, except for wall footings, shall be poured in one operation with no joints.

E. REQUIREMENTS DUE TO ADVERSE WEATHER CONDITIONS – No concrete shall be placed during rain. No concrete shall be placed if rain is forecast, unless there is sufficient time to complete the placement and finishing. All concrete placed prior to rain shall be protected by whatever means necessary to prevent damage to finish or water entering the mix. Protection equipment and materials shall be on hand prior to placement operations.

Freshly placed concrete shall be protected from scour by flowing water and from mud deposits or other injurious conditions. Except as modified herein, cold weather concreting shall comply with ACI 306. The temperature of concrete at the time of placing shall be not less than shown in the following table for the corresponding ambient outdoor air temperature (in shade) existing at the time of placement:

Ambient Outdoor Air Temperature	**Minimum Concrete Temperature**
Below 35 Degrees F.	70 Degrees F.
Between 35 and 45 Degrees F.	60 Degrees F.
Above 45 Degrees F.	45 Degrees F.

Placing of concrete when the ambient air temperature at the time of placement is forty-five degrees Fahrenheit (45° F) or less shall be done only when specifically authorized by the ENGINEER using concrete heated in a manner acceptable to the ENGINEER. If the use of heated concrete is authorized, the temperature of the concrete at the time of placement shall not exceed eighty degrees Fahrenheit (80° F). Adequate means shall be provided for maintaining the temperature of the air surrounding the concrete at seventy degrees Fahrenheit (70º F) for three (3) days, or fifty degrees Fahrenheit (50º F) for five (5) days, or for as long as is necessary to ensure proper curing of the concrete.

Rapid cooling of the concrete shall be prevented. Housing or covering or other protection used in connection with heating shall remain in place and intact at least twenty-four (24) hours after the artificial heat is discontinued. The use of Calcium Chloride or other chemicals to prevent freezing shall not be permitted. Except as modified herein, hot weather concreting shall comply with the requirements of ACI 305. Hot weather precautions shall be taken whenever the maximum ambient outdoor air temperature (in shade) during the day exceeds eighty-five degrees Fahrenheit (85° F).

When rapid mixing water evaporation in transit causes the concrete to be delivered in an unworkable condition, initial correction may be made at the job site, provided that water added is in the form of cement paste having the same water-to-cement ratio as the batch in the truck, and provided that the drum or mixer blades be operated at mixing speed for at least seventy (70) revolutions after the paste addition. Once need for water has been observed, subsequent additions shall be at the batching plant until the need has passed.

Correction shall consist of a simultaneous and proportionate increase of water and cement, up to ten percent (10%) of the stated quantity of each material in the bath. Such increases in cement shall not constitute grounds for an increase in the Contract Price. The temperature of concrete at the time of placement shall not exceed eighty-five degrees Fahrenheit (85° F).

During hot weather, extra caution shall be taken to prevent rapid evaporation of water. Forms shall be kept cool by frequent wettings. Flat work shall be protected from drying winds, direct sun, and high temperatures whenever conditions of temperature and humidity are such as to cause plastic shrinkage cracking. In order to prevent plastic shrinkage cracking due to rapid evaporation of moisture, no concrete shall be placed when the rate of evaporation, determined by using Figure 2.1.4 in ACI 305, equals or exceeds 0.2 pounds per square foot per hour (0.2 lbs/ft^2/hr).

3.06 Finishing

A. FINISHING FORMED SURFACES – All permanently exposed surfaces shall be expected to be smooth and of uniform texture and appearance. Surfaces to be rubbed shall include all submerged concrete surfaces that can be seen when water is drained. Rubbing may be omitted for minor blemishes on buried surfaces or on exposed surfaces that cannot normally be seen, such as inside covered tanks. Final determination for which surfaces are to be rubbed is to be the decision of the ENGINEER.

All holes, pits, or imperfections in the surface of the concrete shall be cleaned with a wire brush, thoroughly wetted and completely filled with damp cement mortar composed of (one) 1 part Portland Cement to two (2) parts fine aggregate. The entire surface shall be left smooth and all lines or markings shall be smoothed over to obtain uniform appearance.

In the event the CONTRACTOR fails to obtain a satisfactory appearance of the

concrete in the opinion of the ENGINEER, the entire surface shall be thoroughly wetted down, kept wet continuously, and rubbed with a No. 20 Carborundum stone until all lines, markings, and surplus materials have been removed from the surface, and until the surface shows a uniform smooth finish. After rubbing is completed, the concrete surface shall be washed clean with water. Rubbing may be done either by hand or with power tools.

B. FINISHING UNFORMED SURFACES – No surface treatment will be required for buried or permanently submerged concrete not forming an integral part of a structure, except that required to obtain the surface elevations or contours and surfaces free of laitance. The unformed surfaces of all other concrete shall be screeded and given an initial float finish followed by additional floating followed by troweling where required. Care shall be taken that no excess water is present when the finish is made. No special concrete or cement mortar topping course shall be used unless so shown on the Drawing.

1. SCREEDING – All slabs shall be screeded to an even surface by the use of a straight edge and screeding strips accurately and securely set to the proper level. Screeds shall be such type and so arranged so as not to interfere with the top bar reinforcement. Screeding shall provide a concrete surface conforming to the proper elevation and contour with all aggregates completely embedded in mortar. All screeded surfaces shall be free of surface irregularities with a height or depth in excess of one-fourth inch (1/4") as measured from a ten-foot (10') straight edge.

2. FLOATING – Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance with no unnecessary working of the surface.

   Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a finish of uniform texture and color. Unless additional finishing is specifically required, the completed finish for unformed surfaces shall be the float finish produced by the second floating. Floating shall be performed with hand floats or suitable mechanical compactor floats.

3. BROOMING – Surfaces of equipment bases and curbs and sidewalks shall be given a light broom finish providing a nonslip surface. Brooming shall be done after the second floating and for traffic areas shall be at right angles to

the normal traffic direction.

4. TROWELING Surfaces to be covered with resilient floor coverings and other surfaces designated on the Drawings to be troweled shall be steel trowel finished. Trowel finishing will not be required for floors which are normally submerged. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.

5. EDGING - All permanently exposed edges of unformed surfaces shall be chamfered with a three-fourth inch (3/4") approved edging tool unless other edge treatment is indicated on the Drawings.

3.07 Curing

All concrete shall be protected from loss of moisture by curing for at least fourteen (14) days following placement. Curing operations shall take place immediately after concrete finishing is complete or forms are removed. Breaking of form ties or otherwise breaking the seal between the concrete surface and the form shall be considered form removal.

Curing shall be accomplished by water curing, membrane curing, film curing, or any other curing method acceptable to the ENGINEER which does not injure or discolor exposed surfaces nor destroy the bond on surfaces to receive subsequent concrete pours or protective coatings.

A. WATER CURING – Concrete surfaces being water-cured shall be kept constantly and visibly wet for a period of not less than fourteen (14) days. Water saturation of concrete surfaces shall begin as quickly as possible after the initial set of the concrete. The rate of water application shall be regulated to provide complete surface saturation with a minimum of runoff.

Slabs poured on grade and decks may be water-cured by ponding or by covering with wet burlap sacks, sand, or sawdust and keeping this covering continually and visibly wet during this period. Standard canvas seep hose placed in parallel runs on eight-foot (8') centers is recommended for ponding. Walls may be cured by leaving the forms tied in place and keeping the forms and all exposed surfaces of the concrete continually and visibly wet for the duration of the curing period.

B. MEMBRANE CURING – Membrane-curing compound may be used in lieu of water

curing on Class B concrete and on concrete which will not be covered later with mortar, liquid hardener, or additional concrete. Except as modified herein, membrane-curing compounds shall be applied in strict accordance with the manufacturer's recommendations. Membrane-curing compounds shall conform to the requirements of Part 2.04, Membrane Curing Compound, of this specification section.

Membrane-curing compound shall be spray applied in two (2) separate coats, each having a surface coverage of not more than three-hundred square feet per gallon (300 ft^2/gal). Unformed surfaces shall be covered with curing compound within thirty (30) minutes after final finishing. If forms are removed before the end of the specified curing period, curing compound shall be immediately applied to the formed surface before they dry out.

Curing compound shall be suitably protected against abrasion during the curing period. Whenever the membrane will be subject to damage from traffic or other cause, it shall be protected after drying for twenty-four (24) hours by a layer of sand or fine earth not less than one inch (1") thick or by other means acceptable to the ENGINEER. Compound applied improperly or compound applied without sufficient dye to produce a distinguishing color shall be reapplied to the satisfaction of the ENGINEER.

C. FILM CURING – Film curing with polyethylene sheeting may be used in lieu of water curing on concrete which will be covered later with mortar or additional concrete or will otherwise be covered or hidden from view. Film curing shall begin as quickly as possible after initial set of the concrete. Polyethylene sheeting shall completely cover the surfaces. Sheeting shall overlap the edges sufficiently for proper sealing and anchorage. Joints between sheets shall be overlapped a minimum of twelve inches (12") and sealed. All tears, holes, and other damage shall be promptly repaired. Covering shall be anchored continuously at edges and shall be anchored on the surface as necessary to prevent billowing.

3.08 Construction Joints

Construction joints shall be made only at locations indicated on the Drawings or specified herein. Construction joints shall not be made at other locations without the concurrence of the ENGINEER. No vertical construction joints shall be used in walls unless specifically approved by the ENGINEER. The work shall be laid out and conducted so as to minimize the number of construction joints.

All construction joints shall be keyed. Keys shall be continuous and shall have a width equal to one-third (1/3) of the thickness of the wall and a depth equal to one-sixth (1/6) of the thickness of the wall. Unless indicated otherwise on the Drawings, no keys smaller than three inches (3") in width and 1-1/2 inches in depth shall be used.

Waterstops of the type specified shall be installed where indicated on the Drawings and in all construction joints in concrete walls and slabs having one face exposed in a dry pit or room and having the other face in contact with backfill, sub grade, groundwater, or other liquid. A jet of air and water shall be applied to the surface of horizontal construction joints to remove all laitance when the concrete has set sufficiently for the jet to expose the coarse aggregate without loosening same.

Immediately prior to placing another lift, the surface shall be thoroughly cleaned and washed by water jet followed by air jet to remove standing water. The surface of the concrete shall then be covered by a uniform, evenly distributed layer of cement-sand mortar to a thickness of one inch (1"). The cement-sand mortar shall be composed of a mixture of 1.3 parts by volume Portland Cement and one (1) part by volume fine aggregate, and shall have a water-to-cement ratio equal to that of the concrete to follow.

3.09 Expansion Joints

Expansion joints shall be provided as shown on the Drawings. Details of the expansion joints and materials of construction shall be as shown on the Drawings and specified in these Contract Documents. If not shown on the Drawings, expansion joints shall consist of full-depth, pre-formed, one-half inch (1/2") asphalt plank material conforming to ASTM D 994.

3.10 Bonding New Concrete to Existing Concrete

Where new concrete is to be cast against and permanently bonded to an existing concrete surface, the existing concrete shall be chipped or cut back from the surface a minimum distance of 1-1/2 inches or as necessary to expose sound concrete, remove loose or weathered concrete, and provide a roughened surface for bonding to the new concrete. Edges shall be cut square and feathered edges will not be permitted. All loose material remaining after chipping or cutting operations shall be removed by sandblasting and/or stiff wire brushing.

Where chipping back of existing concrete is not possible and where approved by the ENGINEER, the surface of existing concrete may be prepared by sandblasting or acid etching. If sandblasting or etching is used, the surface of the existing concrete shall be bare, clean, dry, and structurally sound. All grease, oil, wax, or other residue shall be removed by

scraping, followed by washing with a nonionic detergent or a suitable solvent compatible with the epoxy bonding agent to be used. Animal fats may be removed by scrubbing with a ten percent (10%) solution of caustic soda to saponify them.

After all loose material, grease, etc., have been removed, the surface of the existing concrete shall be etched by either sandblasting or scrubbing with a ten to twenty percent (10% to 20%) solution of hydrochloric acid in water applied at a rate of one quart per square yard (1 qt/yd^2) followed by a thorough rinsing with clean water. The surface shall then be allowed to dry completely before application of the epoxy bonding agent. Goggles, rubber boots, and rubber gloves shall be worn by workmen when applying caustic soda or acids.

When the surface is dry and just prior to placing the new concrete, an epoxy bonding agent shall be applied to the surface of the existing concrete with a whitewash brush or stiff broom. The epoxy bonding agent shall be spread evenly over the surface to be bonded, avoiding skips and holidays, to wet film thickness of forty (40) to sixty (60) mils. The new concrete shall be placed as soon as the epoxy bonding agent becomes tacky.

In the event that the epoxy bonding agent is allowed to dry before placement of the new concrete, the surface shall be recoated with epoxy. The epoxy bonding agent shall comply with the material requirements of Part 2.06, Epoxy Bonding Agents, of this specification section and shall be applied in strict conformance to the manufacturer's recommendations. Adequate safety precautions shall be taken during the handling and use of the epoxy bonding agent.

3.11 Embedded Items

A. Wherever steel, wrought or cast iron piping, fittings, valves, collars, sleeves, structural steel, electrical conduits, appurtenances and fixtures, equipment, anchorages, or castings are shown for embedment in the concrete, such items must be on hand before concrete is poured. They shall be set in place accurately and firmly braced before concrete is poured around them. No cutouts for future installation of these items shall be permitted.

Before placing concrete, the CONTRACTOR shall see that all embedded parts are accurately positioned and firmly and securely fastened in place. They shall be thoroughly clean and free from any coating, rust, scale, oil, or other foreign matter. The embedding of wood in concrete shall be avoided whenever possible. If wood is to be embedded, it shall be thoroughly wetted before the concrete is placed. After placement, surfaces not in contact with concrete shall be cleaned of concrete spatter and other foreign substances.

Conduit shall be installed between the reinforcing steel in walls or slabs which have reinforcement in both faces. In slabs which have only a single layer of reinforcing steel, conduit shall be placed under the reinforcement. Unless installed in pipe sleeves, anchor bolts shall have sufficient threads to permit a nut and washer to be installed on the concrete side of the form or template. A second nut and washer shall be installed on the other side of the form or template and the two nuts shall be adjusted so that the bolt will be held rigidly in proper position.

The CONTRACTOR shall be responsible for coordinating all work and ensuring that all embedded items or openings to be built into the concrete are placed in the forms before concrete is placed. The contractor shall be responsible for conferring with his subcontractors and suppliers regarding their requirements for embedments and openings. Forms, sleeves, and inserts shall be set, and concrete shall be cast to the lines and grades indicated on the Drawings and as detailed in these Contract Documents. The maximum deviation from true line and grade shall not exceed the tolerance listed below. Deviation in alignment of slabs or wall shall not exceed a rate of one-eighth inch (1/8”) in ten feet (10’) within the tolerances specified.

Item	**Maximum Tolerances**	
Sleeves and Inserts	+1/8”	-1/8”
Projected ends of anchor bolts	+1/4”	-0.0”
Anchor bolt setting	+1/16”	-1/16”
Concrete Forms	+1/8”	-1/8”

B. All slabs shall be carefully finished true to grade such that the surface is free draining and contains no depressions which can hold or collect water.

C. Regardless of the tolerances listed herein, it shall be the responsibly of the CONTRACTOR to limit deviations in line and grade to tolerance which will permit proper installation and operation of mechanical equipment and piping.

3.12 Water Tightness

It is the intention of this specification section to provide impervious concrete. All pits below groundwater level and all structures for holding or carrying water shall be watertight. A loss of not more than one-fourth inch (1/4”) depth in twenty-four (24) hours will be permitted when water-holding structures are filled. All exposed surfaces of water-holding structures and

interior surfaces of pits below groundwater level shall be free from visible damp spots or seepage before acceptance.

Repeated tests and repairs may be required by the ENGINEER to obtain watertight structures. All structure shall be drained at the completion of tests unless otherwise directed by the ENGINEER. The cost and expense of all testing for water tightness and of providing a watertight structure shall be borne by the CONTRACTOR. Methods of repair shall be acceptable to the ENGINEER. The use of special admixtures or integral waterproofing compounds in concrete required to be watertight is not required but may be permitted, provided the materials and methods are approved in writing by the ENGINEER.

3.13 Concrete Embedment and Encasement of Pipe

A. Concrete for embedment and encasement shall be installed where and as indicated on the Drawings and at such locations where installation conditions require such pipe reinforcement because of unforeseen conditions encountered in the work, as determined by the ENGINEER. Embedment and encasement of pipe shall be preceded by the following preliminary steps:

1. All loose material shall be removed from the trench prior to placing concrete. All concrete shall have a continuous contact with undisturbed soil on sides and bottom of trench.

2. A base course of concrete shall be accurately screeded to such grade and elevation that the pipe will be at specified grade when pipe bells are supported on, and in contact with, the top surface of such base course.

3. Each length of pipe shall be rigidly held in alignment and anchored, to prevent flotation, in a manner acceptable to the ENGINEER.

3.14 Pile Driving and Concrete Work

The Contractor shall not drive foundation piling which may damage freshly placed or existing concrete structures. Minimum distance between concrete less than seven (7) days old and pile driving operations shall be one-hundred feet (100’). Any damage made to concrete structures from pile driving operations shall be repaired by the Contractor at his expense.

3.15 Defective Work and Methods of Repair

A. All defective or damaged work shall be removed and replaced or repaired as directed

by the ENGINEER. Any work which has not been constructed in accordance with these Contract Documents shall be considered defective. No defective or damaged work shall be patched, repaired, or covered without prior inspection and approval of the ENGINEER. Defects in formed concrete surfaces shall be repaired within twenty-four (24) hours of placement, to the satisfaction of the ENGINEER, and defective concrete shall be replaced within forty-eight (48) hours after the adjacent forms have been removed.

All concrete which is honeycombed or otherwise defective shall be cut out and removed to sound concrete, with edges square cut to avoid feathering. Except as modified herein, concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. All repair work shall be adequately cured. Where authorized by the ENGINEER, repair may be accomplished by patching conducted as specified herein. However, permission to patch shall not waive the ENGINEER's right to have the defective work completely removed if the patch or repairs do not, in the ENGINEER's opinion; satisfactorily restore the quality and appearance of the work. Patching shall be conducted as follows:

1. Chip away defective areas at least 1-1/2 inches deep perpendicular to the surface, wet the area and six inches (6”) around it to prevent absorption of water from patching mortar, and brush a sand-cement grout consisting of one part fine aggregate to one part Portland Cement into the surface, following with patching mortar.

2. Patching mortar shall be no richer than one (1) part Portland Cement to three (3) parts fine aggregate using white Portland Cement to replace a portion of the gray cement as determined by a trial patch and shall contain only the minimum mixing water required for placing. Re-temper the mortar if necessary without the addition of water by allowing it to stand for one hour during which time it shall be mixed with a trowel to prevent setting.

3. Mortar shall be compacted into place and screeded to leave the patch higher than the surrounding surface, then left undisturbed for one or two hours to permit initial shrinkage before being finally finished to match the adjoining surface. Cure patch in accordance with the requirements of Part 3.07, Curing, of this specification section.

3.16 Loads Applied to New Concrete

A. Loads including, but not limited to, earth loads, loads exerted from bracing or shoring, wind loads, hydrostatic or hydraulic loads, equipment or vehicle loads, or loads exerted by stacked materials, shall not be permitted until the concrete has reached its specified twenty-eight (28) day strength. Concrete which has cracked due to overloading, loading before required strength has developed, or otherwise damaged shall be repaired or replaced as determined by the ENGINEER.

3.17 Testing Laboratory

A. The testing laboratory shall have access to all places where concrete materials and concretes are manufactured, stored, proportioned, mixed, placed, and tested. Duties shall include, but not necessarily be limited to the following:

1. Make, store, transport, cure, and test compression specimens made during placing of concrete. Compression test specimens shall be tested in accordance with ASTM C 39. Test reports shall show all pertinent data, such as class of concrete, exact location of pour, air temperature, date of pour, time of pour, truck number for ready-mixed concrete, date on which specimen was broken, age of specimen, compressive strength of specimen, concrete slump test results and air content of concrete from which the specimen was made. One (1) copy each of all tests shall be sent to the Contractor and two (2) copies each to the Engineer.

2. Each strength test requires four (4) standard test cylinders.

3. Samples for strength tests of each class of concrete placed each day shall be taken not less than one (1) time per day, nor less than one (1) time for each one-hundred cubic yards (100 CY) of concrete, nor less than once for each five-thousand square feet (5,000 ft^2) of surface area for slabs or walls.

4. Each class of concrete shall be tested with at least five (5) strength tests.

5. From each set of four (4) cylinders, two (2) shall be tested at twenty-eight (28) days and shall comprise a strength test under the definition of these Specifications. One cylinder shall be broken at seven (7) days and will be used as an aid in determining the early strength of the concrete and the twenty-eight (28) day strength, and one (1) cylinder retained in reserve for later testing if required.

6. Test for unit weight of concrete when the first load of each class of concrete

is delivered and thereafter at the discretion of the testing laboratory.

B. Periodically inspect the batching plant and file a report with the Engineer stating whether the supplier's equipment and methods meet the requirements of these Specifications.

C. Temperature and Placing Record: Temperature record shall be made each day during the concreting operations. Records shall also include location, quantity, and starting and finishing time of placement for all concrete work. Copy distribution shall be as specified above for test reports.

END OF SECTION

CONCRETE PREPLACEMENT SIGN-OFF CARD

Project:_____

Inspection Date:_____ Concrete Placement Date:_____

Expected Time of Concrete Placement:_____

Estimated Quantity:_____

Mix Design Strength:_____

Location of Structure:_____

Member (walls, beams, etc.):_____

Weather Conditions:_____

Method of Pour: Chute_____ Bucket_____ Pump_____

Conveyor_____ Other_____

Work	Status		Signature	Date
Formwork				
Reinforcing				
Mechanical				
Electrical				
Instrumentation				
Plumbing				
Process				
Metal Embeds				
Miscellaneous Specialties				
Clean-Up/OK to Place				

The Contractor certifies that the above work to be cast is prepared in accordance with the Contract Documents.

Contractor (Superintendent): _____
Date:_____
Resident Inspector:_____
Date:_____

Part 1 General

1.01 Scope

A. Clearing and grubbing includes, but is not limited to, removing from the Project site, trees, stumps, roots, brush, structures, abandoned utilities, trash, debris, and all other materials found on or near the surface of the ground in the construction area, and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated. Precautionary measures that prevent damage to existing features to remain are part of the work.

B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.

C. All earthwork operations shall comply with the requirements of Occupational Safety and Health Administration (OSHA) Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations.

1.02 Quality Assurance

A. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state, or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the CONTRACTOR.

B. Open burning is not allowed.

Part 2 Products

2.01 Equipment

The CONTRACTOR shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks, and loaders.

Part 3 Execution

3.01 Scheduling of Clearing

A. The CONTRACTOR shall clear at each construction site only that length of the right-of-way, permanent, or construction easement which would be the equivalent of one (1) month's pipe laying. This length shall be determined from the CONTRACTOR's Progress Schedule.

B. The ENGINEER may permit clearing for additional lengths of the pipe line, provided that temporary erosion and sedimentation controls are in place and a satisfactory stand of temporary grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above.

C. A satisfactory stand of grass shall have no bare spots larger than one square yard (1 yd^2). Bare spots shall be scattered and the bare area shall not comprise more than one percent (1%) of any given area.

3.02 Clearing and Grubbing

A. Clear and grub, as required, on each side of the pipeline before excavating. Remove all trees, growth, debris, stumps, and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.

B. Materials to be cleared, grubbed, and removed from the Project site include, but are not limited to, all trees, stumps, roots, brush, trash, organic matter, paving, miscellaneous structures, houses, debris, and abandoned utilities.

C. Grubbing shall consist of completely removing roots, stumps, trash, and other debris from all graded areas so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.

D. All stumps, roots, foundations, and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of two feet (2') below the limits of excavation for structures, trenches, and roadways, or two feet (2') below finish grade, whichever is lower.

E. Landscaping features shall include, but are not necessarily limited to, fences, mailboxes, cultivated trees, cultivated shrubbery, property corners, man-made improvements, subdivision, and other signs within the right-of-way and easement. The CONTRACTOR shall take extreme care in moving landscape features and promptly re-establishing these features.

F. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as riprap.

G. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.

H. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.

I. All fences adjoining any excavation or embankment that, in the CONTRACTOR's opinion, may be damaged or buried, shall be carefully removed, stored, and replaced. Any fencing that, in the ENGINEER's opinion, is significantly damaged shall be replaced with new fence material.

J. The CONTRACTOR shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc., situated within the limits of the construction area, but not directly within excavation and/or fill limits. The CONTRACTOR shall be held liable for any damage the CONTRACTOR's operations have inflicted on such property.

K. The CONTRACTOR shall be responsible for all damages to existing improvements resulting from CONTRACTOR's operations.

3.03 Disposal of Debris

The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the CONTRACTOR, and shall be disposed of in accordance with all requirements of federal, state, county, and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property, except with written consent of the property owner. In no case shall any material or debris be left on the Project, shoved onto abutting private properties, or buried on the Project.

END OF SECTION

Part 1 General

1.01 Scope

A. The work under this Section consists of furnishing all labor, equipment, and materials, and performing all operations in connection with the trench excavation and backfill required to install the project as specified in the plans.

B. 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.

C. 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.

D. Excavation shall include the removal of any trees, stumps, brush, debris, or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock, or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown in the specified plans.

E. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.

F. The trench is divided into five (5) specific areas:

1. Foundation: The area beneath the bedding, sometimes also referenced as trench stabilization.

2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.

3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.

4. Initial Backfill: The area above the haunching material and below a plane eighteen inches (18") above the top of the barrel of the pipe.

5. Final Backfill: The area above a plane eighteen inches (18") above the top of the barrel of the pipe.

G. The choice of method, means, techniques, and equipment rests with the CONTRACTOR. The CONTRACTOR shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of man-made improvements to be protected, available easement or right-of-way, and prevailing practice in the area.

1.02 Quality Assurance

A. Density: All references to "maximum dry density" shall mean the maximum dry density defined by the "Maximum Density Optimum- Moisture Test", ASTM D 698. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, "Standard Test Method for Density and Unit weight of Soil In Place by the Sand Cone Method", ASTM D 2937, "Density of Soil In Place by the Drive Cylinder Method" or ASTM D 2922, "Density of Soil and –Soil Aggregate- In Place by Nuclear Methods (Shallow Depth)".

B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory at no cost to the OWNER. The CONTRACTOR's testing laboratory shall perform tests, at no cost to the OWNER, upon change of source and at sufficient intervals during the work to certify conformance of all select material furnished for use on this Project.

1.03 Safety

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The CONTRACTOR shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in Occupational Safety and Health Administration (OSHA) publication 2226. All trench safety is the responsibility of the CONTRACTOR.

Part 2 Products

2.01 Trench Foundation Materials

A. Crushed stone or surge stone shall be utilized for trench foundation (trench stabilization).

B. Crushed stone shall be crushed limestone and shall meet the requirements of the Tennessee Department of Transportation (TDOT) Specification 903.11. Stone size shall be between No. 57 and No. 4, inclusive, as determined by the TDOT Specification 903.22.

C. Surge stone shall be crushed limestone and shall meet the requirements of the TDOT Specification 903.11. Stone size shall be No. 1, inclusive, as determined by the TDOT Specification 903.22.

2.02 Bedding and Haunching Materials

A. Bedding, haunching, and backfill materials shall be crushed stone under all pavement areas or if the trench is within three feet (3') of the pavement edge. Otherwise, bedding and haunching materials shall be crushed stone or earth materials as specified below.

B. Crushed stone utilized for bedding and haunching shall meet the requirements of the Tennessee Department of Transportation (TDOT) Specification 903.11. Stone size shall be No. 57, as determined by the TDOT Specification 903.22.

C. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than two inches (2") at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, provide select material conforming to the requirements of this Section at no additional cost to the Owner.

D. Filter Fabric

1. Filter fabric associated with bedding shall be a polypropylene woven fabric. The fabric shall be a high modulus type with good separation capabilities. The fabric shall be inert to biological degradation and naturally occurring chemicals, alkalis, and acids.

2. The fabric shall have an equivalent opening size (EOS or AOS) of 20 to 45. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	Unit	Test Method	Minimum Value
Grab Tensile Strength	lbs.	ASTM D 4632	200
Grab Tensile Elongation	%	ASTM D 4632	30 (max.)
Mullen Burst Strength	psi	ASTM D 3786	400
Trapezoid Tear Strength	lbs.	ASTM D 4533	75
Puncture Strength	lbs.	ASTM D 3787	75

3. If ordered by the ENGINEER, the filter fabric manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of ten (10) days during initial pipe installation.

4. Filter fabric shall be Propex Geotex 104F, Mirafi 500X, Amoco 2002 or Exxon GTF-200.

2.03 Initial Backfill

Unless shown on Drawings or specified otherwise, initial backfill material shall be crushed stone as specified for bedding and haunching materials.

2.04 Final Backfill

Final backfill material shall be general excavated earth materials, shall not contain rock larger than three inches (3") at its greatest diameter, cinders, stumps, limbs, man-made wastes, and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.

2.05 Select Backfill

Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.06 Concrete

Concrete for bedding, haunching, initial backfill, or encasement shall have a compressive strength of not less than three thousand pounds-per-square-inch (3,000 psi), with not less than 5.5 bags of cement per cubic yard (CY) and a slump between three inches (3") and five inches (5"). Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.07 Flowable Fill

Flowable for final backfill shall not have a compressive strength exceeding one-hundred-fifty pounds-per-square-inch (150 psi), with not less than one-hundred pounds of cement per cubic yard (100 lbs/CY), and a minimum of two-hundred-fifty pounds per cubic yard (250 lbs/CY) of Class C or F Fly Ash Flowable Fill shall be mixed and transported in accordance with ASTM C 94.

Part 3 Execution

3.01 Trench Excavation

A. Topsoil and grass shall be stripped a minimum of six inches (6") over the trench excavation site and stockpiled separately for replacement over the finished grading areas.

B. Trenches shall be excavated to the lines and grades shown in the plans, with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.

C. Trench Width for Pipelines

1. The sides of all trenches shall be vertical to a minimum of one foot (1') above the top of the pipe. Unless otherwise indicated in the plans, the minimum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet (2'), or the minimum width required for proper trenching and shoring.

2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.

3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of twelve inches (12”) clearance between the rock and the side of the pipe barrel or manhole.

4. Wherever the prescribed maximum trench width is exceeded, the CONTRACTOR shall use the next higher Class or Type of bedding and haunching as shown in the plans for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the CONTRACTOR's tamping and compaction equipment, intentional over-excavation due to the size of the CONTRACTOR's excavation equipment, or other reasons beyond the control of the ENGINEER or OWNER.

D. Depth

1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the dimensions shown in the plans.

2. Water Mains, Force Mains and Low Pressure Mains

a. Depth of Trenches: Excavate trenches to provide depths as shown on the Drawings. The depth of cover shall not exceed that as shown on the Drawings by more than one foot (1’), without approval of the Engineer.

b. Excavate trenches to provide a minimum cover not less than three feet (3’). Within the right-of-way of highways, streets, or roadways, excavate to place the top of the pipe a minimum of forty inches (40”) below the nearest pavement edge or drainage ditch.

c. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.

d. Depth of cover shall not exceed five feet (5') unless indicated on the Drawings.

3. Where rock is encountered in trenches for pipelines, provide a minimum of six inches (6") clearance between the bottom of the trench and the bottom of the pipe or accessory for pipe twenty-one inches (21") in diameter and smaller and twelve inches (12") for larger pipe, and manholes.

E. Excavated Materials

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Top soil shall be carefully separated and lastly placed in its original location.

2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.02 Sheeting, Bracing, and Shoring

A. Sheeting, bracing, and shoring shall be performed in the following instances:

1. Where sloping of the trench wall does not adequately protect persons within the trench from slides or cave-ins.

2. In caving ground.

3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced, and shored.

4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees, or private properties which are required to remain.

5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.

B. In all cases, excavation protection shall strictly conform to the requirements of the

Occupational Safety and Health Act (OSHA) of 1970, as amended.

C. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.

D. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth, and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The CONTRACTOR shall provide closure and sealing between sheet piling and existing facilities.

E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in six inch (6”) increments with specified backfilling occurring simultaneously. At no time shall the trench shield be “dragged” with the bottom of the shield extending below the top of the pipe or utility.

F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the ENGINEER it cannot be safely removed or is within three feet (3’) of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet (2’) below the surface.

G. 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.

H. 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.

I. 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.

J. 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 twelve inches (12”) 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 twelve inches (12”) above the top of the bottom footing. It shall then be cut off and the upper portion removed.

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

3.03 Rock Excavation

A. Definition of Rock: Any material which cannot be excavated with conventional excavating equipment, is removed by drilling and blasting, and occupies an original volume of at least one-half cubic yard (CY).

B. When rock is encountered near existing concrete or other structures, excavation methods that protect the existing structures should be performed to ensure the structure’s integrity is maintained throughout all construction.

C. Blasting: Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting

damage. If the CONTRACTOR repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the ENGINEER may direct the CONTRACTOR to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.

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.

D. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as riprap or backfill.

E. The CONTRACTOR shall notify the ENGINEER prior to any blasting. Additionally, the CONTRACTOR shall notify the ENGINEER before any charge is set.

F. Following review by the ENGINEER regarding the proximity of permanent buildings and structures to the blasting site, the ENGINEER may direct the CONTRACTOR to employ an independent, qualified specialty sub-CONTRACTOR, approved by the ENGINEER, to monitor the blasting by use of seismograph, identify the areas where light charges must be used, conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

3.04 Dewatering Excavations

A. The CONTRACTOR, at his own expense, 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 dry excavation 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 sub-grades.

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. Dewater the excavation continuously to maintain a water level two feet (2') below the bottom of the trench.

B. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.

C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.

D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.

E. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least two feet (2') below the bottom of the trench. Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet (2') below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged.

F. A minimum of one (1) standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation. A standby unit (a minimum of one [1] for each ten [10], 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.

G. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet (2') below the trench bottom. Where soil conditions dictate, the CONTRACTOR shall construct well points cased in sand wicks. The casing, six inches (6") to ten inches (10") in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

3.05 Trench Foundation and Stabilization

A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.

B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the ENGINEER shall then authorize payment for trench stabilization.

C. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the ENGINEER, an unstable foundation for the pipe, the CONTRACTOR shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone or class “C” concrete as directed by the ENGINEER.

3.06 Bedding and Haunching

A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders, or large dirt clods.

B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated in the plans. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe.

Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.

C. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.

D. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked, or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.

E. Gravity Sewers and Accessories: Lay polyvinyl chloride (PVC) pipe with minimum

Class “B” bedding. Lay all other pipe with Class “C” bedding, unless shown or specified otherwise.

1. Class “A” (Bedding Factor – 2.8): Excavate the bottom of the trench flat at a minimum depth as shown in plans, below the bottom of the pipe barrel. Lay pipe to line and grade on concrete block. Place concrete to the full width of the trench and to a height of one-fourth (1/4) of the outside diameter (O.D.) of the pipe above the invert.

2. Class “B” (Bedding Factor – 1.9): Excavate the bottom of the trench flat at a minimum depth as shown in plans, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.

3. Class “C” (Bedding Factor – 1.5): Excavate the bottom of the trench flat at a minimum depth as shown in the plans, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel.

F. Manholes: Excavate to a minimum of twelve inches (12”) below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.

G. Water Mains

1. Ductile Iron Pipe

a. Unless otherwise shown on the Drawings or specified, bedding and haunching shall utilize earth materials and meet the requirements for Type 2 Pipe Bedding where rock is not encountered.

b. In areas where rock is encountered, bedding and haunching material shall be crushed stone. Crushed stone bedding shall extend a minimum of 6 inches below the pipe.

c. Where the depth of cover over the piping exceeds fifteen feet (15’) , the pipe bedding shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds eighteen feet (18’), the pipe bedding

shall meet the requirements of Type 5 Pipe Bedding.

d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the Engineer, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing crushed stone bedding and haunching material

H. Excessive Width and Depth

1. Gravity Sewers: If the trench is excavated to excess width, provide the bedding class with the next higher bedding factor. Crushed stone haunching and initial backfill may be used in lieu of Class “A” bedding, where Class “A” bedding is necessitated by excessive trench width.

2. Water Mains: If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4, as detailed on the Drawings

3. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

I. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of ninety percent (90%) of the maximum dry density, unless shown or specified otherwise.

3.07 Initial Backfill

A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill, and ensure the uniform distribution of the loads over the top of the pipe.

B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least eighteen inches (18”) above the pipe barrel. Layer depths shall be a maximum of six inches (6”) for pipe eighteen inches (18”) in diameter and smaller and a maximum of twelve inches (12”) for pipe larger than eighteen inches (18”) in diameter.

C. Backfill on both sides of the pipe simultaneously to prevent side pressures.

D. Compact each layer thoroughly with suitable hand tools or tamping equipment.

E. Initial backfill shall be compacted to a minimum ninety percent (90%) of the maximum

dry density, unless shown or specified otherwise.

F. In areas where the trench is cut into rock or where suitable backfill is unavailable, crushed stone shall be used for initial backfill up to twelve inches (12”) above the pipe barrel.

G. Crushed stone shall be used for initial backfill up to twelve inches (12”) above the pipe barrel for all pipe material for gravity sewers.

3.08 Concrete Encasement for Pipelines and Casings

Where concrete encasement is shown in the plans for pipelines, excavate the trench to provide a minimum of six inches (6”) clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than six inches (6”) above the pipe bell. Do not backfill the trench for a period of at least twenty-four (24) hours after concrete is placed.

3.09 Final Backfill

A. Backfill carefully to restore the ground surface to its original condition.

B. The top six inches (6”) shall be topsoil obtained as specified in “Trench Excavation” of this Section.

C. Excavated material which is unsuitable for backfilling and excess material, shall be disposed of, at no additional cost to the OWNER, in a manner approved by the ENGINEER. Surplus soil may be distributed and spread over the site if approved by the ENGINEER. If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.

D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

E. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

1. In six inch (6”) layers, if using light power tamping equipment, such as a

"jumping jack".

2. In twelve inch (12") layers, if using heavy tamping equipment, such as hammer with tamping feet.

3. In twenty-four inch (24") layers, if using a hydra-hammer.

F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.

G. Final backfill shall be compacted to a minimum ninety percent (90%) of the maximum dry density, unless specified otherwise.

3.10 Backfill Under Roads

A. Crushed stone shall be used as bedding, haunching, initial and final backfill for all pipe materials. If Flowable Fill is used, it shall be used as final backfill up to the top of the asphalt or concrete pavement. Steel plate shall cover the patch until the fill has cured. Once the Flowable Fill has cured, the required thickness can be removed and appropriate materials can be used to repair the road.

B. When required by OWNER one-half (1/2) of the road crossing shall be excavated, then temporary bridges consisting of steel plate shall be placed over the excavation for use by the traveling public; then the remainder of the excavation can be carried out.

3.11 Backfill Within Tennessee DOT Right-of-Way

Backfill within the Tennessee Department of Transportation (TDOT) right-of-way shall meet all requirements, standards, and specifications stipulated by TDOT.

3.12 Detection Wire

Provide detection wire for all mains water (PVC and DIP). The wire shall have a minimum cover of twelve inches (12") and be laid approximately twelve inches (12") above the pipe. Detection wire shall be connected together with a brass curney, then taped each direction an additional three inches (3"). Surface access to wire shall be accomplished at each valve and air release valve location for water mains and service lines. Distance shall not to exceed one-thousand feet (1,000) between surface access locations. In cases where no features are present within the specified length, a meter box with valve marker labeled "water" shall be

installed to provide access to the wire. All wire must be tested for location prior to acceptance.

3.13 Testing and Inspection

A. The soils testing laboratory is responsible for the following:

1. Compaction tests in accordance with Article 1.02 of this Section.

2. Field density tests for each two feet (2') of lift, one (1) test for each two-thousand feet (2,000') of pipe installed, or more frequently if ordered by the ENGINEER.

3. Inspecting and testing stripped site, subgrades and proposed fill materials.

B. The CONTRACTOR's duties relative to testing include:

1. Notifying laboratory of conditions requiring testing.

2. Coordinating with laboratory for field testing.

3. Paying costs for additional testing performed beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.

4. Providing excavation as necessary for laboratory personnel to conduct tests.

C. Inspection

1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the ENGINEER.

2. Foundations and shallow spread footing foundations are required to be inspected by a geotechnical ENGINEER, who shall verify suitable bearing and construction.

D. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state, or federal authorities having jurisdiction.

END OF SECTION

Part 1 General

1.01 Scope

The work covered by this section includes furnishing all labor, equipment, and materials to pump Controlled Low Strength Material (CLSM) into abandoned underground pipes, as noted on the Drawings or as directed by the ENGINEER.

Part 2 Products

2.01 Materials for CLSM

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

Material	Specification
Portland Cement Type 1	AASHTO M85
Fly Ash, Class C or Class F	AASHTO M295
Potable Water	

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
¾-inch	100
No. 4	95 to 100
No. 16	50 to 90
No. 50	10 to 30
No. 200	0 to 10

2.02 Proportioning for CLSM

A. A. CLSM shall be proportioned as follows:

Material	Per Cubic Yard
Portland Cement Type 1	50 lbs. (maximum)
Fly Ash, Class C or Class F	250 lbs. (maximum)
Fine Aggregate	2,500 lbs.
Potable Water	34 gals.
Cellflow Foaming Agent (or approved substitute)	3 oz. (added at the jobsite)

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

1. Slump before adding foaming agent shall be 1.5-inches +/-.

2. Slump after adding foaming agent and mixing for at least 5 minutes and no more than ten (10) minutes shall be seven inches (7") to nine inches (9").

Part 3 Execution

3.01 General

A. FOAMING AGENT

1. Before adding foaming agent, check initial slump. If slump meets this specification, reverse the drum and slowly move the mix to the discharge end of the drum.

2. Pour the foaming agent directly into the mix. Run the drum forward to blend the product into the mix.

3. DO NOT SPRAY THE FINS. If the foaming agent remains on the fins, bring mix to discharge end of drum several times to clean the foaming agent off.

4. Mix at full mixing speed for five (5) minutes minimum. The mix should be very fluid after mixing.

5. Only add water AFTER the foaming agent has mixed for a minimum of five (5) minutes. Unnecessary water is detrimental to the performance of the mix.

6. Minimum batch for foaming agent is three cubic yards (3 CY).

7. Pump pipes to capacity.

END OF SECTION

Part 1 General

1.01 Scope

A. The work to be performed under this section shall include replacing existing sidewalks and pavement in paved streets, driveways, and parking areas where such sidewalks and pavement have been removed for constructing water pipelines, fire hydrants, sewers, manholes, and all other water and sewer appurtenances and structures. It shall also include temporary paving, and new sidewalks and pavements where applicable. Dirt shoulders, roads, streets, drives, curbs, and walks are to be restored to their original condition as an incidental part of the installation of utilities.

These specifications and the drawings make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT). Even though the weather limitations, constructions methods, and materials requirements contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the TDOT specifications shall not be considered applicable.

B. Related Work:

1. Section 312300 – Excavation and Fill

2. Section 033000 – Cast-in-Place Concrete

Part 2 Products

2.01 Types of Pavement

A. All references to the Tennessee Department of Transportation (TDOT) specifications shall refer to "Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction", 1981 or latest edition.

1. Mineral Aggregate Base: Class A, Grading D crush stone (TDOT specs, Section 303, Subsection 903.05)

2. Bituminous Prime Coats: cutback asphalt, Grade RD-250, or emulsified asphalt, Grade AE-P (TDOT specs, Section 402, Subsections 904.02 and 904.03)

3. Crushed Stone Chips: Size 6 or Size 7 (TDOT specs, Subsection 903.14)

4. Double Bituminous Surface: for both courses, either cutback asphalt, Grace RC-800 or RC-3000, or emulsified asphalt, Grade RS-2 (TDOT specs, Subsections 904.02 and 904.03)

5. Asphaltic Concrete Binder: Grading B or C, as directed by the ENGINEER (TDOT specs, Section 307)

6. Bituminous Tack Coat: Grade AE-3 (TDOT specs, Section 403, Subsection 904.03)

7. Asphaltic Concrete Surface: Grading D (TDOT specs, Section 411)

8. Quick Dry Traffic Marking Paint (White and Yellow): (TDOT specs, Subsection 910.05)

9. Concrete: Class A (TDOT specs, Sections 604 and 703

B. All existing pavement in streets, driveways, or parking areas which is removed, destroyed, or damaged by construction of sewage or water works shall be replaced per local requirements or as specified below, and as shown on the Drawings. If a conflict is discovered, local ordinances and specifications will govern. Unless otherwise shown or specified, all paved surfaces shall be replaced using the applicable pavement replacement Type 1 through 5 as shown on the Drawings. Pavement shown or specified to be replaced for the full width of the street shall be Types 6, 7, or 8 as applicable and as shown on the Drawings. Materials, equipment, and construction methods used for paving work shall conform to the Specifications applicable to the particular type required for replacement, repair, or new pavements.

1. Type 1 – Portland Cement concrete pavement shall be Class "A" concrete conforming to the *Section 033000 – Cast-In-Place Concrete* of these Specifications, having minimum compressive strength of three-thousand-five-hundred pounds-per-square-inch (3,500 psi). The surface shall conform to the grade and elevation of the surrounding pavement. The slab shall be of a depth of eight (8) inches as shown on the drawings.

2. Type 2 – Not used.

3. Type 3 – Asphaltic concrete pavement for heavy-duty use shall have a maximum thickness of six inches (6") placed in two (2) equal layers. Type 3 pavement shall be composed of four inches (4”) of plant mix binder and a two inch (2”) topping of asphaltic concrete Grading E conforming to "Asphaltic Concrete Surface (Hot Mix)," Section 411, Tennessee Department of Transportation (TDOT), *Standard Specifications for Road and Bridge Construction*, latest edition. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, firm, properly cured, dry, and the tack coat has been applied.

4. Type 4 – Not used.

5. Type 5 – Bituminous penetration pavement shall conform to Section 404, "Double Bituminous Surface Treatment," TDOT, *Standard Specification for Road and Bridge Construction*, latest edition.

6. Replacement of Portland Cement concrete driveways shall be Class "A" concrete conforming to *Section 033000 – Cast-In-Place Concrete* of these Specifications. The surface finish of the concrete pavement shall conform to that of the existing pavement. The slab shall be of depth equivalent to the existing concrete pavement, but in no case less than six inches (6”) thick. Expansion joints removed shall be replaced.

7. Replacement of Portland Cement concrete sidewalks shall be Class "A" concrete conforming to *Section 033000 – Cast-In-Place Concrete* of these Specifications. The surface finish of the concrete sidewalk shall conform to that of the existing sidewalk. The slab shall be of depth equivalent to the existing concrete sidewalk but in no case less than four inches (4”) thick. Expansion joints removed shall be replaced.

8. Where sewerage or water lines and appurtenances are constructed in or across unpaved, chert, or crushed stone surfaced streets, roadways, driveways, or parking areas, the surface removed or damaged shall be repaired or replaced with a minimum of six inches (6”) of crushed stone in accordance with Section 401, "Mineral Aggregate Surface," of the TDOT, *Standard Specifications for Road and Bridge Construction*, latest edition.

9. Unless permanent replacement can be made on the same day as the removal of the surface, and traffic is to be reinstated, holes shall be plated, or

temporary pavement repairs shall consist of a single application of bituminous surface treatment, and be made with two (2) inches of cold mix or hot bituminous seal coat, as directed by OWNER or ENGINEER. The bituminous surface treatment shall conform to TDOT specifications except the second application of bituminous material and mineral aggregate shall be eliminated. Permanent repair MUST be made within ten (10) working days from date of pavement cut.

C. With the prior approval of the ENGINEER, pavement restoration may be performed utilizing an infrared pavement restoration method. This method shall consist of the following:

1. Materials – A one-component emulsified maltenes recycling agent (rejuvenator) is to be applied to the restored area in a ratio of one-to-one (1:1) with water. This solution shall be well dispersed with a commercial grade sprayer at a rate of eight ounces per square yard (8 oz/yd^2) of heated area. This application area shall include both the area under repair as well as the area heated, but left undisturbed around the perimeter of the repair.

   The application shall take place after the area has been scarified and just prior to the addition of new asphalt. The Infrared repair CONTRACTOR shall provide TDOT 411E or D mix at plant mix temperature of two-hundred-seventy-five degrees Fahrenheit to three-hundred-twenty-five degrees Fahrenheit (275° F to 325° F) to be added to the repair to bring the area up to grade with the existing road.

2. Equipment – The infrared restoration equipment shall consist of a truck-mounted self- contained asphalt restoration system. The CONTRACTOR shall have a minimum of two (2) years' experience with this equipment. The infrared heating unit shall have a heating chamber consisting of fourteen 75,000 BTU high Intensity infrared heaters with Venturi type gas mixing.

   The heat area shall be a minimum of six foot by twelve foot (6' x 12') to provide a minimum twelve foot (12') lane width repair area per heat. The chamber shall consume no more than fifteen-thousand British Thermal Units per square foot (15,000 BTU/ ft^2) of heated area. This rate of consumption shall translate into the ability of the heater to soften asphalt to a depth of 1.5-inches to 2.5- inches in a timeframe of eight (8) to ten (10) minutes without burning the surface.

The infrared heat chamber shall be fueled by liquid propane using a high capacity Compressed Gas Association (CGA) approved vaporizer at forty United States Gallons at minus-forty degrees Fahrenheit (40 USG @ -40° F) to convert the liquid propane to vapor and provide full pressure to the heaters until the propane cylinders are empty. The truck unit shall contain at least four (4) cylinders of propane to provide enough fuel to operate heater chamber and re-claimer for two (2) days.

The heat system shall utilize an Intelligent Control Station with human-machine interface (HMI) and programmable logic controller (PLC) functions to monitor heat timing for quality control of infrared system. The asphalt storage unit shall consist of a thermostatically controlled storage unit that will be utilized to insure that sufficient hot virgin asphalt is on hand. The re-claimer/storage unit shall contain two (2) thirty-seven-thousand British Thermal Units (37,000 BTU) atmospheric infrared heaters. The thermostats shall work in conjunction with timers to insure proper temperature is maintained without harming the asphalt.

An electronic ignition shall be standard on this unit. An automatic switchover regulator shall be used to reduce the tank pressure to an eleven inch (11") water column. Compaction equipment consisting of a compactor/roller unit shall be used and should be capable of generating at least two-thousand pounds (2,000 lbs) of applied force per square inch (in^2) through a vibratory unit. A steel rake shall be used to delineate the repair area along the marked chalk line and to scarify the heated area of the patch inside the chalk line to a depth of at least two inches (2”). A thirty-six inch (36”) wide asphalt lute shall be used to distribute the added asphalt and to establish the proper grade.

3. The CONTRACTOR performing this work shall possess a State of Tennessee CONTRACTOR’s license with a Highway, Railroad, and Airport (HRA) classification for roadway work.

D. In no case shall paving repair be commenced without prior approval of the ENGINEER of the type pavement, the equipment to be used, and the method or procedure to be used.

Part 3 Execution

3.01 Replacing Pavement

A. Pavements removed or damaged shall be replaced in accordance with the

following procedures:

1. The existing street pavement or surface shall be removed along the line of the work for the allowable width specified for the trench or structure. All edges of the existing pavement shall be cut to a straight, vertical edge, and care shall be used to get a smooth joint between the old and new pavement and to produce an even surface on the completed street. Cement concrete slabs, cement concrete base slabs, and crushed stone bases, if required, shall be placed and the concrete allowed to cure for three (3) days before asphaltic concrete surface courses are applied. Expansion joints where applicable shall be replaced in a manner equal to the original joint.

2. After the installation of the sewer or water lines, the trench shall be backfilled with thoroughly compacted crushed stone from the top of bedding to finished grade unless otherwise specified on the Drawings or by local specifications. Backfill shall be placed as specified in *Section 312300 – Excavation and Fill* of these Specifications.

3. Trench backfill along streets shall be covered with permanent paving or with a temporary paving as specified above. The temporary paving shall be applied level with the existing paved surface at a time directed by the ENGINEER. Prior to the application of the temporary paving the crushed stone backfill shall be maintained carefully at grade and dust free. Additionally, immediately prior to application of permanent paving by CONTRACTOR or acceptance by the ENGINEER, CONTRACTOR shall again compact the top of all trench backfill in the streets with a hydrotamper and add sufficient crushed stone to bring surface back to bottom of permanent paving as shown on Drawings.

4. Unless otherwise shown or specified, all paved surfaces shall be replaced with pavement of like kind as specified in Paragraph 2.01. The pavement shall be either specified trench width or the full width of the street as shown in the Bid Schedule.

5. Where pavement is specified for trench width only, the temporary surface or sub-base for permanent paving shall be compacted and finished to the base grade compatible with the type of pavement to be applied before pavement is placed. Additional width of pavement to be removed, if any, as shown on the drawings shall be done immediately prior to replacing the pavement. Any additional pavement or street surface removed or damaged beyond the limits shown on the Drawings shall be replaced or repaired by

the CONTRACTOR at the CONTRACTOR's expense.

6. Where the pavement is for the complete width of the street, the following procedures shall be used;

   a. After the crushed stone backfill and temporary surface have settled thoroughly, the entire width of the street to be paved shall be cleaned of loose materials as specified in Section 407, "Bituminous Plant Mix Pavements," Tennessee Department of Transportation (TDOT), *Standard Specifications for Road and Bridge Construction*, latest edition.

      All areas which have settled shall be filled and leveled as described above in Paragraph 3. Manholes shall be raised to match finished grade using precast concrete rings. Before paving a tack coat shall be applied to the full width of the street, as specified in Section 403 "Tack Coat," TDOT, *Standard Specifications for Road and Bridge Construction*, latest edition.

   b. During the time that the full width of the street is being paved, the CONTRACTOR shall extend the paving from the street into existing paved driveways in order to provide a smooth transition from the street to the existing driveway grade. This work shall be completed to the satisfaction of the ENGINEER with no separate payment being allowed.

7. Wherever sewer or water lines are constructed across state highways, the CONTRACTOR shall comply with all requirements and provisions of the Standard Method of the TDOT for opening trenches through highways and replacing pavements as shown on the Drawings and specified herein. All such work shall be subject to inspection and approval by the TDOT.

8. Whenever sewer or water lines are constructed across streets, roads, or highways that are not under the jurisdiction of the TDOT, the CONTRACTOR shall comply with all requirements set forth by the governing body for opening trenches through highways and replacing pavements as specified herein. All such work shall be subject to inspection and approval by the governing body that has jurisdiction over the highway.

9. CONTRACTOR shall remove all surplus excavation materials and debris from the street surfaces and rights-of-way and shall restore street, roadway, or sidewalk surfacing to its original condition. This work shall be considered

as cleanup and no separate payment will be made for this item.

3.02 New Pavements

A. Access roads, parking areas, and other roadways shall be surfaced as shown on the Contract Drawings. The material shall be placed sufficiently thick to produce, after compaction, a uniform surface with a minimum thickness as shown on the drawings and shall be shaped to the required line and grade. Materials, equipment, and construction methods used for paving work shall conform to the Specifications for the particular surface required.

B. Bituminous penetration pavement, Portland Cement Concrete base course or pavement, and bituminous concrete pavement shall include a base course constructed in accordance with the requirements of Section 303, "Mineral Aggregate Base," Tennessee Department of Transportation (TDOT), *Standard Specifications for Road and Bridge Construction*, latest edition. The completed crushed stone road base shall be maintained by the CONTRACTOR in a smooth, first-class condition to required line, grade, and cross section until the entire surface area has become stabilized and compacted. Roadway materials shall not be placed on soft, wet, or frozen sub-grade.

C. After the base has become stabilized, the entire surface shall be covered with the surface course called for on the Drawings. The surface course shall not be placed until all other items of work are completed.

D. Portland Cement Concrete base course or pavement shall be placed as herein specified in this Section. Asphaltic concrete pavement shall be placed as herein specified in Paragraph 2.01. Bituminous penetration surface shall be constructed in accordance with Section 404, "Double Bituminous Surface Treatment," TDOT, *Standard Specifications for Road and Bridge Construction*, latest edition.

E. Crushed stone surface shall be placed as herein specified in this section, Paragraph 2.01.

3.03. Subgrade

A. Before any base material is installed, compact the subgrade of the area to be paved to ninety-five percent (95%) of optimum density as determined by ASTM D698 (Standard Proctor).

B. The backfill material shall be thoroughly compacted crushed stone from the top of bedding to finished grade unless otherwise specified on the Drawings. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of two to three miles-per-hour (2 to 3 mph) over the entire surface. Make further improvements on all areas that show a deflection of one inch (1") or more. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.

C. For tennis courts, the finished surface of the leveling course shall not vary from the specified grade more than one-fourth inch (1/4″) in ten feet (10′) when measured in any direction. The finished surface of the surface course shall not vary from the specified grade more than one-eighth inch (1/8″) in ten feet (10′) when measured in any direction.

3.04 Base

A. Install a mineral aggregate base of the type specified above in accordance with the requirements of Section 303, “Mineral Aggregate Base," Tennessee Department of Transportation (TDOT), Standard Specifications for Road and Bridge Construction, latest edition. The mineral aggregate layer shall be six inches (6”), and the total thickness of the base shall be that indicated by the standard drawings or as shown on the plans.

B. When a base course is compacted, cut back the surface course of the existing pavement a minimum of twelve inches (12”) beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

3.05 Chip Seal Surface

Uniformly apply a bituminous prime coat of either emulsified asphalt, Grade AE-P, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallon per square yard. Immediately after application, uniformly cover the entire area with Size 7 crushed stone chips at a rate of twelve pounds per square yard (12 lbs/yd^2).

3.06 Double Bituminous Surface

A. Apply the first course at a rate of 0.38 to 0.42 gallon per square yard with either emulsified asphalt, Grade RS-2, Grade RC-800, or RC-3000, and then immediately cover with Size 6 crushed stone chips at a rate of thirty-three to thirty-seven pounds per square yard (33 lbs/yd^2 to 37 lbs/yd^2) After this is rolled, apply the second course at a rate of 0.30 to 0.35 gallon per square yard, and at once uniformly cover them with Size 7 chips at a rate of twenty to twenty-five pounds per square yard (20 lbs/yd^2 to 25 lbs/yd^2), and then roll the entire area.

B. After the application of the cover aggregate, lightly broom or otherwise maintain the surface for a period of four (4) days. Maintenance of the surface shall include the distribution of cover aggregate over the surface to absorb any free bitumen and cover any areas deficient in aggregate. Sweep excess material from the entire surface.

3.07 Asphaltic Concrete Binder

A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, Grade RC-250, at a rate of 0.38 to 0.42 gallon per square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs and gutters, walls, walks, trees, etc. If such plashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder to the thickness shown on the standard drawings or the plans.

B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.08 Asphaltic Concrete Surface

If the asphaltic concrete surface course is to be placed directly on the mineral aggregate base, place a bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under PRODUCTS at a rate of 0.05 to 0.10 gallon per square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs and gutters, walls, walks, trees, etc. If such splashing does occur, remove it immediately after the prime coat has been properly cured, apply an asphaltic concrete binder to the thickness shown on the standard drawings or the plans.

3.09 Smoothness

The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding one-fourth inch (1/4″) in any direction when tested with a twelve foot (12′) straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects.

3.10 Sampling and Testing

A. Submit to the ENGINEER test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain his/her approval of these reports before starting paving operations.

B. Tests shall be made by OWNER on the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. All such sections shall be removed and reinstalled at the CONTRACTOR's expense. Patch all test holes in connection with thickness tests.

3.11 Maintenance

The CONTRACTOR shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the project. Maintenance shall include such dragging, reshaping, refilling, wetting, rerolling, and reapplication of the temporary paving surface as are necessary to prevent raveling of the road material, the preservation of reasonably smooth surface and repair of damaged or unsatisfactory surfaces to the satisfaction of the ENGINEER. Maintenance shall also include sprinkling as may be necessary to abate dust.

3.12 Sidewalk Replacement

A. Materials

1. All concrete sidewalks shall be built and/or replaced with Class "A" concrete which shall conform to *Section 033000– Cast-in-Place Concrete* of these Specifications.

2. Preformed joints shall be 1/2-inch thick conforming to the latest edition of

AASHTO Standard Specifications, M59, for preformed bituminous fiber joints.

3. Concrete forms shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength when in place to hold the concrete true to line and grade without springing or distortion.

B. When a section of sidewalk is removed, the existing sidewalk shall be cut to a neat line perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing contraction joints unless such joints do not exist in which case the cut shall be made at minimum distances shown on the Drawings.

C. Existing concrete sidewalks that have been cut and removed for construction purposes shall be replaced with sidewalks of the same width and surface as the portion removed and shall have a minimum uniform thickness of four inches (4"). The new work shall be neatly joined to the old concrete so that the surface of the new work shall form an even unbroken plane with the old sidewalk.

D. The subgrade for concrete sidewalks shall be formed by excavating to a depth equal to the thickness of the concrete plus two inches (2”). Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrade shall be compacted by hand tamping or rolling. Soft, yielding, or unstable material shall be removed and backfilled with satisfactory material. Two inches (2") of porous compacted crushed stone shall be placed and shall be compacted thoroughly and finished to a smooth, unyielding surface at proper line, grade, and cross section.

E. Expansion joints shall be required to replace any existing expansion joints that are removed with the sidewalk or in new construction wherever shown on the Drawings. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within one-half inch (1/2”) of the top of finished concrete surface.

F. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured.

3.13 Replacing Curbs

A. All existing curbs which are removed, damaged, or destroyed during construction of sewerage or water works shall be replaced in accordance with the following:

1. Asphaltic concrete curbs shall be constructed with the same dimensions as the existing curb using asphaltic concrete pavement Grading E, conforming to the section entitled "Asphalt Paving." Prior to constructing curbs on pavement, the pavement shall be dry and cleaned of loose material and a tack coat of RS-2 asphalt shall be applied to the curb area of the pavement at the rate of 0.08 to 0.20 gallons per fifteen linear feet (15 LF) of curb area.

2. Portland Cement Concrete curbs shall be constructed with the same dimensions as the existing curb using Class A concrete in accordance with *Section 033000 – Cast-In-Place Concrete* and with Section 702, "Cement Concrete Curb," Tennessee Department of Transportation (TDOT), *Standard Specifications for Road and Bridge Construction*, latest edition.

3.14 Infrared Pavement Restoration

A. All Proper safety precautions shall be taken including traffic cones, signage, and flagmen to insure a safe workplace for workers, pedestrians and automobile traffic. All Traffic Control shall be in accordance with current Manual on Uniform Traffic Control Devices (MUTCD) standards.

B. Defining and Preparing the Work Area:

1. The area shall be swept clean of dirt, loose aggregate or standing water.

2. A chalk line shall be drawn six to twelve inches (6” to 12”) back from the damage.

C. Heating the Repair Area:

1. The infrared chamber shall be lowered over the repair being sure to allow at least twelve to eighteen inches (12” to 18”) of heated area beyond the perimeter of the original opening.

2. To insure the proper heating time, the CONTRACTOR shall check the surface temperature of the asphalt at seven minutes and every minute thereafter using an infrared thermometer so as not to allow the surface temperature to exceed three-hundred-fifty degrees Fahrenheit (350° F).

3. After the appropriate heating time, typically eight (8) to ten (10) minutes, the asphalt surface will be softened to a depth of two inches (2”) to 2.5-inches.

D. Raking Heated Area:

1. Once the asphalt surface is softened, the infrared chamber will be removed from the heated area.

2. The backside of the steel rake will then be used to neatly square off the repair, cutting six inches (6”) to twelve inches (12”) back from the damaged area along the chalk line.

3. The area inside the repair will then be deeply scarified, taking special care to eliminate the original seam between the repair and the road surface.

4. The maltenes rejuvenator shall be applied to the repair and the surrounding heated asphalt surface.

E. Adding Plant Mix Asphalt:

TDOT 411E or D mix, one-fourth inch (1/4”) to one-half inch (½”) aggregate will then be added to the area to bring it up to the proper grade. The repair will then be luted smooth.

F. Compaction:

1. The area shall be properly compacted while ensuring that the edges are rolled first to fuse the hot repair to the heated but untouched surrounding pavement.

2. A light coating of stone dust will then be spread over the repair area to remove the tackiness.

3. The total time for a single heat restoration shall not exceed more than thirty (30) minutes to ensure that both the heated pavement and the added asphalt have not been allowed to cool.

END OF SECTION

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. Related Work:

1. Section 312300 – Excavation and Fill

C. The work shall include temporary seeding operations to stabilize earthen surfaces during construction or inclement weather and to minimize stream siltation and erosion. Temporary seeding shall be performed at the times and locations as directed by the ENGINEER.

D. Perform Work under favorable weather and soil moisture conditions as determined by accepted local practice.

Part 2 Products

2.01 Acceptable Manufacturers

A. All materials shall conform to the requirements and standards of this Section.

B. Wood-cellulose fiber mulch shall be manufactured by Weyerhauser Company or Conway Corporation.

2.02 Topsoil

A. Utilizing designated stockpiles or borrow areas on site, the CONTRACTOR shall place a minimum of four inches (4") 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. Importing topsoil from offsite sources shall be at the discretion of the ENGINEER and shall be justification for additional compensation to the CONTRACTOR. A change order properly authorized by the OWNER shall be agreed upon prior to importing offsite topsoil. No additional compensation will be allowed for spreading of topsoil.

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 one-half inch (1/2") 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 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 five percent (5%) nor more than twenty percent (20%), by weight, of organic matter as determined by loss on ignition of oven-dried samples to sixty-five degrees Celsius (65° C).

D. Topsoil shall possess the following characteristics, shall be subject to testing as described above, and shall be subject to the approval of the ENGINEER:

20-60% sand (.075-2mm)
0-50% silt (.002-.075mm)
0-30% clay (.001-.002mm)
96% passing no. 10 sieve

2.03 Seed

A. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the United States Department of Agriculture (USDA) 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 ninety-eight percent (98%) for purity and ninety percent (90%) for germination. At the discretion of the ENGINEER, samples of seed may be taken for verification against the grower's analysis.

D. Species, rate of seeding, fertilization, and other requirements as described herein and/or shown on the Drawings.

E. Furnish in standard containers with seed name, lot number, net weight, percentages of purity, germination, and hard seed and maximum weed seed content, clearly marked for each container of seed.

F. Keep dry during storage.

2.04 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 uniform in composition, free-flowing, and suitable for application with equipment designed for that purpose. It shall contain a minimum percentage of plant food by weight, with a ready mixed material equivalent to the grade or grades specified in the Seeding Schedule as described herein and/or shown on the Drawings. Container bags shall have the name and address of the manufacturer, the brand name, net weight, and chemical composition. Top Dress Type shall be as recommended by local soil service and standard practice.

C. Mix:

1. Nitrogen: 10

2. Phosphoric Acid: 10

3. Potash: 10

D. Application Rate: One-thousand Pounds per Acre (1,000 lbs/ac)

E. Agricultural limestone shall be a pulverized dolamitic limestone having a calcium

carbonate content of not less than eighty-five percent (85%) by weight. Agricultural limestone shall be crushed so that at least eighty-five percent (85%) of the material will pass a No. 10 mesh screen and fifty percent (50%) will pass a No. 40 mesh screen.

2.05 Sod

Strongly rooted pads, capable of supporting own weight and retaining size and shape when suspended vertically from a firm grasp on upper ten percent (10%) of the pad.

A. Grass Height: Normal.

B. Strip Size: Supplier's standard.

C. Soil Thickness: Uniform; One inch plus (+1") or minus one-fourth inch (-1/4") at time of cutting.

D. Age: Not less than ten (10) months or more than thirty (30) months.

E. Condition: Healthy, green, moist; free of diseases, nematodes and insects, and of undesirable grassy and broadleaf weeds. Yellow sod, or broken pads, or torn or uneven ends will not be accepted.

2.06 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. Straw mulch shall be partially decomposed stalks of wheat, rye, oats, or other approved grain crops. It shall be free from (i) seed of noxious weeds or (ii) clean salt hay.

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

2.07 Mulch Binder

A. Mulch on slopes exceeding three-to-one (3:1) 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. Cutback asphalt binder shall be Grade RC 70 or RC 250.

2.08 Hydroseeding Mulch

A. Wood Cellulose Fiber Mulch:

1. Specially processed wood fiber containing no growth or germination inhibiting factors.

2. Dyed a suitable color to facilitate inspection of material placement.

3. Manufactured such that after addition and agitation in slurry tanks with water, the material fibers will become uniformly suspended to form homogenous slurry.

4. When hydraulically sprayed on ground, material will allow absorption and percolation of moisture.

2.09 Netting

A. Jute: Heavy-duty, twisted, weighing one pound per square yard (1 lb/yd^2)

1. Openings Between Strands: Approximately one square inch (1 in^2).

B. Plastic:

1. Extruded Polypropylene: twenty (20) mils.

2. Opening Between Strands: One inch by two inches (1” x 2”).

C. Matting: Excelsior mat or straw blanket; staples as recommended by matting manufacturer

2.10 Tackifier

Derived from natural organic plant sources containing no growth or germination-inhibiting materials.

A. Capable of hydrating in water, and to readily blend with other slurry materials.

B. Wood Cellulose Fiber: Add as tracer, at rate of one-hundred pounds per acre (150 lbs/ac).

2.11 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.

2.12 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 Sodding

A. Do not plant dormant sod, or when ground is frozen.

B. Lay sod to form solid mass with tightly fitted joints, butt ends and sides. Do not overlap.

1. Stagger strips to offset joints in adjacent courses.

2. Work from boards to avoid damage to subgrade or sod.

3. Tamp or roll lightly to ensure contact with subgrade; work sifted soil into minor cracks between pieces of sod, remove excess to avoid smothering adjacent grass.

4. Complete sod surface true to finished grade, even, and firm.

C. Fasten sod on slopes to prevent slippage with wooden pins six inches (6”) long driven through sod into subgrade, until flush with top of sod. Install at sufficiently close intervals to securely hold sod.

D. Water sod with fine spray immediately after planting. During first week, water daily or more frequently to maintain moist soil to depth of four inches (4”).

E. Apply top dress fertilizer at rate of one pound per one-thousand square feet (1 lb/1,000 ft^2).

3.02 Stripping Topsoil

A. Strip any available topsoil to its full depth at all areas to be regarded, resurfaced, or paved within contract limit work area.

B. Stockpile topsoil in a location acceptable to the OWNER, for use in finish grading.

1. Stockpiled topsoil shall be free from trash, brush, stones over three inches (3") diameter, and other extraneous matter.

2. Grade and slope stockpiles for proper drainage and to prevent erosion.

3. **No topsoil shall be removed from the site**. It is the property of the OWNER.

C. Protect all areas which are not to be resurfaced or regraded, and adjacent areas outside of the contract limits from damage due to site preparation.

D. Unless otherwise specified, topsoil, and other unsuitable materials at the site and at a minimum distance of five feet (5’) beyond the surfaced area, shall be removed in such a manner to minimize disturbance of the remaining subgrade soils, and to facilitate placement of embankment materials and/or base course materials.

3.08 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. On-site sources of topsoil shall be approved by the ENGINEER prior to disturbance. 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.

C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of subgrades.

D. Remove stones, roots, weeds, and debris while spreading topsoil materials. Rake surface clean of stones one inch (1”) or larger in any dimension and all debris.

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

F. 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.

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

H. The areas in which topsoil is to be placed or incorporated shall be prepared before securing topsoil for use.

3.09 Seedbed Preparation

A. Before fertilizing and seeding, the topsoil surfaces shall be trimmed and worked to true line from unsightly variation, bumps, ridges and depressions and all detrimental material, roots and stones larger than three inches (3”) in any dimension shall be removed from the soil.

B. Not earlier than twenty-four (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 four inches (4”) 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, as determined by the ENGINEER.

3.10 Fertilization and Liming

A. Following seedbed preparation, fertilizer shall be applied to all areas to be seeded so as to achieve the application rates as described herein and/or shown on the Drawings.

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 one inch (1”).

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 thirty (30) minutes when a hydraulic seeder is used.

D. Agricultural limestone shall be thoroughly mixed into the soil according to the rates shown in the Seeding Schedule as described herein and/or shown on the Drawings. 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 a maintenance fertilizer according to the recommendations listed in the Seeding Schedule shown in these Specifications.

3.11 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 as described herein and/or shown on the Drawings 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.

B. Seed shall be uniformly sown by any approved mechanical method suitable for 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 one-eighth inch (1/8”) to three-eighth inch (3/8”) by a cultipacker or suitable roller.

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

E. Schedule – (See end of Section)

3.12 Mulching

A. All seeded areas shall be uniformly mulched in a continuous blanket immediately after seeding. The mulch shall be applied evenly so as to permit sunlight to penetrate and the air to circulate and at the same time shade the ground, reduce erosion and conserve soil moisture. Approximately forty-five percent (45%) 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: One-thousand pounds/acre (1,000 lbs/ac)

2. Straw: Four-thousand pounds/acre (4,000 lbs/ac)

3. Stalks: Four-thousand pounds/acre (4,000 lbs/ac)

4. 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 three-to-one (3:1) 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 five gallons per one-thousand square feet (5 gal/1,000 ft^2) as required to hold the mulch in place.

D. The CONTRACTOR shall cover structures, poles, fences, 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 in a manner acceptable to the ENGINEER.

3.13 Watering

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

B. Watering shall be accomplished by hoses, tank truck, or sprinklers in such a way to prevent erosion, excessive runoff, and over-watered spots.

3.15 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, and any regrading, refertilizing, reliming, reseeding, or remulching shall be done at CONTRACTOR's own expense. Seeding work shall be repeated on defective areas until a satisfactory uniform stand is accomplished. Damage resulting from erosion, gulleys, washouts, or other causes shall be repaired by filling with topsoil, compacting and repeating the seeding work at CONTRACTOR's expense.

END OF SECTION

SEEDING REQUIREMENTS TABLE

			RATES PER 1,000 SQUARE FEET			
General Seeding Areas:	**SOWING SEASON**	**SPECIES**	**Seed** (lbs)	**Fertilizer**	**Pelletized Lime** *(lbs)*	**Maintanance ****
Flat to rolling terrain	3/1 to 6/1	Kentucky 31 Fescue	4	30 lbs.	20	15 lbs.
(With slopes less than 3:1)		Ladino White Clover*	1/4	18-24-12		10-10-10
		Annual Ryegrass	2			
	8/1 to 11/1	Kentucky 31 Fescue	4	30 lbs.	20	15 lbs.
		Ladino White Clover*	1/4	6-12-12		10-10-10
		Annual Ryegrass	2			
Embankments	1/1 to 6/1	Crownvetch*	1	30 lbs.	20	10 lbs.
(Slopes greater than 3:1)		Kentucky 31 Fescue	2	18-24-12		0-20-20
		Weeping Lovegrass	1/4			
	8/1 to 11/1	Crownvetch*	1	30 lbs.	20	10 lbs.
		Kentucky 31 Fescue	2	6-12-12		0-20-20
		Annual Ryegrass	2			
Turf Seeding Areas:	1/1 to 6/1	Team-Mates***	7	4 lbs.	20	20 lbs.
		(or approved equal)		18-24-12		

* Requires inoculation.

** Maintenance fertilizer shall be applied in early spring following initial establishment of cover.

*** Team-Mates is a blend of Stetson, Bravo, Lancer, and All-Sport fescues, with an additional 20% perennial rye.

Part 1 General

1.01 Scope

The work covered by this Section includes furnishing all labor, materials, equipment, and services required to perform the Closed Circuit Television (CCTV) inspection of the specific storm sewer pipelines authorized by the ENGINEER.

1.02 Definition

"Internal inspection" shall consist of using CCTV within a designated storm sewer pipeline segment to determine the physical condition of the storm sewer pipeline.

Part 2 Products

2.01 Television Equipment

A. The camera unit shall be a color pan and tilt unit for mainline inspections. The television camera shall have a resolution of seven-hundred (700) lines minimum and shall have a source of illumination attached to it. With the monitor adjusted for correct saturation, the six (6) colors plus black-and-white shall be clearly resolved with the primary and complementary colors in order of decreasing luminance. The gray scale shall appear in contrasting shades of gray with no tint.

To ensure the camera shall provide similar results when used with its own illumination source, the lighting shall be fixed in intensity prior to commencing the inspection. In order to ensure color constancy, no variation in illumination shall take place during the inspection. The televised image shall be displayed on a monitor, located in an enclosed space in the television inspection vehicle.

B. CCTV Focus/Iris/Illumination: The adjustment of focus and iris shall allow optimum picture quality to be achieved and shall be remotely operated. The adjustment of focus and iris shall provide a minimum focal range from six inches (6”) in front of the camera’s lens to infinity. The distance along the storm sewer in focus from the initial point of observation shall be a minimum of two (2) times the vertical height of the storm sewer. The illumination must allow an even distribution of the light around the storm sewer perimeter without the loss of contrast picture, flare-out, or shadowing.

C. The camera shall be self-propelled or mounted on skids and drawn or pushed through

the storm sewer by winches for pipelines with an equivalent diameter from six inches (6”) to thirty-six inches (36”) for mainline inspections. The inspecting equipment shall be capable of inspecting a length of storm sewer up to at least one-thousand feet (1,000’) when entry onto the storm sewer may be obtained at each end, and up to seven-hundred-fifty feet (750’) where a self-propelled unit is used, where entry is possible at one (1) end only. The CONTRACTOR shall maintain this equipment in full working order and shall satisfy the ENGINEER at the commencement of each working shift that all items of equipment have been provided and are in full working order.

D. Each inspection unit shall contain a means of transporting the CCTV camera equipment in a stable condition through the storm sewer under inspection. Such equipment shall ensure the maintained location of the CCTV camera on or near to the central axis of a circular shaped storm sewer when required in the prime position.

E. Where the CCTV camera head is towed by winch and bond through the storm sewer, all winches shall be stable with either lockable or ratcheted drums. All bonds shall be steel or of an equally non-elastic material to ensure the smooth and steady progress of the CCTV camera and/or Sonar equipment. All winches shall be inherently stable under loaded conditions.

F. Each unit shall carry sufficient numbers of guides and rollers such that, when inspecting, all bonds are supported away from pipe and catch basin structures and all CCTV cables and/or lines used to measure the CCTV camera’s head location within the storm sewer are maintained in a taut manner and set at right angles where possible, to run through or over the measuring equipment.

G. The CONTRACTOR shall use a suitable metering device, which enables the cable length to be accurately measured; this shall be accurate to within plus-or-minus two inches (+/- 2”). When requested by the ENGINEER in writing at any time during a survey or inspection, the CONTRACTOR shall demonstrate compliance with the above tolerance. The device used by the CONTRACTOR to measure the footage along the storm sewer will be compared with a standard tape measure. The results will be noted. If the CONTRACTOR fails to meet the required standard of accuracy, the designated ENGINEER may instruct the CONTRACTOR to provide a new device to measure the footage.

H. The in-sewer photographic/video camera system and suitable illumination shall be capable of providing an accurate, uniform and clear record of the storm sewer’s internal condition. In-sewer lighting standards shall meet the requirements of the designated ENGINEER and applicable codes regarding safety and power.

I. A reserve television camera shall be available to replace the regular television camera in the event of a breakdown. Should the reserve equipment malfunction, another camera shall be provided within twenty-four (24) hours.

J. Suitable flow control devices shall be plugs designed and manufactured for use in storm sewers. Sand bags or other types of devices shall not be used within storm sewer pipelines or catch basins.

2.02 Television Equipment Operation

Operation of the television inspection equipment shall be controlled from above ground, with a skilled technician at the control panel in the television inspection van controlling the movement of the television camera. The technician shall have the capability to: adjust the brilliance of the built-in lighting system; change the focus of the television camera by remote control; control the forward and reverse motion of the camera; and determine the camera's position, at any time.

Part 3 Execution

3.01 Procedure

A. The inspections shall be performed by pulling, pushing, or propelling the television camera through the section of the storm sewer along the axis of the pipeline. The inspection shall be performed in a forward and/or backward direction, as dictated by the pipeline conditions at the time of the inspection. During the inspection of the pipelines, every possible means shall be taken to ensure total viewing of the inside periphery of the pipeline.

B. Pre-rehabilitation video inspection – No more than forty-eight (48) hours prior to rehabilitation, the locations of all point repairs and service laterals will be identified via television inspections performed in one section of the storm sewer pipeline at a time. The inspection shall be conducted in such a manner as to determine that the line is clean and the location is free of any conditions which may prevent the proper rehabilitation of the pipeline.

Television camera movement shall be temporarily halted at each visible point source of infiltration/inflow. The camera shall also be stopped at all service connections. A digital copy of each mainline inspection conforming to the data collection standards

of this section shall be supplied to the ENGINEER for review prior to commencing rehabilitation.

C. Post-installation video inspection – The camera shall be stopped at all service connections and point repairs. The video shall clearly depict the condition of all catch basin terminations. A digital copy of each mainline inspection conforming to the data collection standards of this section shall be supplied to the ENGINEER for final acceptance.

When filming Cured-in-Place Pipe (CIPP), the video shall stop and clearly depict the CIPP liner tube thickness marking at the beginning of each video and following a splice of two liner tubes. Where splices do occur between CIPP liner tubes, a three-hundred-sixty degree (360°) view of the entire splice length shall be depicted. CCTV all text printed on the liner immediately upstream and immediately downstream of all splices.

3.02 Provisions

A. The CONTRACTOR shall maintain on site at all times a competent field supervisor in charge of the inspection. The field supervisor shall be responsible for the safety of all site workers and site conditions as well as ensuring that all work is conducted in conformance with these Specifications and to the level of quality specified.

B. The CONTRACTOR shall provide bypass pumping in accordance with these Specifications, where necessary, to prevent flooding or storm sewer overflows.

C. The CONTRACTOR shall provide for the pumping down of any surcharged catch basin section, if required, before television inspection commences.

D. The CONTRACTOR shall furnish, to the ENGINEER, certification of the accuracy of the automatic counter before any work shall begin on the Project. If, at any time, the ENGINEER has reason to believe that the counter is inaccurate, the calibration of the counter will be checked before any more work progresses.

E. CCTV Camera Head Speed: The speed of the CCTV camera in the storm sewer shall be limited to twenty-feet-per-minute (20’/min) for inspections to enable all details to be extracted from the ultimate video recording.

F. At the start of each storm sewer length being surveyed or inspected and each reverse set-up, the length of pipeline from zero (0) footage (the entrance to the

pipe) up to the cable calibration point shall be recorded and reported in order to obtain a full record of the storm sewer length. Only one (1) inspection shall be indicated in the final report. All reverse set-ups, blind catch basins, and buried catch basins shall be logged on a separate log. Each log shall make reference to a start (ST) and finish (FH) catch basin.

G. If during the course of CCTV Inspection, a protruding tap is discovered in the pipeline that will not allow the passage of a CCTV inspection camera, then the CONTRACTOR will be required to remove the protruding tap.

H. If for any reason the camera becomes disabled inside the storm sewer and cannot further proceed, the CONTRACTOR shall be responsible for retrieving the camera.

3.03 Data Collection

A. The CONTRACTOR shall furnish all equipment and software required for taking videos of the view which appears on the monitor. Digital Video will be used to record location of taps and service connections, severe leaks, holes, collapses, misalignments, and serve as a record of the pre and post-installation conditions of the storm sewer and rehabilitated service laterals. Standard header information such as upstream and downstream catch basin numbers, direction of survey, pipe size, pipe material, date performed, person performing the inspection, and length of survey shall be captured utilizing either Cues Granite XP v. 3.4.2 or greater or Subcam 2007 inspection software.

B. At the start of each catch basin length a data generator shall electronically generate and clearly display on the viewing monitor and subsequently on the video recording a record of data in alpha-numeric form containing the following minimum information:

1. Automatic update of the camera’s footage position in the storm sewer line from adjusted zero (0).

2. Storm sewer dimensions in inches

3. Catch Basin numbers

4. Date of survey

5. Road name (nearest)/location

6. Direction of survey, *i.e*., downstream or upstream

7. Time of start of survey

8. Material of construction of the pipe

C. The size and position of the data display shall be such as not to interfere with the main subject of the picture.

D. Once the survey of the pipeline is under way, the following minimum information shall be continually displayed: Automatic update of the camera's footage position in the storm sewer line from adjusted zero (0).

E. A typical log and summary form used to record internal inspection data shall be submitted by the CONTRACTOR to the ENGINEER for review and approval prior to any television work being initiated.

F. The actual field work shall be monitored by the ENGINEER. The ENGINEER will be available during internal television inspection, and no work shall be performed without the ENGINEER being present, unless authorized by the ENGINEER.

3.04 Deliverables

A. After completion of the pre-installation CCTV work for each pipeline section to be rehabilitated, the CONTRACTOR shall deliver a composite database and videos of the pipelines inspected on DVD Minus R format or external hard drive to the ENGINEER for review. The CCTV video shall be formatted to work with Cues® Granite XP version 5.4.4, Engineering Edition. External hard drives shall be a minimum of one-hundred-sixty Gigabytes (160 GB) in capacity, shall have a USB 2.0 compliant connection, and shall be powered either through the host computers USB hub or shall have an external power adapter.

External hard drives will be returned within four (4) business days to the CONTRACTOR for use on outstanding inspections after download by the ENGINEER. At the conclusion of the project, the external hard drive will become the property of the OWNER for use in archival of data. Video files shall be in either Microsoft Windows Media Player (*.wmv) or Moving Picture Experts Group (*.mpg) file format. The composite database shall be in Microsoft Access 2003, or 2007, or 2010 format (*.mdb file), and shall contain tables with the following information:

1. Inspection Number

2. Upstream Catch Basin Number

3. Downstream Catch Basin Number

4. Person and Company Performing Inspection

5. Date Inspection Performed

6. Length Surveyed

7. Direction of Survey

8. Video path and filename (pipeline ID– e.g., Upstream Catch Basin Number to Downstream Catch Basin Number \\HB\HB1234 HB12345.wmv)

9. Location of all service connections to be reinstated if method of repair is CIPP.

10. Location of all point repairs and service connections to be replaced if method of repair is open cut.

11. Clock direction of tap entry to main.

B. After completion of the post-installation CCTV work for each pipeline section to be rehabilitated, the CONTRACTOR shall deliver a composite database and videos of the pipelines inspected on DVD-ROM or external hard drive to the ENGINEER for review. At the conclusion of the Project, the external hard drive will become the property of the OWNER for use in archival of data. The composite database shall be in Microsoft Access 2003, or 2007, or 2010 format (*.mdb file), and shall contain tables with the following information:

1. Inspection Number.

2. Upstream Catch Basin Number

3. Downstream Catch Basin Number

4. Person and Company Performing Inspection.

5. Date Inspection Performed.

6. Length Surveyed.

7. Direction of Survey.

8. Video path and filename (pipeline ID– e.g. \\HH\GMHH642.wmv).

9. Location of all service connections reinstated if method of repair is CIPP.

10. Location of all point repairs if method of repair is open cut.

11. Clock direction of tap entry to main.

12. Date of CIPP rehabilitation.

13. Thickness of CIPP installed in millimeters (mm).

END OF SECTION

Part 1 General

1.01 Scope

The work covered by this Section includes furnishing all labor, material, equipment, and services required for cleaning all stormwater sewer pipelines, prior to inspection of the storm sewers, by closed circuit television, authorized by the ENGINEER, as shown on the Drawings and/or specified herein. Preconditioning and cleaning involves removal of silt, which is defined as any and all solid or semi-solid materials, including fine and granular material, such as sand, grit, gravel, and rock as well as debris, grease, oil, sludge, slime, or any other loose material or encrustation lodged in the catch basin or storm sewer. Preconditioning and cleaning also involves removal of invading roots, corroded concrete, intruding laterals, and any other extraneous debris.

1.02 Definitions

A. The term "cleaning" as used in this Section, shall mean removing all sand, dirt, roots, grease, and all other solid or semi-solid materials from the storm sewer pipelines, so that a closed circuit television camera can be used in the internal pipeline inspection for the purpose of discerning structural defects, misalignment and infiltration/inflow sources.

B. “Heavy Cleaning” shall be defined as performing cleaning, as defined above when greater than twenty-five percent of a pipe’s cross-sectional area is full of debris, silt, roots, sand, grit, gravel, rock, grease, oil, sludge, slime, or any other loose material or encrustation or when the use of mechanical apparatuses (i.e., buckets, pigs, rodding machines, grinders, etc.), are required to remove debris and/or obstructions from a pipe.

Part 2 Products (Not Used)

Part 3 Execution

3.01 General

A. The CONTRACTOR shall certify that sufficient cleaning units can be provided, including standby units in the event of breakdown, in order to complete the work

within the contract period. Further, the CONTRACTOR shall certify that standby or back-up equipment can be delivered to the site within twenty-four (24) hours in the event of equipment breakdown.

B. Water from fire hydrants near the work area will be furnished by OWNER free of charge to the CONTRACTOR, provided that there is no undue waste or misuse.

C. All details of the point of water connection, backflow protection, conveyance methods, draw-off rates, times, and all local conditions regarding the use of water shall be approved by the ENGINEER prior to commencement of work. All equipment, labor, and material required for obtaining water for the work shall be provided by the CONTRACTOR.

D. The CONTRACTOR must ensure that a six inch (6”) minimum air gap is maintained at the water supply point on desilting/cleaning/jetting equipment or any other receiving apparatus.

3.02 Cleaning

A. Cleaning shall be accomplished by utilizing a high pressure, hydraulic sewer pipeline cleaner. Pressure jetting equipment used shall be sufficient for the purposes of attaining the degree of cleanliness in storm sewers as specified. The inspection shall be conducted in such a manner as to determine that the line is clean and the location if any conditions which may prevent the proper rehabilitation of the pipeline.

B. The cleaning unit(s) shall be capable of operating routinely, up to a minimum of five-hundred feet (500’) from the point of access to the storm sewer. Minimal hose diameter shall be one-inch (1”) diameter.

C. Cleaning shall be performed immediately prior to the internal inspection to preclude the build-up of debris. Should television inspection reveal that a storm sewer pipeline is not clean, the cleaning operations shall be repeated until the storm sewer pipeline is clean.

This additional cleaning shall be done at the expense of the CONTRACTOR, at no additional cost to the OWNER unless “Heavy Cleaning” as described in Section 1.02, Item B of this Specification is authorized by ENGINEER.

D. During preconditioning and cleaning work and all other associated Contract operations, wastewater service shall be maintained at all times. This requirement

may be relaxed only with the written approval of the ENGINEER.

E. Cleaning shall include the trapping and removal of all sediments and residual wastes from successive catch basin s as the cleaning progresses. When hydraulic cleaning equipment is used, a suitable weir or dam shall be constructed in the downstream catch basin , in such a manner, that the solids and water are trapped. Under no circumstances shall sewage or solids removed from the pipeline or catch basin, be dumped onto streets, in catch basins, or in storm drains. Material which could cause pipeline stoppages, accumulations of sand in wet wells, or damage to pumps, shall not be permitted to pass from catch basin section to catch basin section. Residual wastes shall be removed and disposed in a manner and place approved by the ENGINEER and the OWNER.

F. The CONTRACTOR shall provide for the pumping down of any surcharged catch basin section and provide all bypass pumping, if required, during the cleaning operation.

G. The CONTRACTOR shall submit a comprehensive equipment list to the ENGINEER before commencement of the work. The complete list, which shall include all backup and standby equipment, shall be broken down into the following categories (at a minimum):

1. Catch basin preconditioning and cleaning equipment

2. Storm sewer preconditioning and cleaning equipment

3. Flow diversion and flow control equipment

4. Traffic control equipment

5. All other equipment necessary for the completion of the work

H. Blockages in the system shall be reported to the ENGINEER immediately.

I. A responsible representative of the CONTRACTOR shall be present on the site of the work, or other location approved by the ENGINEER, to provide supervision of the work. At all times, and especially when a change of work location is underway, the CONTRACTOR’s representative shall keep the ENGINEER continuously aware of the location, progress, planned execution of the work, and problems encountered.

J. Flows may be attenuated using suitable flow control devices such as plugs designed and manufactured specifically for use in storm sewers. Sand bags or other types of devices shall not be used within storm sewer pipelines or catch basins.

3.03 Heavy Cleaning

If, during the course of cleaning and/or inspection operations, the CONTRACTOR believes a pipeline will require “heavy cleaning”, the CONTRACTOR shall inform the ENGINEER prior to conducting “heavy cleaning” operations. Visual evidence in the form of a CCTV image or digital image of the pipeline shall be provided by the CONTRACTOR to the ENGINEER to justify heavy cleaning operations. After reviewing the evidence, the ENGINEER shall make a determination if the evidence provided meets the definition of “heavy cleaning”. If it is determined that “heavy cleaning” is required, the ENGINEER shall provide written authorization to the CONTRACTOR to proceed with “heavy cleaning” operations at the rate set forth in the Bid for the pipe or pipes determined to require “Heavy Cleaning”.

3.04 Precautions

A. The CONTRACTOR shall take all necessary precautions to ensure that water used does not flood property or buildings served by the storm sewer pipeline being cleaned.

B. No fire hydrant shall be obstructed.

C. The CONTRACTOR shall take all necessary precautions to protect the storm sewer pipelines from damage that might be caused by use of cleaning equipment and shall repair any damage caused by the cleaning operation.

D. The CONTRACTOR shall furnish, to the OWNER, certification of the accuracy of the automatic counter before any work begins on this Project. If, at any time, the ENGINEER has reason to believe that the counter is inaccurate, the calibration of the counter will be checked before any more work progresses.

E. The CONTRACTOR shall provide, operate, maintain, and subsequently remove upon completion, adequate ventilation apparatus in the form of blowers and/or fans. The ventilation apparatus shall introduce a fresh air supply to support a safe environment for Work in storm sewers, catch basins, manholes, and all other confined spaces, which shall be kept free from dangerous, toxic and/or explosive

gases, whether generated from sewage, soil strata, or other source.

F. The CONTRACTOR shall employ the “best practicable means” to minimize and mitigate noise, as well as vibration, resulting from operations. Mitigation measures shall include the utilization of sound suppression devices on all equipment and machinery, particularly in residential areas, and in the near vicinity of hospitals and schools, especially at night.

G. The CONTRACTOR shall inform the ENGINEER before the commencement of any portion of the work of any significant change in the methods of noise attenuation from those previously utilized.

H. All pumps, generators, combination cleaners, or other noise emitting equipment be shall be suitably screened to minimize nuisance and noise pollution. This requirement shall not be taken as preventing or prohibiting the execution of work necessary for the saving of life, protection of property, or safety of the personnel and/or facilities. The CONTRACTOR shall notify the ENGINEER of such use of plant or equipment in an emergency situation as soon as practicable.

I. CONTRACTOR shall take all necessary precautions for safe installation and removal of flow attenuation devices such as plugs.

3.05 Data Collection

A. The CONTRACTOR shall complete a cleaning report for each storm sewer segment cleaned. A hard copy of this report shall be furnished on a weekly basis to the ENGINEER. The information required on the cleaning report shall be as follows:

1. Upstream and downstream catch basin identifications corresponding to the section of storm sewer cleaned.

2. Degree and nature of deposits prior to cleaning.

3. Length of storm sewer cleaned.

4. Method and man-hours required for cleaning.

B. The CONTRACTOR shall submit a legibly hand written, tabular inspection sheet that includes the above required items. CONTRACTOR shall submit samples of the inspection sheet they intend to use for approval of the ENGINEER prior to beginning inspection activities.

END OF SECTION

Part 1 General

1.01 Scope

A. Furnish all labor, material, and equipment to provide for the reconstruction of existing stormwater pipes using an approved Cured-In-Place Pipe (CIPP) method by forming a new pipe within an existing pipe.

B. Related Work:

1. Section 013000 – Administrative Requirements
2. Section 333000 – Sanitary Sewerage
3. Section 330130.41 – Cleaning of Sewers
4. Section 330130.11 – Television Inspection of Sewers

C. The sewer reconstruction shall be accomplished by the installation of a thermosetting resin-impregnated flexible felt-fiber tube coated on one side with an impermeable plastic which is installed into the existing stormwater sewer utilizing a hydrostatic head, or air pressure. Curing is accomplished by circulating hot water or the introduction of controlled steam throughout the length of the inverted tube to cure the resin into a hard, impermeable pipe with the plastic coating on the interior surface of the newly formed pipe.

The CIPP shall extend the full length of the original pipe segment and shall provide a structurally sound, joint-less, close-fitting, and corrosion resistant cured-in-place pipe. Hydrostatic inversion and water curing CIPP methods shall be the primary means of completing all work shown in these specifications. Air inversion and steam curing will only be allowed in extreme circumstances where the CONTRACTOR can clearly demonstrate that hydrostatic inversion and water curing cannot be physically performed, pose a safety threat to personnel or property, or result in an inferior installation. Air inversion and steam curing methods must be pre-approved in writing by the ENGINEER after the CONTRACTOR has submitted documentation and a request to utilize these methods.

D. It is the intent of this Specification to provide for the reconstruction of existing storm sewers by the CIPP method in pipes which have generally maintained their original shape. The CIPP shall provide flow capacity not less than one-hundred percent (100%) of the original pipe's flow capacity when new.

E. The CONTRACTOR shall utilize the services of specialty subcontractors on those parts of the Work which, under normal contracting practices, are best performed by specialty subcontractors, as required by the ENGINEER in the ENGINEER's sole discretion, at no additional cost to the OWNER.

If the CONTRACTOR desires to perform specialty work, the CONTRACTOR shall submit a request to the OWNER, accompanied by evidence that the CONTRACTOR's own organization has successfully performed the type of work in question, is presently competent to perform the type of work, and the performance of the work by specialty subcontractors will result in materially increased costs or inordinate delays.

F. The work performed under this Section of the Specifications is deemed to be Specialty CONTRACTOR Work and is subject to the provisions of *Section 007200 – General Conditions*, Article 10, subparagraph (b).

1.02 Reference Standards

Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. The latest revisions of all standards in effect on date of advertisement are applicable. Where discrepancies exist between this Specification and referenced product/process standards, this Specification shall govern.

1.03 Quality Assurance

A. In order to establish minimum product quality and Installer capability, the following minimum requirements shall be met. The purpose for these submittals is to allow the OWNER/ENGINEER the opportunity to conduct a complete, thorough, and objective evaluation of proposed CIPP products, and the Installing CONTRACTOR and to determine if the submitted products and Installer meet all experience, quality, and utility standards required by the specification.

B. CIPP System Manufacturer: The cured-in-place system must have a minimum proven performance record of one million linear feet (1,000,000 LF) installed of the exact name-brand product bid in the United States. Documentation shall be submitted to the ENGINEER during the submittal review process. Any exceptions to

this footage requirement must be approved in writing by ENGINEER.

C. CONTRACTOR/Installer Experience: The Installing CONTRACTOR for the cured-in-place reconstruction of sewers must have a minimum of three (3) years' experience using the exact named product proposed and, have installed at least three-hundred-thousand linear feet (300,000 LF) of the exact named proposed product, including at least ten-thousand linear feet (10,000 LF) of twenty-four inch (24") diameter (or larger) cured-in-place product. Documentation along with contact names and telephone numbers from the last ten (10) projects shall be submitted as part of the bid package. Any exceptions to this footage requirement must be approved in writing by ENGINEER.

D. On-Site Field Superintendent: The Qualifying Superintendent must have a minimum of five (5) years' experience with cured-in-place pipe products. In addition, the Qualifying Superintendent must have supervised jobs in which at least 20,000 feet of pipe has been reconstructed using the exact named product proposed including a minimum of five-thousand linear feet (5,000 LF) of twenty-four inch (24) diameter (or larger) cured-in-place product. The CONTRACTOR shall submit information to document his experience as part of the bid package. The superintendent for the job shall be on-site during all phases of the work involving any pre- and post-installation video inspection, sewer cleaning, or insertion and processing of the CIPP.

E. Resin Class

1. The CONTRACTOR shall designate a wet-out facility and shall provide wet-out liner tubes from this designated facility only. Multiple facilities to supply wet-out liner tubes for the duration of this Contract may not be used without prior approval of the ENGINEER.

2. The CONTRACTOR shall place a sampling valve in-line at a point in the resin/catalyst mixing stage so that a sample of non-catalyzed resin may be taken. A second sampling valve shall be placed in-line at a point after the resin/catalyst mixing stage, but prior to catalyzed resin injection into the liner so that a resin sample may be taken. Both sampling valves shall be left in place for the duration of the Contract.

3. The ENGINEER shall have the right to inspect the designated wet-out facility and draw samples form one (1) or both sampling valves without prior notice to the CONTRACTOR for the duration of the Contract.

4. Infrared Analysis

   a. The ENGINEER reserves the right to subject resin samples to an infrared analysis (IR Scan). This standard analytical test involves shining a beam of light in the infrared frequency region through a thin sample of subject resin. The frequency of light is then varied across the infrared spectrum. Chemical functional groups present in the resin being analyzed will absorb infrared light as specific frequencies and with characteristic absorption intensities.

   b. A spectrum created from the measurement of light transmitted through the sample across the range of infrared frequencies shall be used to determine the resin's chemical fingerprint. An overlaid IR spectrum of Reichhold Polylite® 33420 shall be used as a baseline comparison for the purpose of a polyester test. The baseline comparison for vinyl ester shall be Reichhold Dion® 9800.

   c. The ENGINEER may perform random Infrared Scans (IR Scans) and/or Composite Burn-offs to ensure resin quality and consistency throughout the duration of the Contract.

1.04 Submittals

A. Submit shop drawings in accordance with the requirements of *Section 013000 – Administrative Requirement* of these Specifications. Specific submittal information shall include the following:

1. The CONTRACTOR shall furnish design calculations for each pipe establishing the structural capabilities, chemical composition, thickness, and other mechanical properties of the liner system proposed.

2. The CONTRACTOR shall furnish a Summary Table of CIPP material properties, including short-term flexural modulus of elasticity, fifty (50) year flexural modulus of elasticity, short-term flexural strength, fifty (50) year flexural strength, and chemical resistance. Certified test reports shall be submitted verifying each value.

3. The CONTRACTOR shall furnish independent third-party certified laboratory test reports demonstrating that the exact resin/liner combination to be used for the project meets the requirements for initial structural properties per ISO

178 with wall thickness measured per DIN EN 13566-4, and for chemical resistance with testing performed in accordance with ASTM F1216-Appendix X2.

4. The CONTRACTOR shall furnish independent third-party certified laboratory test reports demonstrating the exact resin/liner combination to be used for the project has been tested for long-term flexural modulus of elasticity and long term flexural strength in accordance with ASTM 2990

5. The CONTRACTOR shall furnish copies of the manufacturer's brochures giving a complete description of the product proposed, its physical and chemical composition, the same for the thermosetting resin or epoxy hardener.

6. Pre- and post-installation videos and logs per Article 3.04 shall be submitted during the course of work.

7. Catalyst system and resin/catalyst ratio.

8. The proposed curing schedules/process shall be approved by the resin manufacturer in writing. Cure schedules shall include specific information on "step curing" procedures, "cooking times", duration and "cool down" procedures – all to be approved by the resin manufacturer and the ENGINEER in writing.

9. The CONTRACTOR shall submit a Certificate of Authenticity from the resin manufacturer for each shipment to the wet-out facility to include the date of manufacture and Heat Distortion Temperature. This information shall be submitted before the manufacture or installation of any CIPP.

10. The CONTRACTOR shall submit a written Contingency Plan, including methods and equipment to be used to repair unacceptable liner defects and for removing failed liners. The Contingency Plan should account for availability and accessibility of backup equipment.

B. The manufacturer shall submit a CURRENT written certification that the lining system complies with all applicable requirements of these Specifications.

Part 2 Products

2.01 Resins

A. Polyester Resins

1. The resin for CIPP installed under this Contract shall be a Standard Polyester Resin or Enhanced Polyester Resin unless otherwise directed by the ENGINEER due to site-specific field conditions and/or design requirements.

B. Standard Polyester Resins

1. The resin used shall be a corrosion resistant isophthalic polyester specifically designed for the CIPP being installed. Only premium, virgin, non-recycled resin shall be used. The resin shall be manufactured under ISO 9001 certified procedures.

2. The resin shall have been tested according to ASTM D2990, D5813, and F1216 by accredited, third-party testing facilities. Results of these tests shall be made available to ENGINEER upon request.

3. The resin vendor must be able to reference the corrosion scale with the resin itself having a heat deflection temperature greater than two-hundred-twelve degrees Fahrenheit (212° F).

C. Enhanced Polyester Resins

1. The resin used shall be a corrosion resistant enhanced thixotropic, medium reactivity, high viscosity, and rigid, chemical resistant isophthalic resin. These resins contain a mineral filler to enhance mechanical properties and are specifically formulated for use in the cured-in-place pipe (CIPP) industry.

2. The resin shall have physical and chemical properties equal to those of Reichhold Polylite® 33420-E and shall have been tested according to ASTM D 2990, D 5813 and F 1216 by accredited third party testing facilities. Results of these tests shall be made available to the ENGINEER upon request.

3. The resin must be manufactured under ISO 9001 certified procedures. The resin vendor must be able to reference the corrosion scale with the resin

itself having a heat deflection temperature greater than two-hundred-twenty-four degrees Fahrenheit (224° F). Only premium, non-recycled resins will be accepted. The resin vendor must be able to reference the corrosion scale, with the resin itself having a heat deflection temperature greater than one hundred degrees Celsius or two-hundred-twelve degrees Fahrenheit (100° C or 212° F).

D. Resins shall be shipped directly from the resin manufacturer's facility to the CIPP wet-out facility. Resins shall not be sent to any intermediate mixing facility. Copies of the shipping documents from the resin manufacturer shall be submitted to the ENGINEER indicating dates of shipment, originating and receiving locations.

2.02 Catalyst Systems

A. The catalyst system shall be made up of a primary catalyst and a secondary catalyst. The primary catalyst shall be Akzo Perkadox 16 or approved equal and shall be added at a maximum of one percent (1%) of the resin volume by weight unless otherwise approved by the ENGINEER. The secondary catalyst shall be Akzo Trigonox or approved equal and shall be added at a maximum of 0.5% of the resin volume by weight unless otherwise approved by the ENGINEER.

B. "Quick-Cure" or accelerated resin systems including those formulated by substantially increasing the amount of catalysts from that specified above will not be allowed. Resins, catalysts and resin/catalyst mix ratios shall not be changed or altered during this Contract unless specifically approved by the ENGINEER in writing.

2.03 Liner Tube

A. The tube shall consist of two (2) or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216. In the event of a discrepancy between the referenced ASTM requirement and this Specification, this Specification will govern.

B. The acceptable liner tube shall be constructed under ISO 9001 certified procedures. Proper certification shall be provided prior to the manufacture or installation of any CIPP.

C. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular shaped pipe sections.

D. The wet-out tube shall have a uniform thickness that when compressed at installation pressures shall meet or exceed design thickness.

E. The tube shall be manufactured to a size that when installed shall tightly fit the internal circumference and length of the original pipe. No more than one (1) splice per two-thousand linear feet (2,000 LF) shall be allowed. In the event that under-sized pipe is present, the liner tube shall be manufactured so that overlap folds or wrinkles do not occur. Allowances shall be made for circumferential stretching during inversion.

F. The outside layer of the tube, before installation, shall have an impermeable polyurethane or polyethylene plastic coating. This coating shall be an impermeable, flexible membrane that shall contain the resin and facilitate monitoring of resin saturation during resin impregnation. This coating shall form the inner layer of the finished pipe and is required for enhancement of corrosion resistance, flow and abrasion properties.

G. The tube shall be homogeneous across the entire wall thickness, containing no intermediate or encapsulated layers. No material may be included in the tube that may cause de-lamination in the cured liner, and no dry or unsaturated areas or layer shall be evident. Liners with delineation and/or blistering will be cause for rejection.

H. The wall color of the interior liner surface after installation shall be a light-reflective color so that a clear, detailed inspection with Closed-Circuit Television (CCTV) equipment may be conducted.

I. The outside of the tube shall be marked for distance at regular intervals not to exceed ten feet (10’). Such markings shall include the manufacturer’s name or identifying symbol.

J. The minimum length necessary to effectively span the distance between catch basin sections of the segment to be lined shall be deemed by the CONTRACTOR unless otherwise specified. The line lengths shall be verified in the field before impregnation of the tube with resin. The minimum length should include and make allowance for samples of eighteen-inches (18”) on each segment as required and requested by OWNER and ENGINEER.

K. The Internal Diameter (I.D.) of the host pipe shall be measured from twelve (12) to six (6) o’clock and from nine (9) to three (3) o’clock. The average of these two (2) numbers shall be considered the I.D. of the host pipe. The host pipe shall be measured during pre-TV by placing a “Fat-Boy” or equivalent tape measure at the

mouth of the host pipe so that the camera records a true measurement of the host pipe from the twelve (12) to six (6) o'clock position in the pipe.

2.04 CIPP Design

A. Liner Thickness

1. The CIPP shall be designed in accordance with the applicable provisions of ASTM F1216 and D2412 for "fully deteriorated gravity pipe conditions" and shall meet the following design conditions:

   a. AASHTO HS20-44 Live Load, whether under streets or not. The live load will vary based on depth of pipe.

   b. A dead load based on the depth of pipe shown in the Master Spreadsheet. A soil modulus of elasticity of one-thousand pounds per square inch (1,000 psi), soil weight of one-hundred-twenty pounds per cubic foot (120 lbs/ft^3), and a coefficient of friction of Ku'=0.130r.

   c. Short-term flexural modulus and long-term modulus when tested in accordance with ASTM D790.

      i. Standard Polyester: 250,000 psi and 125,000 psi

      ii. Enhanced Polyester: Short-term flexural modulus of 250,000 psi and long-term modulus of 125,000 psi. Flexural strength of 4,500 psi.

   d. Minimum Flexural Stress of 4,500 psi, when tested in accordance with ASTM D790.

   e. Safety factor of 2.0 shall be used.

   f. Groundwater elevation at the ground surface.

   g. Pipe ovality of 5%.

   h. Poisson ratio of 0.3.

   i. Enhancement factor (K) of 7.

j. Service temperature range shall be 40 to 140 degrees F.

k. Maximum long-term deflection shall be 5%.

2. Minimum Acceptable Pipe Thickness

The CIPP shall conform to the minimum requirements demonstrated in the following table:

Physical Property		Minimum Value
Flexural Stress	ASTM D 790	4,500 psi
Flexural Modulus of Elasticity	ASTM D 790	250,000 psi

a. The minimum cured liner thickness shall be as follows, regardless of what the calculations indicate as the required minimum thickness:

Pipe Diameter (Inches)	Depth to Invert (Feet)	Minimum Thickness (Installed) (mm)
8 and 10	0-17	6.0
8 and 10	> 17	7.5
12	0-8	7.5
12	8-16	7.5
15	0-16	10.5
18	0-18	13.5
24	0-18	16.5
30	0-18	18.0
48	0-18	30

b. The above table is in regards to **MINIMUM** installed liner thicknesses only. It is the CONTRACTOR's responsibility to determine the site specific external loads on the liner and increase its thickness as required. The CONTRACTOR shall submit his proposed plan for ensuring that the finished and installed CIPP meets the above minimum thickness requirements. The plan shall include detailed inversion procedures to reduce stretching and resin loss.

c. **Any liner that does not meet the specified strength and/or thickness requirements, regardless of the amount below the specified requirements, shall be corrected by the CONTRACTOR in a manner approved by the ENGINEER at no additional cost to**

the OWNER. The ENGINEER's decision on how to correct deficient CIPP installations shall be final.

d. All references to cured liner thickness shall be defined as total thickness after installation and after curing is complete.

4. The finished CIPP shall provide a uniform smooth, interior wall surface and will have at least one-hundred percent (100%) the flow capacity of the original pipe before rehabilitation. In lieu of measurements, calculated capacities may be derived using a Manning "n" coefficient of 0.013 for the original pipe material and a Manning "n" coefficient of 0.010 for a joint-less smooth-wall cured-in-place pipe.

2.05 Hydrophilic End Seals

A. CONTRACTOR is to install Hydrophilic End seal at all catch basin penetrations. The End Seals must be in a tubular form which when installed will form a three-hundred-sixty degree (360°) seal between the host pipe and the newly installed liner and must be a minimum of three inches (3") wide. The use of caulking, rope or band type of an end seal will not be allowed. Acceptable End Seals are Insignia™ End Seals by LMK Enterprises, 1779 Chessie Lane, Ottawa, IL 61350 (815) 433-1275, or pre-approved equal.

B. Materials

1. The materials utilized for the INSIGNIA™ END SEAL shall be provided in kits that are designed to accommodate varying pipe diameters, catch basin depths, junction configurations, and pipe liner products. The INSIGNIA™ END SEAL kits are compatible with most rehabilitative pipe liner products, including cured-in-place, and fold-and-form Additionally, the INSIGNIA™ END SEAL kit may be used with many different pipe liner installation and curing methods, including inversion, pull-in-place, hot water curing, steam curing, ultra violet curing, and ambient curing methods. The components of the INSIGNIA™ END SEAL include a tubular sleeve, and a mechanical fastener.

2. Tubular Sleeve: The member that creates the end seal is a hydrophilic neoprene rubber of approximately 50 Shore A durometer. The tubular sleeve has a uniform wall thickness of approximately two millimeters (2mm), a length of approximately 3.5 inches, and a diameter slightly less

than the interior pipe diameter. The hydrophilic neoprene rubber has the following characteristics:

Physical Property	Test Method	Unit	Minimum Value
Shore A Hardness	ASTM D 2240	Point	50 +/- 5
Tensile Strength	ASTM D 412	psi	1,177
Elongation at Break	ASTM D 412	%	523
Specific gravity	ASTM D 297		1.2
Swell capacity in water contact	GRCSC	%	200

3. Mechanical Fastener: There are several mechanical fasteners available for use with the INSIGNIA™ END SEAL product. A first option is a shape-memory alloy that has been formed into a specific arcuate or other curvilinear configuration having an outer profile that is generally greater than the circumference of the pipe before insertion. This conformation allows the alloy to be bent into a configuration that fits inside of the tubular sleeve and the pipe. Once inside the pipe, the alloy is pressed against the wall of the tubular sleeve, thus pressing the tubular sleeve against the wall of the pipe.

   The shape memory characteristic of the fastener urges the fastener to return to its original profile. The alloy remains in a strained configuration, pressing the tubular sleeve against the pipe wall. A second option for a mechanical fastener is a ratcheting retaining ring. The ratcheted retaining ring includes a strip of material having a total length generally greater than the pipe diameter. A ratcheting worm gear is attached to the strip and the strip is formed into a ring shape of variable diameter. The ratcheting retaining ring allows an operator to manually adjust the outer profile of the mechanical fastener, allowing for a small initial diameter before placement into the pipe. After the ratcheting retaining ring is placed within the pipe, the diameter of the retaining ring may be expanded by actuation of the worm gear to tightly hold the tubular sleeve in place.

4. Dual-sided Adhesive Tape: For some mechanical fasteners, a dual-sided adhesive tape may be used to affix the mechanical fastener to the tubular sleeve before installation within the pipe. This feature encourages the mechanical fastener to remain within the tubular sleeve during installation of the tubular sleeve and the pipe liner.

2.06 Preliner/Outer Film/Outer Liner

A. CONTRACTOR is to install preliner tube at all locations where the CIPP liner is inverted into a Spirolite host pipe, prior to inserting the CIPP liner or otherwise directed by the OWNER or ENGINEER in cases of significant infiltration. Acceptable pre-liner tubes are Griffolyn® TX 1200 by Reef Industries, Inc. 9209 Almeda Genoa Rd., Houston, TX, 77075, 713-507-4251, or pre-approved equal.

B. Materials

1. The material of the Preliner Tube shall be a two (2) ply laminate combining two (2) layers of linear low density polyethylene and a high strength cord grid.

2. Physical Properties:

Property	Test Method	Value
Weight	ASTM D-751	38 lb/1000 ft^2
3” Load @ Yeild	ASTM D-882	90 lbf
3” Load @ Break	ASTM D-882	54 lbf or 2500 psi
3” Elongation @ Break	ASTM D-882	400%
Tongue Tear	ASTM D-4533	29 lbf
PPT Resistance	ASTM D-2582	29 lbf
Dart Impact Strength	ASTM D-1709	1.6 lbs
Cold Impact Strength	ASTM D-1790	-40° F
Permeance	ASTM E-96	0.040 Grain/hr*ft^2*in.HG

2.07 CIPP Sectional Repair

A. The reconstruction will be accomplished using a liner tube of a particular length and a thermo-set resin with physical and chemical properties appropriate for the application. The tube positioned within a translucent inversion bladder is vacuum impregnated with the resin, then placed inside a protective launching device and winched through the sewer pipe. When the launching device is properly positioned, the end is opened and the resin-saturated tube and bladder are inverted out of the launching device and through the damaged section using controlled air -pressure. Once the tube/resin composite is cured, the inversion bladder is re-inverted back into the launching device and removed from the pipe. The liner system shall be capable of repairing pipe defects in continuous lengths up to one-hundred feet (100’), ranging in diameters from six inches (6”) to thirty-six inches (36”).

B. Material

1. The tube will consist of one (1) or more layers of flexible non-woven needled felt or a reinforced non-woven. The tube will be continuous in length exhibiting a uniform minimum wall thickness based upon design calculations found in ASTM F1216. No overlapping sections shall be allowed in the circumference or the length of the liner. The tube shall include compressible material at each end forming a smooth transition to the host pipe.

   The liner will be capable of conforming to offset joints, bells, and disfigured pipe sections. The resin will be polyester, or vinyl-ester with proper catalysts as designed for the specific application. The cured-in-place pipe shall provide a smooth bore interior. Each installation shall have a design report documenting the design criteria for a fully deteriorated pipe section, or a partially deteriorated pipe in cases where the pipe has previously been lined. Each end of the sectional liner should be tapered into the pipe for favorable hydraulic conditions.

2. The cured-in-place pipe shall meet or exceed the minimum test standards specified by the American Society for Testing Methods as described in ASTM F1216.

3. The tube should be outfitted with expanding hydrophilic O-rings at each end to form a compression end seal.

4. The installer shall be capable of viewing the beginning of the liner contacting the host pipe verifying the exact placement of the liner and that the liner has covered the entire damaged section. Video documentation of the placement, prior to curing, shall be provided to the OWNER. No measurement from a Closed-Circuit Television (CCTV) counter or estimating will be allowed.

5. The liner must be installed at low pressure, not to exceed ten pounds-per-square-inch (10 psi), to prevent damage or further damage to the host pipe. The tube shall be held tightly in place against the wall of the host pipe by pressure until the cure is complete for the required time per manufacture’s specifications.

Part 3 Execution

3.01 General

A. All reconstruction of existing stormwater sewers using an approved CIPP product and installer shall be performed in strict accordance with this Specification and the latest revision of ASTM F1216. Where discrepancies exist, or any latitude is either inferred or interpreted between this Specification and ASTM product and process standards, this Specification shall govern.

B. Pull-in and inflate methods of CIPP installations, (reference ASTM F1743), will not be acceptable.

C. The CONTRACTOR shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

D. The CONTRACTOR shall be responsible for coordinating payment and usage with the local owning utility of water withdrawn from fire hydrants.

E. The CONTRACTOR shall be responsible for locating and accessing all catch basins needed to perform the work.

F. All surfaces, which have been damaged by the CONTRACTOR's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of the CONTRACTOR’s operations. Suitable materials and methods, acceptable to the ENGINEER, shall be used for such restoration. The restoration of existing property or structures shall be performed as promptly as practicable and shall not be left until the end of the construction period. The cost for correcting damages resulting from the CONTRACTOR’s actions shall be the responsibility of the CONTRACTOR.

G. The tube shall be fabricated to a size that, when installed, will neatly fit the internal circumference of the conduit(s) designated for CIPP. Allowance shall be made for the circumferential stretching during insertion of the tube.

H. The CONTRACTOR shall be responsible for determining the minimum length to effectively span the distance from the catch basin to catch basin and shall verify the length of the fabric tube in the field before the tube is either cut to length or wet-out with resin. The tube may run through one or more catch basins with the approval of the ENGINEER.

I. Traffic Control: The CONTRACTOR shall be responsible for traffic control during the course of each phase of the work. Prior to beginning work, CONTRACTOR shall submit a traffic control plan for each section of work for the review and approval. It is the intent that this work is to be accomplished with as little disturbance to traffic, private property, and the public as is reasonably possible, consistent with timely completion thereof.

The traffic control plan shall reflect such requirements where applicable. Signs, signals, and detours shall conform to the Tennessee Department of Transportation (TDOT) requirements for streets and highways, latest edition. The CONTRACTOR shall have and maintain on site a sufficient supply of traffic cones and other traffic signaling devices, including trained and properly equipped flagmen, to safely control all traffic through the work zone(s). Road closures and/or detours will require advance scheduling and prior approval by the ENGINEER.

3.02 Daily Work Schedule

Insofar as is possible, work shall be so scheduled that the lining of the pipe, curing of the tube, and the reinstatement of service connections can be accomplished in a single working day or shift. Prior approval must be obtained from the ENGINEER if work is to be performed at night or on weekends to minimize traffic disturbance. At the end of each working day, temporary tie connections shall be made between the relined section of pipe and the existing system and the plug in the upstream catch basin removed, but not before the section being lined has been properly cured in accordance with the manufacturer's instructions and all service connections are reinstated. In some instances, it may be necessary to bypass effluent from service connections.

3.03 By-Pass Pumping

As required for acceptable completion of the work and/or to avoid damages due to spills or overflows, the CONTRACTOR shall provide for continuous flow maintenance around the section or sections of pipe designated for rehabilitation when necessary in accordance with *Section 333000 – Sanitary Sewerage* of these Specifications. CONTRACTOR shall be responsible to limit the extent and duration of such blockages and back-ups so that overflows and spillage onto public or private property and into storm sewers, waterways, and streets does not occur. In the event that such spillage or overflows do occur during the course of or as a result of the Work, the CONTRACTOR performing the Work shall immediately eliminate the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up.

On elimination of the spillage or overflow, the CONTRACTOR is to clean up and disinfect the area. Work to stop or contain such events is to be deemed emergency in nature and sufficient justification for total mobilization of resources, the use of overtime or double time, and any other reasonable measures to assure correction of the problem without delay. Damages arising from blockages, back-ups, spillage, or overflows of sewage during the course of the Work or because of the Work shall be the sole responsibility of the CONTRACTOR.

3.04 Preliminary Installation Requirements

A. Prior to CIPP installation, the pipe shall be cleaned to the satisfaction of the ENGINEER per *Section 330130.41 – Cleaning of Sewers* of these Specifications.

B. Debris Disposal: All debris cleaned from the pipe shall be removed and disposed of at the OWNER's Wastewater Treatment Plant. Debris shall not be allowed to wash into any other pipe segment either upstream or downstream from the pipe segment being cleaned.

C. Holes and Voids: All holes and voids visible in video inspection of the pipe shall be completely filled by the CONTRACTOR with flowable fill, cementitious grout, or equal approved by the ENGINEER, prior to CIPP Pre-Installation Video Inspection. All materials shall be installed according to the manufacturer's recommendations. The finished surface of any material used to fill holes and voids shall be smooth and shall conform to the interior surface of the host pipe and not be visible as a bulge or dimple in the finished CIPP.

D. Pre-Installation Video Inspection: The section of storm sewer designated for CIPP shall to be televised its full length using a remote television camera in accordance with *Section 330130.11 – Television Inspection of Sewers* of these Specifications and shall be submitted to the ENGINEER for review. Note: See Article 2.03 K of these specifications regarding additional work to be performed during Pre-video inspection activities. Camera shall have rotation of plus/minus three-hundred degrees (+/-300º) and equipped with a zoom lens.

3.05 Resin Impregnation of the CIPP Tube (Wet-Out)

A. The CONTRACTOR shall designate a location where the tube shall be impregnated or "wet out" with resin, using distribution rollers and a vacuum impregnation system to thoroughly saturate the tube's felt fiber prior to installation

in the field. The impregnated tube shall be free of pinholes, resin voids, and other defects. The quality management system for the wet-out facility must be registered in accordance with ISO 9001. The quality management system must ensure that proper materials and amounts are used in the resin saturation process and in liner shipping and storage. The quality control documentation shall include resin lot numbers, volumes of resin, catalyst, enhancers, date of wet-out, storage/transportation controls, and quality assurance procedures. A checklist must be included documenting that each critical step in the resin impregnation process is checked off and initialed.

B. Care shall be taken in shipping, handling, and storage to avoid damaging the liner. Any liner damaged in shipment shall be replaced as directed by the OWNER at no additional cost to the OWNER.

C. If the cured-in-place pipe is impregnated at the manufacturing plant, it shall be delivered to the job site in a refrigerated truck, and remain refrigerated prior to installation to prevent premature curing.

D. The flexible tube shall be vacuum impregnated with resin under controlled conditions or by such other means provided such means can assure thorough resin impregnation to the full satisfaction of the OWNER/ENGINEER. The volume of resin used shall be sufficient to fill all voids in the tube material at normal or design thickness and diameter. The volume of resin shall be adjusted by adding seven to ten percent (7% to 10%) excess resin for the change in resin volume due to polymerization and allow for any migration of resin into the cracks and joints in the original pipe.

3.06 Inversion of CIPP

A. The impregnated tube shall be inverted through an existing catch basin or other approved access point utilizing a hydrostatic water column until it has fully traversed the designated line length and the inversion face breaches the destination catch basin or termination point. The fluid column shall have been adjusted and maintained to be sufficient to cause the impregnated tube to hold tight against the existing pipe wall, produce dimples at side connections, and flared ends at the catch basins. Lubricant during inversion shall be used as necessary in accordance with the CIPP manufacturer’s recommendations. Thermocouples shall be placed at the top and bottom interface of both ends of the liner for monitoring temperature during the cure cycle. Care should be taken during tube installation not to over-stress the fabric fiber.

B. The CONTRACTOR shall maintain pressure requirements as defined by the manufacturer. The pressure used during the installation process shall be sufficient to hold the liner tight to the pipe wall and prevent wrinkles in the cured liner. The same pressure shall be great enough to prevent any infiltration from entering the pipeline during the curing process. The pressure shall be maintained for a time sufficient to allow any pockets of water to exfiltrate the host pipe, and to prevent lifts in the liner and resin washout.

Pressurized air may be used in the place of a hydrostatic water column as determined by manufacturer recommendations. The CONTRACTOR shall provide documentation for each segment as part of the submittal process. Should one or the other of the installation methods utilized by the CONTRACTOR prove not to be successful, as determined at the sole discretion of the ENGINEER/OWNER, the ENGINEER/OWNER may eliminate the option of that method.

C. Air over water pressure vessels or pressure head simulators may be used with prior approval from the ENGINEER. Approval for the use of this type apparatus may be considered on a “case by case” basis. Pull-In and Inflate methods of CIPP installations, (i.e., ASTM F1743), will not be acceptable. Before the inversion begins, the tube manufacturer shall submit to the CONTRACTOR, and the CONTRACTOR to the ENGINEER, the minimum pressure required to hold the tube tight against the host pipe and the maximum allowable pressure so as not to damage the tube.

D. Pull-In and Inflate methods of CIPP installations, (i.e., ASTM F1743), will not be acceptable. Before the inversion begins, the tube manufacturer shall submit to the CONTRACTOR, and the CONTRACTOR to the ENGINEER, the minimum pressure required to hold the tube tight against the host pipe and the maximum allowable pressure so as not to damage the tube.

E. When using pressurized air, particular attention should be given to the maintenance of the minimum required “finished and installed” thickness of the CIPP. Once the inversion has started, pressure shall be maintained between the minimum and maximum pressures until the inversion has been accomplished.

F. Prior to any inversion, the CONTRACTOR shall submit a Post-Cure Hold Time and Temperature Table. This table shall indicate the minimum time and temperature the inverted tube will be held at in order to achieve desired physical properties. The resin manufacturer shall certify both the time and temperatures presented in the table. The Time and Temperature Table submitted for using steam curing shall

be identical to time and temperature hold times when curing with heated, circulated water.

3.07 Curing

A. Follow the submitted cure schedule in curing the CIPP liner. Initial cure shall occur during temperature heat-up and is completed when exposed portions of the new pipe appear to be hard and sound and the thermocouples indicate that the temperature is of a magnitude to realize an exotherm or cure in the resin. After initial cure is reached, the temperature shall be raised to the post-cure temperature recommended by the resin manufacturer. Post-Cure temperature should be held for a period as recommended by the resin manufacturer, during which time the recirculation of the water and cycling of the heat source to maintain the temperature continues.

B. Curing must take into account the existing pipe material, the resin system, and the ground conditions (temperature, moisture level, and thermal conductivity of the soil).

C. Circulated Heated Water Method: A suitable heat source and water recirculation equipment is required to circulate heated water throughout the pipe. The equipment shall be capable of delivering hot water throughout the inverted tube to uniformly raise the temperature required to affect a cure of the resin.

All water used in the Circulated Heated Water Method must be reclaimed and disposed of properly by the CONTRACTOR. Water used in this method may not be discharged into the storm water system.

D. Controlled Steam Method: Suitable steam-generating equipment is required to distribute steam throughout the pipe. The equipment shall be capable of delivering steam throughout the inverted tube to uniformly raise the temperature required to affect a cure of the resin.

E. Curing must take into account the existing pipe material, the resin system, and the ground conditions (temperature, moisture level, and thermal conductivity of the soil).

3.08 Cool-Down

Cool-down of the cured pipe liner shall be in accordance with the manufacturer's recommendations. Care should be taken during the cool-down process so as to minimize shrinkage of the CIPP.

3.09 Termination and Sealing at Catch Basin Outlets

A. Termination of the cured-in-place pipe at the catch basin shall be completed by trimming the inverted pipe end back in accordance with the CIPP manufacturer's recommendations. If, in the judgment of the ENGINEER, the CIPP does not fit tightly against the storm sewer pipe at its termination point(s), the void between the host pipe and the CIPP shall be sealed by filling it with a resin mixture compatible with the CIPP at no additional cost to the OWNER.

B. The Cured-in-place pipe inverts of lined-through catch basins shall remain in place as part of the finished CIPP. The finished CIPP shall be trimmed to match the profile of the existing interface between the pipe and catch basin wall or bench. The annular space between the CIPP and the host structure(s) shall be sealed with a Hydrotite™ style SS-0215 hydrophilic waterstop seal or ENGINEER approved equal. Any water entering or exiting the annular space between the catch basin and the finished CIPP after installation must be stopped by the CONTRACTOR by a method approved by the ENGINEER.

C. If Catch Basin or Storm Sewer Manholes require repair for successful liner installation, or if any damage occurs to them during the installation process, they shall be repaired to functional condition according to the OWNER's direction.

3.10 Testing of CIPP

A. The ENGINEER may, at its discretion, direct the CONTRACTOR to collect samples of the cured CIPP for laboratory determination of flexural strength, flexural modulus, and wall thickness for each test sample. These three (2) individual analyses shall comprise one completed test. All samples shall be collected per the sampling protocols set forth in ASTM F1216.

B. For each line segment, the CONTRACTOR shall remove one restrained sample of the installed liner at least twelve inches (12") in length for testing. The sample shall be removed from the point most distant from the heat source. The sample submitted shall be the exact same I.D. as the host pipe, samples caught in smaller diameter pipe shall not be acceptable. For storm sewers fifteen inches (15") and larger, plate samples may be taken and cured in the same water as the installed

CIPP. For each sample taken, the CONTRACTOR shall cut and deliver a twelve inches (12”) in length representative sample (taken at least two inches [2”] from the end of the specimen) to the ENGINEER. The sample delivered to the ENGINEER shall be labeled and removed from any restraining mold. The samples shall be taken in the presence of the ENGINEER. (NOTE: Any preliner tube material must be removed from the sample by the CONTRACTOR before delivering the sample to the ENGINEER.)

C. The tests shall be used to verify that the installed CIPP meets these Specifications. CIPP thickness shall be measured in accordance with ASTM D5813. Flexural properties shall be determined per ASTM D790. The CONTRACTOR shall label and date all samples and deliver the samples directly to the ENGINEER.

D. Any liner that does not meet the specified strength and/or thickness requirements, regardless of the amount below the specified requirements, shall be corrected by the CONTRACTOR in a manner approved by the ENGINEER at no additional cost to the OWNER. The ENGINEER’s decision on how to correct deficient CIPP installations shall be final. Options for correcting deficient liners that may be considered by the ENGINEER include removing the liner and re-lining the storm sewer, excavating and replacing the storm sewer from catch basin to catch basin, or providing the OWNER with a credit. The primary option that will be considered will be to re-line the storm sewer.

Credits will only be authorized for CIPP that does not meet required thickness. If a credit is acceptable to the OWNER, the credit shall be calculated by multiplying the bid price by the percent that the liner thickness is below the required installed thickness as follows:

Credit = (1 – Installed CIPP thickness/required CIPP thickness) x bid price

The CONTRACTOR shall not assume a credit will be acceptable to the OWNER under any circumstance. This would be the OWNER’s sole discretion.

E. Leakage Testing of CIPP Storm Sewer Main: Leakage testing of all finished CIPP-lined storm sewer mains shall be conducted prior to the reinstatement of laterals in the presence of the ENGINEER in accordance with the exfiltration test method for gravity pipes described in *Section 333000 – Sanitary Sewerage* of these Specifications. The CONTRACTOR shall furnish all equipment and personnel necessary to conduct all of the leakage tests.

3.11 Final Acceptance

A. Post-installation videos shall be conducted and submitted to the ENGINEER in accordance with *Section 330130.11 – Television Inspection of Sewers* of these Specifications. The finished CIPP shall be continuous over the length of pipe between two (2) catch basins and shall be an impermeable, joint-less conduit, free from visual defects such as foreign inclusions, dry spots, pin holes, lifts, or delamination. Camera shall have rotation of plus/minus three-hundred degrees (+/-300º) and equipped with a zoom lens. In order to be considered for payment, the post installation videos MUST include the pipe connections at both ends of the pipe.

B. Wrinkles in the CIPP, (other than minor, longitudinal pressure wrinkles) will not be acceptable. The ENGINEER shall determine as to the acceptability of pressure wrinkling with that decision being final. In the event the finished liner does not fit tightly against the original pipe at its termination point(s), the space between the liner and the pipe shall be made watertight, utilizing catch basin end seals, hydro-tite gaskets, or approved equal.

C. After curing of the resin is completed, the hardened CIPP shall extend from catch basin to catch basin of the section designated providing a structurally sound, corrosion-resistant, watertight conduit that excludes exfiltration and infiltration, is tight-fitting within the existing pipe, and is free of voids or annular spaces between the CIPP and the existing pipe walls. K-Factor for tightness shall equal 7.0 or greater. All terminations into catch basin walls shall be watertight at the time of final inspection. No annular space shall be visible between the CIPP and catch basin wall. In the event that an annular space is present, it shall be completely filled with epoxy or other suitable material to the satisfaction of the ENGINEER.

D. The finished pipe must be such that when the thermosetting resin cures, the total wall thickness will be a homogeneous, monolithic felt and resin composite matrix that will be chemically resistant to withstand internal exposure to domestic sewage. When cured, the CIPP must form a mechanical bond with the host pipe.

END OF SECTION

Part 1 General

1.01 Scope

A. Furnish all labor, material, and equipment to provide for the reconstruction of existing stormwater pipes using an approved ultraviolet light Cured-In-Place Pipe (UV-CIPP) method by forming a new pipe within an existing pipe.

B. Related Work:

1. Section 013000 – Administrative Requirements
2. Section 330130.41 – Cleaning of Sewers
3. Section 330130.11 – Television Inspection of Sewers

C. The storm sewer reconstruction shall be accomplished by the installation of a resin-impregnated flexible tube into the existing stormwater sewer, expanding the tube against the host pipe, and curing the tube to form a hard, impermeable pipe liner. The UV-CIPP shall extend the full length of the original pipe segment and shall provide a structurally sound, joint-less, close fitting and corrosion resistant cured-in-place pipe. Curing shall be accomplished by applying ultraviolet light to obtain the desired cure throughout the tube, extending from catch basin to catch basin.

D. It is the intent of this Specification to provide for the reconstruction of existing storm sewers by the UV-CIPP method in pipes which have generally maintained their original shape. The UV-CIPP shall provide flow capacity not less than one-hundred percent (100%) of the original pipe’s flow capacity when new.

E. The CONTRACTOR shall utilize the services of specialty subcontractors on those parts of the Work which, under normal contracting practices, are best performed by specialty subcontractors, as required by the ENGINEER in ENGINEER's sole discretion, at no additional cost to the OWNER.

If the CONTRACTOR desires to perform specialty work, the CONTRACTOR shall submit a request to the OWNER, accompanied by evidence that the CONTRACTOR's own organization has successfully performed the type of work in question, is presently competent to perform the type of work, and the performance of the work by specialty subcontractors will result in materially increased costs or inordinate delays.

1.02 Reference Standards

Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. The latest revisions of all standards in effect on date of advertisement are applicable. Where discrepancies exist between this Specification and referenced product/process standards, this Specification shall govern.

1.03 Quality Assurance

A. In order to establish minimum product quality and Installer capability, the following minimum requirements shall be met. The purpose for these submittals is to allow the OWNER/ENGINEER the opportunity to conduct a complete, thorough and objective evaluation of proposed UV-CIPP products and the Installing CONTRACTOR and to determine if the submitted products and Installer meet all experience, quality and utility standards required by the specification.

B. UV-CIPP System Manufacturer: The UV-CIPP system must have a minimum proven performance record of three-hundred-and-fifty-thousand linear feet (350,000 LF) installed of the exact name-brand product bid in the United States. Documentation shall be submitted to the ENGINEER during the submittal review process. Any exceptions to this footage requirement must be approved in writing by ENGINEER.

C. CONTRACTOR/Installer Experience: The Installing CONTRACTOR for the cured-in-place reconstruction of storm sewers must have a minimum of three (3) years' experience using the exact named product proposed and, have installed at least two-hundred-thousand linear feet (200,000 LF) of the exact named proposed product including at least ten-thousand linear feet (10,000 LF) of twenty-four inch (24") diameter (or larger) cured-in-place product. Documentation, along with contact names and telephone numbers, from the last ten (10) projects shall be submitted as part of the bid package. Any exceptions to this footage requirement must be approved in writing by ENGINEER.

D. On-Site Field Superintendent: The Qualifying Superintendent must have a minimum of five (5) years' experience with cured-in-place pipe products. In addition, the Qualifying Superintendent must have supervised jobs in which at least twenty-thousand linear feet (20,000 LF) of pipe has been reconstructed using the exact

named product proposed, including a minimum of five-thousand linear feet (5,000 LF) of twenty-four inch (24) diameter (or larger) cured-in-place product. The CONTRACTOR shall submit information to document his experience as part of the bid package. The superintendent for the job shall be on-site during all phases of the work involving any pre and post-installation video inspection, storm sewer cleaning, or insertion and processing of the CIPP.

E. Resin Class

1. The CONTRACTOR shall designate a wet-out facility and shall provide wet-out liner tubes from this designated facility only. Multiple facilities to supply wet-out liner tubes for the duration of this Contract may not be used without prior approval of the ENGINEER.

2. The CONTRACTOR shall place a sampling valve in-line at a point in the resin/catalyst mixing stage so that a sample of non-catalyzed resin may be taken. A second sampling valve shall be placed in-line at a point after the resin/catalyst mixing stage, but prior to catalyzed resin injection into the liner, so that a resin sample may be taken. Both sampling valves shall be left in place for the duration of the Contract.

3. The ENGINEER shall have the right to inspect the designated wet-out facility and draw samples from one or both sampling valves without prior notice to the CONTRACTOR for the duration of the Contract.

4. Infrared Analysis

a. The ENGINEER reserves the right to subject resin samples to an infrared analysis (IR Scan). This standard analytical test involves shining a beam of light in the infrared frequency region through a thin sample of subject resin. The frequency of light is then varied across the infrared spectrum. Chemical functional groups present in the resin being analyzed will absorb infrared light as specific frequencies and with characteristic absorption intensities.

b. A spectrum created from the measurement of light transmitted through the sample across the range of infrared frequencies shall be used to determine the resin’s chemical fingerprint. An overlaid IR spectrum of Reichhold Polylite® 33420 shall be used as a baseline comparison for the purpose of a polyester test. The baseline

comparison for vinyl ester shall be Reichhold Dion® 9800.

c. The ENGINEER may perform random Infrared Scans (IR Scans) and/or Composite Burn-offs to ensure resin quality and consistency throughout the duration of the Contract.

1.04 Submittals

A. Submit shop drawings in accordance with the requirements of *Section 013000 – Administrative Requirements* of these Specifications. Specific submittal information shall include the following:

1. The CONTRACTOR shall furnish design calculations for each pipe establishing the structural capabilities, chemical composition, thickness, and other mechanical properties of the liner system proposed.

2. The CONTRACTOR shall furnish a Summary Table of CIPP material properties, including short-term flexural modulus of elasticity, fifty (50) year flexural modulus of elasticity, short-term flexural strength, fifty (50) year flexural strength, and chemical resistance. Certified test reports shall be submitted verifying each value.

3. The CONTRACTOR shall furnish independent third-party certified laboratory test reports demonstrating that the exact resin/liner combination to be used for the project meets the requirements for initial structural properties per ISO 178 with wall thickness measured per DIN EN 13566-4, and for chemical resistance with testing performed in accordance with ASTM F1216-Appendix X2.

4. The CONTRACTOR shall furnish independent third-party certified laboratory test reports demonstrating the exact resin/liner combination to be used for the project has been tested for long-term flexural modulus of elasticity and long term flexural strength in accordance with ASTM 2990

5. The CONTRACTOR shall furnish copies of the manufacturer’s brochures giving a complete description of the product proposed, its physical and chemical composition, the same for the thermosetting resin or epoxy hardener.

6. Pre- and post-installation videos and logs per Article 3.04 shall be submitted

during the course of work.

7. Catalyst system and resin/catalyst ratio.

8. The proposed curing schedules/process shall be approved by the resin manufacturer in writing. Cure schedules shall include specific information on “step curing” procedures, “cooking times”, duration and “cool down” procedures – all to be approved by the resin manufacturer and the ENGINEER in writing.

9. The CONTRACTOR shall submit a Certificate of Authenticity from the resin manufacturer for each shipment to the wet-out facility to include the date of manufacture. This information shall be submitted before the manufacture or installation of any CIPP.

10. The CONTRACTOR shall submit a written Contingency Plan, including methods and equipment to be used to repair unacceptable liner defects and for removing failed liners. The Contingency Plan should account for availability and accessibility of backup equipment.

B. The manufacturer shall submit a CURRENT written certification that the lining system complies with all applicable requirements of these Specifications.

Part 2 Products

2.01 Resins

A. Polyester Resins

1. The resin for CIPP installed under this Contract shall be a Standard Polyester Resin unless otherwise directed by the ENGINEER due to site-specific field conditions and/or design requirements. Only premium, non-recycled resin shall be used. The resin must be manufactured under ISO 9001 certified procedures.

2. The resin vendor must be able to reference the corrosion scale with the resin itself having a heat deflection temperature greater than two-hundred-twelve degrees Fahrenheit (212° F).

3. The resin shall have been tested according to ASTM D2990, D5813, and

F1216 by accredited, third-party testing facilities. Results of these tests shall be made available to ENGINEER upon request.

B. Resins shall be shipped directly from the resin manufacturer's facility to the CIPP wet-out facility. Resins shall not be sent to any intermediate mixing facility. Copies of the shipping documents from the resin manufacturer shall be submitted to the ENGINEER indicating dates of shipment, originating and receiving locations.

2.02 Liner Tube

A. The tube shall consist of one (1) or more layers of fiberglass laminate and meet the requirements of ASTM F2019. In the event of a discrepancy between the referenced ASTM requirement and this Specification, this Specification will govern.

B. The acceptable liner tube shall be constructed under ISO 9001 certified procedures. Proper certification shall be provided prior to the manufacture or installation of any CIPP.

C. Gliding Foil – A continuous heavy gauge (10mm) plastic sheet shall be pulled into the entire length of host pipe, covering 1/3 to 1/2 the diameter of lower portion of the host pipe, protecting the liner during the pull in process.

D. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular shaped pipe sections.

E. The wet-out tube shall have a uniform thickness that when compressed at installation pressures shall meet or exceed design thickness.

F. The tube shall be manufactured to a size that when installed shall tightly fit the internal circumference and length of the original pipe. No more than one (1) splice per two-thousand linear feet (2,000 LF) shall be allowed. In the event that under-sized pipe is present, the liner tube shall be manufactured so that overlap folds or wrinkles do not occur. Allowances shall be made for circumferential stretching during inversion.

G. The outside layer of the tube, before installation, shall have an impermeable coating. This coating shall be an impermeable, flexible membrane. The liner shall include an outer layer which inhibits the release of steam, styrene, odors, or other pollutants into the stormwater system.

H. The tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated layers. No material may be included in the tube that may cause de-lamination in the cured liner, and no dry or unsaturated areas or layer shall be evident. Liners with delamination and/or blistering will be cause for rejection.

I. The wall color of the interior liner surface after installation shall be a light-reflective color so that a clear, detailed inspection with closed-circuit television (CCTV) equipment may be conducted.

J. The outside of the tube shall be marked for distance at regular intervals not to exceed ten feet (10'). Such markings shall include the manufacturer's name or identifying symbol.

K. The minimum length necessary to effectively span the distance between catch basin sections of the segment to be lined shall be deemed by the CONTRACTOR unless otherwise specified. The line lengths shall be verified in the field before impregnation of the tube with resin. The minimum length should include and make allowance for samples of eighteen-inches (18") on each segment as required and requested by OWNER and ENGINEER.

L. The Internal Diameter (I.D.) of the host pipe shall be measured from twelve (12) to six (6) o'clock and from nine (9) to three (3) o'clock. The average of these two (2) numbers shall be considered the I.D. of the host pipe. The host pipe shall be measured during pre-TV by placing a "Fat-Boy" or equivalent tape measure at the mouth of the host pipe so that the camera records a true measurement of the host pipe from the twelve (12) to six (6) o'clock position in the pipe.

2.03 Light System

A. When inserting the curing equipment in the liner, care should be taken to not damage the inner film material.

B. Approved UV light systems shall have the ability to record specific parameters during the curing process utilizing an integrated CCTV system on the light assembly to ensure the liner is properly cured, recording parameters will include the following:

1. Project name

2. Line Section

3. Date and Time

4. Curing Speed

5. Light Source working and wattage

6. Inner Air pressure

7. Inner Temperatures

8. Length of liner

2.04 CIPP Design

A. Liner Thickness

1. The CIPP shall be designed in accordance with the applicable provisions of ASTM F2019 for fully deteriorated host pipe conditions and shall meet the following design conditions:

a. American Association of State Highway and Transportation Officials (AASHTO) HS20-44 Live Load, whether under streets or not. The live load will vary based on depth of pipe.

b. A dead load based on the depth of pipe shown in the Master Spreadsheet. A soil modulus of elasticity of one-thousand pounds per square inch (1,000 psi), soil weight of one-hundred-twenty pounds per cubic foot (120 lbs/ft^3), and a coefficient of friction of Ku'=0.130r.

c. Long-term Flexural Strength and Long-term Flexural Modulus when tested in accordance with ASTM D2990.

i. 50-Year Flexural Strength: 4,500 psi minimum

ii. 50-Year Flexural Modulus: 200,000 psi minimum

d. Safety Factor of 2.0 shall be used.

e. Groundwater elevation at the ground surface.

f. Pipe Ovality of 5%.

g. Poisson Ratio of 0.3.

h. Enhancement factor (K) of 7.

i. Service temperature range shall be forty to one-hundred-forty degrees Fahrenheit (40° F to 140° F).

j. Maximum long-term deflection shall be 5%.

2. Minimum Acceptable Pipe Thickness

a. The minimum cured liner thickness shall be as follows, regardless of what the calculations indicate as the required minimum thickness:

Pipe Diameter (Inches)	Depth to Invert (Feet)	Minimum Thickness (Installed) (mm)
15	0-15	6.0
18	0-15	6.0
24	0-15	7.5
30	0-15	9.0
36	0-15	10.5
48	0-15	15.0

b. The above table is in regards to **MINIMUM** installed liner thicknesses only. It is the CONTRACTOR's responsibility to determine the site specific external loads on the liner and increase its thickness as required. The CONTRACTOR shall submit his proposed plan for ensuring that the finished and installed CIPP meets the above minimum thickness requirements. The plan shall include detailed inversion procedures to reduce stretching and resin loss.

c. **Any liner that does not meet the specified strength and/or thickness requirements, regardless of the amount below the specified requirements, shall be corrected by the CONTRACTOR in a manner approved by the ENGINEER at no additional cost to the OWNER. The ENGINEER's decision on how to correct deficient CIPP installations shall be final.**

d. All references to cured liner thickness shall be defined as total

thickness after installation and after curing is complete.

B. The finished CIPP shall provide a uniform smooth, interior wall surface and will have at least one-hundred percent (100%) of the flow capacity of the original pipe before rehabilitation. In lieu of measurements, calculated capacities may be derived using a Manning “n” coefficient of 0.013 for the original pipe material and a Manning “n” coefficient of 0.010 for a joint-less smooth-wall cured-in-place pipe.

2.05 Hydrophilic End Seals

A. CONTRACTOR is to install Hydrophilic End seal at all catch basin penetrations. The End Seals must be in a tubular form which when installed will form a three-hundred-sixty degree (360°) seal between the host pipe and the newly installed liner and must be a minimum of three inches (3”) wide. The use of caulking, rope, or band type of an end seal will not be allowed. Acceptable End Seals are Insignia™ End Seals by LMK Enterprises, 1779 Chessie Lane, Ottawa, IL 61350 (815) 433-1275, or pre-approved equal.

B. Materials

1. The materials utilized for the INSIGNIA™ END SEAL shall be provided in kits that are designed to accommodate varying pipe diameters, catch basin depths, junction configurations, and pipe liner products. The INSIGNIA™ END SEAL kits are compatible with most rehabilitative pipe liner products, including cured-in-place, and fold-and-form. Additionally, the INSIGNIA™ END SEAL kit may be used with many different pipe liner installation and curing methods, including inversion, pull-in-place, hot water curing, steam curing, ultra violet curing, and ambient curing methods. The components of the INSIGNIA™ END SEAL include a tubular sleeve, and a mechanical fastener.

2. Tubular Sleeve: The member that creates the end seal is a hydrophilic neoprene rubber of approximately 50 Shore A durometer. The tubular sleeve has a uniform wall thickness of approximately two millimeters (2 mm), a length of approximately 3.5 inches, and a diameter slightly less than the interior pipe diameter (ID). The hydrophilic neoprene rubber has the following characteristics:

Physical Property	Test Method	Unit	Minimum Value
Shore A Hardness	ASTM D 2240	Point	50 +/- 5

Tensile Strength	ASTM D 412	psi	1,177
Elongation at Break	ASTM D 412	%	523
Specific gravity	ASTM D 297		1.2
Swell capacity in water contact	GRCSC	%	200

3. Mechanical Fastener: There are several mechanical fasteners available for use with the INSIGNIA™ END SEAL product. A first option is a shape-memory alloy that has been formed into a specific arcuate or other curvilinear configuration having an outer profile that is generally greater than the circumference of the pipe before insertion. This conformation allows the alloy to be bent into a configuration that fits inside of the tubular sleeve and the pipe. Once inside the pipe, the alloy is pressed against the wall of the tubular sleeve, thus pressing the tubular sleeve against the wall of the pipe.

   The shape memory characteristic of the fastener urges the fastener to return to its original profile. The alloy remains in a strained configuration, pressing the tubular sleeve against the pipe wall. A second option for a mechanical fastener is a ratcheting retaining ring. The ratcheted retaining ring includes a strip of material having a total length generally greater than the pipe diameter. A ratcheting worm gear is attached to the strip and the strip is formed into a ring shape of variable diameter. The ratcheting retaining ring allows an operator to manually adjust the outer profile of the mechanical fastener, allowing for a small initial diameter before placement into the pipe. After the ratcheting retaining ring is placed within the pipe, the diameter of the retaining ring may be expanded by actuation of the worm gear to tightly hold the tubular sleeve in place.

4. Dual-sided Adhesive Tape: For some mechanical fasteners, a dual-sided adhesive tape may be used to affix the mechanical fastener to the tubular sleeve before installation within the pipe. This feature encourages the mechanical fastener to remain within the tubular sleeve during installation of the tubular sleeve and the pipe liner.

2.06 CIPP Sectional Repair

A. The reconstruction will be accomplished using a liner tube of a particular length and a thermo-set resin with physical and chemical properties appropriate for the application. The tube positioned within a translucent inversion bladder is vacuum impregnated with the resin, then placed inside a protective launching device and

winched through the storm sewer pipe. When the launching device is properly positioned, the end is opened and the resin-saturated tube and bladder are inverted out of the launching device and through the damaged section using controlled air -pressure. Once the tube/resin composite is cured, the inversion bladder is re-inverted back into the launching device and removed from the pipe. The liner system shall be capable of repairing pipe defects in continuous lengths up to one-hundred feet (100'), ranging in diameters from six inches (6") to thirty-six inches (36").

B. Material

1. The tube will consist of one (1) or more layers of flexible non-woven needled felt or a reinforced non-woven. The tube will be continuous in length exhibiting a uniform minimum wall thickness based upon design calculations found in ASTM F2019, Appendix X1. No overlapping sections shall be allowed in the circumference or the length of the liner. The tube shall include compressible material at each end forming a smooth transition to the host pipe.

   The liner will be capable of conforming to offset joints, bells, and disfigured pipe sections. The resin will be polyester, or vinyl-ester with proper catalysts as designed for the specific application. The cured-in-place pipe shall provide a smooth bore interior. Each installation shall have a design report documenting the design criteria for a fully deteriorated pipe section, or a partially deteriorated pipe in cases where the pipe has previously been lined. Each end of the sectional liner should be tapered into the pipe for favorable hydraulic conditions.

2. The cured-in-place pipe shall meet or exceed the minimum test standards specified by the American Society for Testing Methods as described in ASTM F1216.

3. The tube should be outfitted with expanding hydrophilic O-rings at each end to form a compression end seal.

4. The installer shall be capable of viewing the beginning of the liner contacting the host pipe verifying the exact placement of the liner and that the liner has covered the entire damaged section. Video documentation of the placement, prior to curing, shall be provided to the OWNER. No measurement from a CCTV counter or estimating will be allowed.

5. The liner must be installed at low pressure, not to exceed ten pounds-per-square-inch (10 psi), to prevent damage or further damage to the host pipe. The tube shall be held tightly in place against the wall of the host pipe by pressure until the cure is complete for the required time per manufacture's specifications.

Part 3 Execution

3.01 General

A. All reconstruction of existing stormwater sewers using an approved UV-CIPP product and installer shall be performed in strict accordance with this Specification and the latest revision of ASTM F2019. Where discrepancies exist, or any latitude is either inferred or interpreted between this Specification and ASTM product and process standards, this Specification shall govern.

B. The CONTRACTOR shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

C. The CONTRACTOR shall be responsible for coordinating payment and usage with the local owning utility of water withdrawn from fire hydrants.

D. The CONTRACTOR shall be responsible for locating and accessing all catch basins needed to perform the work.

E. All surfaces, which have been damaged by the CONTRACTOR's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of the CONTRACTOR's operations. Suitable materials and methods, acceptable to the ENGINEER, shall be used for such restoration. The restoration of existing property or structures shall be performed as promptly as practicable and shall not be left until the end of the construction period. The cost for correcting damages resulting from the CONTRACTOR's actions shall be the responsibility of the CONTRACTOR.

F. The tube shall be fabricated to a size that, when installed, will neatly fit the internal circumference of the conduit(s) designated for CIPP. Allowance shall be made for the circumferential stretching during insertion of the tube.

G. The CONTRACTOR shall be responsible for determining the minimum length to effectively span the distance from the catch basin to catch basin and shall verify the length of the fabric tube in the field before the tube is either cut to length or wet-out with resin. The tube may run through one or more catch basins with the approval of the ENGINEER.

H. Traffic Control: The CONTRACTOR shall be responsible for traffic control during the course of each phase of the work. Prior to beginning work, CONTRACTOR shall submit a traffic control plan for each section of work for the review and approval. It is the intent that this work is to be accomplished with as little disturbance to traffic, private property, and the public as is reasonably possible, consistent with timely completion thereof. The traffic control plan shall reflect such requirements where applicable. Signs, signals, and detours shall conform to the Tennessee Department of Transportation (TDOT) requirements for streets and highways, latest edition. The CONTRACTOR shall have and maintain on site a sufficient supply of traffic cones and other traffic signaling devices, including trained and properly equipped flagmen, to safely control all traffic through the work zone(s). Road closures and/or detours will require advance scheduling and prior approval by the ENGINEER.

3.02 Daily Work Schedule

Insofar as is possible, work shall be so scheduled that the lining of the pipe and curing of the tube can be accomplished in a single working day or shift. Prior approval must be obtained from the ENGINEER if work is to be performed at night or on weekends to minimize traffic disturbance. At the end of each working day, temporary tie connections shall be made between the relined section of pipe and the existing system and the plug in the upstream catch basin removed, but not before the section being lined has been properly cured in accordance with the manufacturer’s instructions.

3.03 By-Pass Pumping

As required for acceptable completion of the work and/or to avoid damages due to spills or overflows, the CONTRACTOR shall provide for continuous flow maintenance around the section or sections of pipe designated for rehabilitation when necessary. CONTRACTOR shall be responsible to limit the extent and duration of such blockages and back-ups so that overflows and spillage onto public or private property, waterways, and streets does not occur. In the event that such spillage or overflows do occur during the course of or as a result of the Work, the CONTRACTOR performing the Work shall immediately eliminate

the spillage or overflow and, as necessary, remove the blockage and eliminate the back-up.

On elimination of the spillage or overflow, the CONTRACTOR is to clean up the area. Work to stop or contain such events is to be deemed emergency in nature and sufficient justification for total mobilization of resources, the use of overtime or double time, and any other reasonable measures to assure correction of the problem without delay. Damages arising from blockages, back-ups, spillage, or overflows during the course of the Work or because of the Work shall be the sole responsibility of the CONTRACTOR.

3.04 Preliminary Installation Requirements

A. Prior to CIPP installation, the pipe shall be cleaned to the satisfaction of the ENGINEER per *Section 330130.41 – Cleaning of Sewers* of these Specifications.

B. Debris Disposal: All debris cleaned from the pipe shall be removed and disposed of properly. Debris shall not be allowed to wash into any other pipe segment either upstream or downstream from the pipe segment being cleaned.

C. Holes and Voids: All holes and voids visible in video inspection of the pipe shall be completely filled by the CONTRACTOR with flowable fill, cementitious grout, or equal approved by the ENGINEER, prior to CIPP Pre-Installation Video Inspection. All materials shall be installed according to the manufacturer's recommendations. The finished surface of any material used to fill holes and voids shall be smooth and shall conform to the interior surface of the host pipe and not be visible as a bulge or dimple in the finished CIPP.

D. Pre-Installation Video Inspection: The section of storm sewer designated for CIPP shall to be televised its full length using a remote television camera in accordance with *Section 330130.11 – Television Inspection of Sewers* of these Specifications and shall be submitted to the ENGINEER for review. Note: See Article 2.02 J.1 of these specifications regarding additional work to be performed during Pre-video inspection activities. Camera shall have rotation of 300º (+/-) and equipped with a zoom lens.

3.05 Resin Impregnation of the CIPP Tube (Wet-Out)

A. The CONTRACTOR shall designate a location where the tube shall be impregnated or "wet out" with resin. The impregnated tube shall be free of pinholes, resin voids, and other defects. The quality management system for the wet-out

facility must be registered in accordance with ISO 9001. The quality management system must ensure that proper materials and amounts are used in the resin saturation process and in liner shipping and storage. The quality control documentation shall include resin lot numbers, volumes of resin, catalyst, enhancers, date of wet-out, storage/transportation controls, and quality assurance procedures. A checklist must be included documenting that each critical step in the resin impregnation process is checked off and initialed.

B. Care shall be taken in shipping, handling, and storage to avoid damaging the liner. Any liner damaged in shipment shall be replaced as directed by the OWNER at no additional cost to the OWNER.

3.06 Installation of CIPP

A. The liner material shall be inserted through a catch basin or other access point by a means and method authorized by the manufacturer until it has fully traversed the designated line length and the inversion face breaches the destination catch basin or termination point. Lubricant during inversion shall be used as necessary in accordance with the CIPP manufacturer's recommendations. Care should be taken during tube installation not to over-stress the tube.

B. The CONTRACTOR shall maintain pressure requirements as defined by the manufacturer. The pressure used during the installation process shall be sufficient to hold the liner tight to the pipe wall and prevent wrinkles in the cured liner. The same pressure shall be great enough to prevent any infiltration from entering the pipeline during the curing process. The pressure shall be maintained for a time sufficient to allow any pockets of water to exfiltrate the host pipe, and to prevent lifts in the liner and resin washout.

C. When using pressurized air, particular attention should be given to the maintenance of the minimum required "finished and installed" thickness of the CIPP. Once the inversion has started, pressure shall be maintained between the minimum and maximum pressures until the inversion has been accomplished.

D. Liner Installation – The liner shall be securely attached to a winch and pulled into place taking care not to exceed pulling forces as stated in the manufacturer's installation protocol.

E. Liner Inflation – Liner shall be inflated per manufacturer's inflation process. Once inflate to working pressures, the liner shall fit tightly against the host pipe.

F. Pre-Curing Inspection – Once working inflation pressures are reached, the liner shall be inspected by an integrated CCTV on the light assembly. The entire length of the pipe shall be checked for proper fit and expansion of the liner system.

3.07 Curing

A. Follow the submitted cure schedule in curing the CIPP liner.

B. Curing must take into account the existing pipe material, the resin system, and the ground conditions (temperature, moisture level, and thermal conductivity of the soil).

C. Continuously monitor liner temperatures throughout the curing process. Continue curing uninterrupted until the CIPP liner is thoroughly cured from access-point to access-point.

D. Initial curing speeds will begin at a sufficient speed to ensure the first fifteen feet (15 ft) of the liner is cured properly. The working speed shall be increased to properly cure the remainder of the liner per the manufacturer's protocol. The same process will be reversed for the last fifteen (15 ft) of the liner, whereby the speeds and curing speeds will be slowed to allow the liner to cure properly.

3.08 Cool-Down

Cool-down of the cured pipe liner shall be in accordance with the manufacturer's recommendations. Care should be taken during the cool-down process so as to minimize shrinkage of the CIPP.

3.09 Termination and Sealing at Catch Basin Outlets

A. Termination of the cured-in-place pipe at the catch basin shall be completed by trimming the inverted pipe end back in accordance with the CIPP manufacturer's recommendations. If, in the judgment of the ENGINEER, the CIPP does not fit tightly against the storm sewer pipe at its termination point(s), the void between the host pipe and the CIPP shall be sealed by filling it with a resin mixture compatible with the CIPP at no additional cost to the OWNER.

B. The Cured-in-place pipe inverts of lined-through catch basins shall remain in place

as part of the finished CIPP. The finished CIPP shall be trimmed to match the profile of the existing interface between the pipe and catch basin wall or bench. The annular space between the CIPP and the host structure(s) shall be sealed with a Hydrotite™ style SS-0215 hydrophilic waterstop seal or ENGINEER approved equal. Any water entering or exiting the annular space between the catch basin and the finished CIPP after installation must be stopped by the CONTRACTOR by a method approved by the ENGINEER.

C. If Catch Basin or Storm Sewer Manholes require repair for successful liner installation, or if any damage occurs to them during the installation process, they shall be repaired to functional condition according to the OWNER's direction.

3.10 Testing of CIPP

A. The ENGINEER may, at its discretion, direct the CONTRACTOR to collect samples of the cured CIPP for laboratory determination of flexural strength, flexural modulus and wall thickness for each test sample. These three individual analyses shall comprise one completed test. All samples shall be collected per the sampling protocols set forth in ASTM F1216.

For each line segment, the CONTRACTOR shall remove one restrained sample of the installed liner at least twelve inches (12") in length for testing. The sample submitted shall be the exact same I.D. as the host pipe, samples caught in smaller diameter pipe shall not be acceptable. For each sample taken, the CONTRACTOR shall cut and deliver a twelve inches (12") in length representative sample (taken at least two inches [2"] from the end of the specimen) to the ENGINEER.

The sample delivered to the ENGINEER shall be labeled and removed from any restraining mold. The samples shall be taken in the presence of the ENGINEER. (NOTE: Any preliner tube material must be removed from the sample by the CONTRACTOR before delivering the sample to the ENGINEER.)

B. The tests shall be used to verify that the installed CIPP meets these Specifications. CIPP thickness shall be measured in accordance with ASTM D5813. Flexural properties shall be determined per ASTM D790. The CONTRACTOR shall label and date all samples and deliver the samples directly to the ENGINEER.

C. Any liner that does not meet the specified strength and/or thickness requirements, regardless of the amount below the specified requirements, shall be corrected by the CONTRACTOR in a manner approved by the ENGINEER at no additional cost

to the OWNER. The ENGINEER's decision on how to correct deficient CIPP installations shall be final. Options for correcting deficient liners that may be considered by the ENGINEER include removing the liner and re-lining the storm sewer, excavating and replacing the storm sewer from catch basin to catch basin, or providing the OWNER with a credit. The primary option that will be considered will be to re-line the storm sewer. Credits will only be authorized for CIPP that does not meet required thickness. If a credit is acceptable to the OWNER, the credit shall be calculated by multiplying the bid price by the percent that the liner thickness is below the required installed thickness as follows:

Credit = (1 – Installed CIPP thickness/required CIPP thickness) x bid price

The CONTRACTOR shall not assume a credit will be acceptable to the OWNER under any circumstance. This would be the OWNER's sole discretion.

3.11 Final Acceptance

A. Post-installation videos shall be conducted and submitted to the ENGINEER in accordance with *Section 330130.11 – Television Inspection of Sewers* of these Specifications. The finished CIPP shall be continuous over the length of pipe between two (2) catch basins and shall be an impermeable, joint-less conduit, free from visual defects such as foreign inclusions, dry spots, pin holes, lifts, or delamination. Camera shall have rotation of 300º (+/-) and equipped with a zoom lens. In order to be considered for payment, the post installation videos MUST include the pipe connections at both ends of the pipe.

B. Wrinkles in the CIPP, (other than minor, longitudinal pressure wrinkles) will not be acceptable. The ENGINEER shall determine as to the acceptability of pressure wrinkling with that decision being final. In the event the finished liner does not fit tightly against the original pipe at its termination point(s), the space between the liner and the pipe shall be made watertight, utilizing catch basin end seals, hydro-tite gaskets, or approved equal.

C. After curing of the resin is completed, the hardened CIPP shall extend from catch basin to catch basin of the section designated providing a structurally sound, corrosion-resistant, watertight conduit that excludes exfiltration and infiltration, is tight-fitting within the existing pipe, and is free of voids or annular spaces between the CIPP and the existing pipe walls. K-Factor for tightness shall equal 7.0 or greater. All terminations into catch basin walls shall be watertight at the time of final inspection.

No annular space shall be visible between the CIPP and the catch basin wall. In the event that an annular space is present, it shall be completely filled with epoxy or other suitable material to the satisfaction of the ENGINEER.

D. The finished pipe must be such that when the thermosetting resin cures, the total wall thickness will be a homogeneous, monolithic composite matrix that will be chemically resistant to withstand internal exposure to domestic sewage. When cured, the CIPP must form a mechanical bond with the host pipe.

END OF SECTION