GENERAL CONDITIONS AND TECHNICAL SPECIFICATIONS

for

Construction of

WATER LINE AND SEWER LINE ADDITIONS

for the

CITY OF GALLATIN

in

SUMNER COUNTY, TENNESSEE

WS 04-1246
Approval Expires 10/15/07

WPC 04-0974
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AUGUST 2004

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Consulting Engineers
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JCH Project #04228
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### GENERAL CONDITIONS

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DEFINITIONS GC-1.01 Thru 1.09

GC-1.01 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:

GC-1.02 ADDENDA - Written or graphic instruments issued prior to the execution of the Agreement, which modify or interpret the CONTRACT DOCUMENTS, DRAWINGS and SPECIFICATIONS, by additions, deletions, clarifications or corrections.

GC-1.03 BID - The offer or proposal of the BIDDER submitted on the prescribed form setting forth the prices for the WORK to be performed.

GC-1.04 BIDDER - Any person, firm or corporation submitting a BID for the WORK.

GC-1.05 BONDS - Bid, Performance, and Payment Bonds and other instruments of security, furnished by the CONTRACTOR and his security in accordance with the CONTRACT DOCUMENTS.

GC-1.06 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.

GC-1.07 CONTRACT DOCUMENTS - The contract, including Advertisement for Bids, Information for Bidders, BID, Bid Bond, Agreement, Payment Bond, Performance Bond, NOTICE TO AWARD, NOTICE TO PROCEED, CHANGE ORDER, DRAWINGS, SPECIFICATIONS, and ADDENDA.

GC-1.08 CONTRACT PRICE - The total monies payable to the CONTRACTOR under the terms and conditions of the CONTRACT DOCUMENTS.

GC-1.09 CONTRACT TIME - The number of calendar days stated in the CONTRACT DOCUMENTS for the completion of the WORK.
DEFINITIONS GC-1.10 Thru 1.19

GC-1.10 **CONTRACTOR** – The person, firm or corporation with whom the **OWNER** has executed the Agreement.

GC-1.11 **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**.

GC-1.12 **ENGINEER** – The person, firm or corporation named as such in the **CONTRACT DOCUMENTS**.

GC-1.13 **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.

GC-1.14 **NOTICE OF AWARD** – The written notice of the acceptance of the **BID** from the **OWNER** to the successful **BIDDER**.

GC-1.15 **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**.

GC-1.16 **OWNER** – a public or quasi-public body or authority, corporation, association, partnership, or individual for whom the **WORK** is to be performed.

GC-1.17 **PROJECT** – The undertaking to be performed as provided in the **CONTRACT DOCUMENTS**.

GC-1.18 **RESIDENT PROJECT REPRESENTATIVE** – The authorized representative of the **OWNER** who is assigned to the **PROJECT** site or any part thereof.

GC-1.19 **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.
DEFINITIONS

GC-1.20 SPECIFICATIONS – A part of the CONTRACT DOCUMENTS consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

GC-1.21 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.

GC-1.22 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.

GC-1.23 SUPPLEMENTAL GENERAL CONDITIONS – Modifications to General Conditions required by a Federal agency for participation in the PROJECT and approved by the agency in writing prior to inclusion in the CONTRACT DOCUMENTS.

GC-1.24 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.

GC-1.25 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.

GC-1.26 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.
ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS GC-2.01 Thru 2.02

GC-2.01 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.

GC-2.02 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.
GC-3

SCHEDULES, REPORTS AND RECORDS

GC-3.01 The CONTRACTOR shall submit to the OWNER such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and data as the OWNER may request concerning WORK performed or to be performed.

GC-3.02 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 he will start the various parts of the WORK, estimated date of completion of each part and, as applicable:

GC-3.2.1 the dates at which special detail drawings will be required; and

GC-3.2.2 respective dates for submission of SHOP DRAWINGS, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

GC-3.03 The CONTRACTOR shall also submit a schedule of payments that he anticipates he will earn during the course of the WORK.
DRAWINGS AND SPECIFICATIONS

GC-4.01 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.

GC-4.02 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.

GC-4.03 Any discrepancies found between the DRAWINGS and SPECIFICATIONS and site conditions or any inconsistencies or ambiguities in the DRAWINGS and 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.
SHOP DRAWINGS

GC-5

SHOP DRAWINGS

GC-5.01 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 DRAWINGS, which substantially deviates from the requirement of the CONTRACT DOCUMENTS, shall be evidenced by a CHANGE ORDER.

GC-5.02 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 are in conformance with the requirements of the CONTRACT DOCUMENTS.

GC-5.03 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. A copy of each approved SHOP DRAWING and each approved sample shall be kept in good order by the CONTRACTOR at the site and shall be available to the ENGINEER.
It is understood that, except as otherwise specifically stated in the CONTRACT DOCUMENTS, the CONTRACTOR shall provide and pay for the 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.

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.

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

Materials, supplies and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.

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.
INSPECTIONS AND TESTING  GC-7.01 Thru 7.07

GC-7 INSPECTIONS AND TESTING

GC-7.01 All materials and equipment used in the construction of the PROJECT shall be subject to adequate inspection and testing in accordance with generally accepted standards.

GC-7.02 The CONTRACTOR shall provide at his expense the necessary testing and inspection services required by the CONTRACT DOCUMENTS, unless otherwise provided.

GC-7.03 The OWNER shall provide all other inspection and testing services not required by the CONTRACT DOCUMENTS.

GC-7.04 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.

GC-7.05 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.

GC-7.06 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 the 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.

GC-7.07 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
INSPECTIONS AND TESTING  GC-7.08 Thru 7.08

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 and testing and of satisfactory reconstruction. If, however, such WORK is not found to be defective, the CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate CHANGE ORDER shall be issued.
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 function 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.
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 **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**.
GC-10.1 The **OWNER** shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the **WORK** together with a suitable number of benchmarks adjacent to the **WORK** as shown in the **CONTRACT DOCUMENTS**. From the information provided by the **OWNER**, unless otherwise specified in the **CONTRACT DOCUMENTS**, the **CONTRACTOR** shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations and cut sheets.

GC-10.02 The **CONTRACTOR** shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, 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.

GC-10.03 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**.
GC-11.01 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 courses of construction.

GC-11.02 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, except damage or loss attributable to the fault of the CONTRACT DOCUMENTS or to the acts or omissions of the OWNER or the ENGINEER or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the CONTRACTOR.

GC-11.03 In emergencies affecting the safety of persons or the WORK or property at the site 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.
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.
GC-15

CHANGES IN THE WORK

GC-13

CHANGES IN THE WORK

GC-13.01  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**.

GC-13.02  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 seven (7) days after the receipt of the ordered change. Thereafter the **CONTRACTOR** shall document the basis for the change in **CONTRACT PRICE** or **TIME** within thirty (30) days. The **CONTRACTOR** shall not execute such changes pending the receipt of an executed **CHANGE ORDER** or further instructions from the **OWNER**.
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 the 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 percent (15%) of the actual cost of the WORK to cover the cost of general overhead and profit.
TIME FOR COMPLETION AND LIQUIDATED DAMAGES

GC-15.01 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 an a date specified in the NOTICE TO PROCEED.

GC-15.02 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 the average climatic and economic conditions and other factors prevailing in the locality of the WORK.

GC-15.03 If the 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 of 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.

GC-15.04 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 the CONTRACTOR has promptly given WRITTEN NOTICE of 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.

**GC-18**

**CORRECTION OF WORK**

**GC-16**

**CORRECTION OF WORK**

**GC-16.01** 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.

**GC-16.02** 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**.
SUBSURFACE CONDITIONS    GC-17.01 Thru 17.02

GC-17.01 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.

GC-17.02 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 an equitable adjustment shall be made and the CONTRACT DOCUMENTS shall be modified by a CHANGE 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 determined the facts so justify, consider and adjust any such claims asserted before the date of final payment.
GC-18.01 The OWNER may, at any time and without cause, suspend the WORK or any portion thereof for a period of not more than ninety (90) days or such further time as agreed upon by the CONTRACTOR, by WRITTEN NOTICE to the CONTRACTOR and the ENGINEER 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.

GC-18.02 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 recognize 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 payment 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.
SUSPENSION OF WORK, TERMINATION AND DELAY

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 the CONTRACTOR and take possession of the PROJECT and all materials, equipment, tools, construction equipment and machinery thereon owned by the CONTRACTOR, and finish the WORK by whatever 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.

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.

After ten (10) days from delivery of 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.
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.

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.
At least ten (10) days before each progress payments falls due (but not more often than once a month), the CONTRACTOR will submit to the ENGINEER a partial payment estimate filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by the partial payment estimate and supported by such data as the ENGINEER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the WORK but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such 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. The ENGINEER will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present partial payment estimate to the OWNER, or return the partial payment estimate to the CONTRACTOR indicating in writing his reasons to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the partial payment estimate. The OWNER will within fifteen (15) days of presentation to him of an approved partial payment estimate, pay the CONTRACTOR a progress payment on the basis of the approved partial payment estimate less the retainage. The retainage shall be an amount equal to ten percent (10%) of said estimate until fifty percent (50%) of the WORK has been completed.
GC-24

PAYMENT TO CONTRACTOR  GC-19.01 Cont. Thru 19.04

At fifty percent (50%) completion, further partial payments shall be made in full to the CONTRACTOR and no additional amounts may be retained unless the ENGINEER certifies that the job is not proceeding satisfactorily, but amounts previously retained shall not be paid to the CONTRACTOR. At fifty percent (50%) completion or any time thereafter when the progress of the WORK is not satisfactory additional amounts may be retained but in no event shall the total retainage be more than ten percent (10%) of the value of the WORK completed. Upon substantial completion of the WORK, any amount retained may be paid to the CONTRACTOR. When the WORK has been substantially completed except for work which cannot be completed because of weather conditions, lack of materials or other reasons which in the judgment of the OWNER are valid reasons for noncompletion, the OWNER may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the WORK still to be completed.

GC-19.02 The request for payment may also include an allowance for the cost of such major materials and equipment, which are suitably stored either at or near the site.

GC-19.03 Prior to SUBSTANTIAL COMPLETION, the OWNER, with the approval of the ENGINEER and with the concurrence of the CONTRACTOR, may use any completed or substantially completed portions of the WORK. Such use shall not constitute an acceptance of such portions of the WORK.

GC-19.04 The OWNER shall have the right to enter the premises for the purpose of doing work not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care and protection of the WORK, or the restoration of any damaged WORK except such as may be caused by agents or employees of the OWNER.
GC-25
PAYMENT TO CONTRACTOR GC-19.05 Cont. Thru 19.07

GC-19.05 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 the 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.

GC-19.06 The CONTRACTOR will indemnify and save the OWNER or the OWNER’S agents harmless from all claims growing out of the lawful demand 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 payment made in good faith.

GC-19.07 If the OWNER fails to make payment thirty (30) days after approval by the
ENGINEER, in addition to other remedies available to the CONTRACTOR, there shall be added to each such payment interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the CONTRACTOR.

GC-26

ACCEPTANCE OF FINAL PAYMENT AS RELEASE  GC-20.01 Thru 20.01

GC-20  ACCEPTANCE OF FINAL PAYMENT AS RELEASE

GC-20.01  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 stated 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.
GC-21.01 The CONTRACTOR shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of or result from the CONTRACTOR'S executions of the WORK, whether such execution be by himself or by any SUBCONTRACT or by anyone directly employed by any of them, or by anyone for whose acts any of them may be liable.

21.1.1 Claims under workmen's compensation, disability benefit and other similar employee benefit acts;

21.1.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees;

21.1.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;

21.1.4 Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the CONTRACTOR, or (2) by any other person; and

21.1.5 Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

GC-21.02 Certificates of Insurance acceptable to the OWNER shall be filed with the OWNER prior to commencement of the WORK. These Certificates shall contain a provision that coverages afforded under the policies will not be cancelled unless at least fifteen (15) days prior WRITTEN NOTICE has been given to the
The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, liability insurance as hereinafter specified;

INSURANCE GC-21.03 Thru 21.04

21.3.1 CONTRACTOR'S General Public Liability and Property Damage Insurance including vehicle coverage issued to the CONTRACTOR and protecting him from all claims for personal injury, including death, and all claims for destruction of our damage to property, arising out of or in connection with any operations under the CONTRACT DOCUMENTS, whether such operations be by himself or by any SUBCONTRACTOR under him, or anyone directly or indirectly employed by the CONTRACTOR or by a SUBCONTRACTOR under him. Insurance shall be written with the following limits of liability:

- General Aggregate $2,000,000
- Products/Completed Operations Aggregate $2,000,000
- Per Occurrence $2,000,000
- Fire Legal Liability $500,000
- Medical Payments $5,000

21.3.2 The CONTRACTOR shall acquire and maintain, if applicable, Fire and Extended Coverage insurance upon the PROJECT to the full insurable value thereof for the benefit of the OWNER, the CONTRACTOR, and SUBCONTRACTORS as their interest may appear. This provision shall in no way release the CONTRACTOR or CONTRACTOR'S surety from obligations under the CONTRACT DOCUMENTS to fully complete the PROJECT.

The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, in accordance with the provisions of the laws of the state in which the work is performed, Workmen's Compensation Insurance, including occupational disease provisions, for all of his employees at the site of the PROJECT and in case any work is sublet, the CONTRACTOR shall require such
SUBCONTRACTOR similarly to provide Workmen's Compensation Insurance, including occupational disease provisions for all of the latter’s employees unless such employees are covered by the protection afforded by the CONTRACTOR. In case any class of employees engaged in hazardous work under this contract at the site of the PROJECT is not protected under Workmen's Compensation statue, the CONTRACTOR shall provide, and shall cause each SUBCONTRACTOR to provide, adequate and suitable insurance for the protection of his employees not otherwise protected.

INSURANCE GC-21.05 Thru 21.05

GC-21.05 The CONTRACTOR shall secure, if applicable, "All Risk" type Builders Risk Insurance for WORK to be performed. Unless specifically authorized by the OWNER, the amount of such insurance shall not be less than the CONTRACT PRICE totaled in the bid. The policy shall cover not less than the losses due to fire, explosion, hail, lightning, vandalism, malicious mischief, win, collapse, riot, aircraft, and smoke during the CONTRACT TIME, and until the WORK is accepted by the OWNER. The policy shall name as the insured the CONTRACTOR, the ENGINEER, and the OWNER.
GC-22.01 The CONTRACTOR shall within ten (10) days after the receipt of the NOTICE OF AWARD furnish the OWNER with a Performance Bond and a Payment Bond in the 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 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.
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.
GC-24  INDEMNIFICATION

GC-24.01 The CONTRACTOR will indemnify and hold harmless the OWNER and the ENGINEER and their agents and employees from and against all claims, damages, losses and expenses including attorneys’ fees arising out of or resulting from the performance of the WORK, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or injury to or destruction of tangible property, including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the CONTRACTOR, and SUBCONTRACTOR, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

GC-24.02 In any and all claims against the OWNER or the ENGINEER, or any of their agents or employees, by any employee of the CONTRACTOR, and SUBCONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or any SUBCONTRACTOR under workmen’s compensation acts, disability benefit acts or other employee benefits acts.

GC-24.03 The obligation of the CONTRACTOR under this paragraph shall not extend to the liability of the ENGINEER, his agents or employees arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, CHANGE ORDERS, designs or SPECIFICATIONS.
GC-33

SEPARATE CONTRACTS

GC-25 SEPARATE CONTRACTS

GC-25.01 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.

GC-25.02 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.

GC-25.03 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 him in additional expense or entitles him to an extension of the CONTRACT TIME, he may make a claim thereof as provided in Sections 14 and 15.
The CONTRACTOR may utilize the services of specialty SUBCONTRACTORS on those parts of the WORK which, under normal contracting practices, are performed by specialty CONTRACTORS.

The CONTRACTOR shall not award WORK to SUBCONTRACTOR(S), in excess of fifty percent (50%) of the CONTRACT PRICE, without prior written approval of the OWNER.

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.

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.

Nothing contained in this CONTRACT shall create any contractual relation between any SUBCONTRACTOR and the OWNER.
ENGINEERING AUTHORITY  GC-27.01 Thru 27.04

GC-27  ENGINEERS AUTHORITY

GC-27.01 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.

GC-27.02 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 or fabrication plant of the source of material supply.

GC-27.03 The ENGINEER will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

GC-27.04 The ENGINEER shall promptly make decisions relative to interpretation of the CONTRACT DOCUMENTS.
GC-28.01 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.

GC-28.02 The OWNER shall provide to the CONTRACTOR information, which delineates and describes the lands owned and right-of-way acquired.

GC-28.03 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.
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. The CONTRACTOR warrants and guarantees for a period of one (1) year from the date of SUBSTANTIAL COMPLETION of the system that the completed system is free from all defects due to fault materials or workmanship and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. 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 through the guarantee period.
GC-38

TAXES GC-30.01 Thru 30.01

GC-30     TAXES

GC-30.01  The CONTRACTOR will pay all sales, consumer, use and other similar taxes required by the law of the place where the WORK is performed.
1. **QUALIFICATIONS OF BIDDER**
   The apparent low bidder shall submit to the **OWNER** a list and description of work performed on previous projects similar to this along with evidence of financial ability, including a list of equipment owned, to satisfactorily complete the project, if requested by the **OWNER**.

2. **SUBCONTRACTORS AND SUPPLIERS**
   In accordance with paragraph GC-26 of the **General Conditions** the **CONTRACTOR** shall submit a list of any Subcontractors and major material suppliers proposed on this project.

3. **CONTRACT SECURITY**
   Contract Security shall be provided as set out in the **Information for Bidders** and in accordance with paragraph GC-22 of the **General Conditions**.

4. **CONTRACTOR’S AND SUBCONTRACTOR’S PUBLIC LIABILITY, AUTOMOBILE LIABILITY AND PROPERTY DAMAGE INSURANCE**
   With reference to Section GC-21 of the **General Conditions**, the **CONTRACTOR** is advised that he shall purchase and maintain at his own expense Property Insurance as will protect the **CONTRACTOR** and the **OWNER** from loss or damage while the project is under construction and prior to full acceptance thereof by the **OWNER**.

5. **ESTIMATE FOR PARTIAL PAYMENT**
   Form FHA 424-18 "Partial Payment Estimate", shall be used when estimating periodic payment due the **CONTRACTOR**. The applications for progress or final payments by the **CONTRACTOR** will be submitted to the **ENGINEER** on or before the 5th day of each calendar month. The date at which receipt of partial payment by **ENGINEER** as stipulated in **General Conditions** (GC-19) is hereby set as the 5th day of the month provided estimates are received by such time. The partial payment estimate shall be for work performed no later than the last day of the preceding calendar month.
6. **CONTRACTOR - WITHDRAWAL OF RETAINED FUNDS**

The **GENERAL CONTRACTOR**, subcontractor and material suppliers waive all rights to withdrawal of retained funds, which may accrue under Tennessee Code Annotated 12-434.

SC 1 OF 1
SECTION 1 - SCOPE OF PROJECT

1.01 GENERAL - The work to be accomplished under these Specifications consists of the furnishing of all materials, machinery, labor, equipment and services necessary for the construction of water line addition more particularly described elsewhere in the Specifications and shown on the Plans.

The CONTRACTOR shall perform all necessary clearing, staking, excavating, backfilling, grading, clean-up, restoration of damage to property, testing, etc., for the proper and complete installation of the system and restoration of the surface to its original condition.
SECTION 2 - PRELIMINARY WORK

2.01 GENERAL

A. No construction shall commence until plans are approved by the Tennessee Department of Environment and Conservation and said approved plans are on site.

B. In addition, no construction shall commence until a Notice to Proceed letter has been received from the District.

2.02 LOCATION AND PROTECTION OF UNDERGROUND UTILITIES - Prior to trenching, the CONTRACTOR shall determine, insofar as possible, the actual location of all underground utilities in the vicinity of his operations and shall have the respective utilities clearly mark their location so that they may be avoided by equipment operators. As per Tennessee State Law, a minimum of 72 hours before excavation is to begin, the CONTRACTOR shall call the Tennessee One Call System at 1-800-351-111 to have member utilities mark their utilities. Please note that non-member utilities will have to be contacted individually. Where such utility lines or services appear to lie in the path of construction they shall be uncovered in advance to determine the exact location and depth and to avoid damage due to trenching operations. Existing facilities shall be protected during construction or removed and replaced in equal condition, as necessary.

Should any existing utility line or service be damaged during or as a result of the CONTRACTOR's operations, the CONTRACTOR shall take such emergency measures as may be necessary to minimize damage and shall immediately notify the utility involved. The CONTRACTOR shall then repair the damage to the satisfaction of the utility or shall pay the utility for making the repairs. In all cases, the restoration and/or repair shall be such that the damaged structure will be in as good or better condition as before the damage occurred.

2.03 SURVEYING AND STAKING - The plans show the desired location of the water mains and it shall be the responsibility of the CONTRACTOR to provide the necessary stakes and lines to insure that the water mains will be actually installed in the location shown. Graphic symbols are used to indicate valve and hydrant general locations but ARE NOT drawn to scale. Minor changes in pipe line location to avoid obstructions or provide better coordination with topographic conditions may be worked out in the field between representatives of the CONTRACTOR and the ENGINEER. In general such field changes shall be limited to occasional deflections to avoid side drains, culverts, ditches, or other obstructions or lateral shifts which would result in an improved laying condition or a decrease in inconvenience to property owners or motorists.

It is intended that the water main be held a reasonable uniform distance from rights-of-way, edge of pavement, or other boundary and indiscriminate wandering over the available area solely for the purpose of selecting the easiest trenching conditions will not be tolerated.

Once the proposed location of the pipeline has been established the CONTRACTOR shall provide sufficient stakes and lines to guide the equipment operators and insure that the trenching will be done to proper alignment.
2.04 **REMOVAL OF OBSTRUCTIONS** - The CONTRACTOR shall be responsible for the removal, safeguarding and replacement of fences, walls, structures, culverts, street signs, billboards, shrubs, mailboxes, or other obstruction, which must be moved to facilitate construction. Such obstructions must be restored to at least their original condition.

2.05 **CLEARING AND GRUBBING** - The CONTRACTOR shall be responsible for cutting, removing and disposing of all trees, brush, stumps, roots and weeds within the construction area. Disposal shall be by means of chippers, landfills, or other approved method not in conflict with State or local ordinances.

Care shall be taken to avoid unnecessary cutting or damage to trees not in the construction area. The CONTRACTOR will be responsible for loss or damage to trees outside the permanent easement or rights-of-ways.
SECTION 3 - MATERIALS

3.01 **GENERAL** - All materials to be incorporated in the project shall be first quality, new and undamaged material conforming to all applicable portions of these specifications.

All materials must be furnished by the CONTRACTOR, and with all applicable taxes paid by the CONTRACTOR, and must conform to applicable portions of these specifications.

3.02 **CEMENT** - Cement shall be Portland cement of a brand approved by the ENGINEERS and shall conform to "Standard Specifications for Portland Cement", Type 1, ASTM Designation C150, latest revision. Cement shall be furnished in undamaged 94 pound, one (1) cubic foot sacks, and shall show no evidence of lumping.

3.03 **CONCRETE FINE AGGREGATE** - Fine aggregate shall be clean, hard uncoated natural sand conforming to ASTM Designation C33, latest revision, "Standard Specifications for Concrete Aggregate".

3.04 **CONCRETE COARSE AGGREGATE** - Coarse aggregate shall consist of clean, hard, dense particles of stone or gravel conforming to ASTM Designation C33, latest revision, "Standard Specifications for Concrete Aggregate". Aggregate shall be well graded between 1- 1/2" and #4 sieve sizes.

3.05 **WATER** - Water used in mixing concrete shall be clean and free from organic matter, pollutants and other foreign materials.

3.06 **READY MIX CONCRETE** - Ready-mix concrete shall be secured only from a source approved by the ENGINEERS, and shall conform to ASTM Designation C94, latest revision, "Specifications for Ready-Mix Concrete". Before any concrete is delivered on the job site, the supplier must furnish a statement of the proportions of cement, fine aggregate and coarse aggregate to be used for each mix ordered, and must receive the ENGINEERS approval of such proportions.

3.07 **CLASS "A" CONCRETE** - Class A concrete shall have a minimum compressive strength of 3500 pounds per square inch in 28 days and shall contain not less than 6 sacks of cement per cubic yard.

3.08 **CLASS "B" CONCRETE** - Class B concrete shall have a minimum compressive strength of 2000 pounds per square inch in 28 days and shall contain not less than 4 1/2 sacks of cement per cubic yard.

3.09 **METAL REINFORCING** - Reinforcing bars shall be Grade 60 steel conforming to ASTM Designation A615, latest revision, "Standard Specifications for Billet Steel Bars for Concrete Reinforcement". Bars shall be deformed with a cross sectional area at all points equal to that of plain bars of equal nominal size.

3.10 **CRUSHED STONE** - Crushed stone for bedding or backfill shall be Tennessee Department of Transportation Standard Size No. 67 and shall meet State Highway Department Standards for road surfacing.

3.11 **PEA GRAVEL** - Pea gravel for shaping cradle bedding shall be #4 to 1/2" size Ohio River, or approved local gravel of similar character.
3.12 **DUCTILE IRON PIPE** - Ductile iron pipe for water shall be manufactured in accordance with ANSI A21.51, AWWA C151 for centrifugally cast ductile iron pipe. The pipe shall be manufactured of iron having acceptance values of 60-42-10. Pipe shall be minimum pressure class or thickness class specified.

Pipe shall be furnished in lengths of 18' to 20' and unless otherwise indicated, shall be provided with a compression type slip joint equal to the Fastite joint as manufactured by American or approved equal. Gaskets and lubricant shall be furnished with the pipe.

Pipe shall be furnished with standard thickness cement lining on the inside with a bituminous seal coat and a bituminous coating on the outside. Cement lining shall conform to ANSI A21.4. The exterior of the pipe shall be clearly marked to indicate the manufacturer, date of manufacture, the pipe class and weight. Exterior markings shall also positively identify the pipe as being Ductile Iron.

3.13 **PLASTIC WATER PIPE & FITTINGS** - All plastic water pipe shall be made from clean, virgin, NSF-approved, Type I, Grade I polyvinyl chloride (PVC), conforming to ASTM resin specification D-1784. All pipe shall meet or exceed minimum requirements of Commercial Standard CS 256-63 and ASTM D-2241 for type 1120 material made to pressure ratings or SDR classifications as called for on the Bid Proposal or minimum SDR-21 wall thickness. Samples of pipe and joints shall be submitted to ENGINEER along with physical and chemical data sheets for his approval before purchase of pipe.

Pipe length shall not exceed 40 feet unless approved by ENGINEER. Provision must be made for proper transporting, handling and storage of pipe. Pipe and fittings are to be assembled with non-toxic lubricant as recommended by manufacturer and approved by ENGINEER. Pipe shall be as manufactured by Consolidated Pipe & Supply, Vulcan Plastic Corporation, North American Pipe Corporation, Extrusion Technologies, Inc., Napco Manufacturing Corporation or equal.

Pipe joints shall be the coupling or bell and spigot type utilizing rubber ring compression gasket(s) (ASTM D1869). Provision shall be made for thermal expansion and contraction to be taken up at the joint. Pipe joint shall conform to ASTM D-3139 latest revision.

Fittings shall be Ductile Iron (M.J.) and approved by ENGINEER. Proper adapters shall be used when connecting to piping of different material or dimensions, as approved by ENGINEER. Fittings shall have pressure ratings at least equal to that of connected piping. The end of the pipe installed in all fittings, valves, hydrants, etc., shall **not** be beveled but shall be square cut.

Manufacturer shall have pipe tested in accordance with provisions of Commercial Standard CS256-63. Manufacturer shall furnish ENGINEERS upon request, three (3) copies of certified statement to the effect that all items have met or exceeded requirements of the applicable specification. Test certificates will be required unless noted otherwise on drawings and shall cover all pipe used on this project.

All pipe and fittings shall be subjected to a rigid inspection after delivery to the site, and before being placed in the work. Any item found defective by such field inspection will be rejected and shall be immediately removed from the premises. Marking shall include the following on each length of pipe: manufacturer's name, nominal size, class pressure rating, "PVC 1120", and NSF seal of approval.
3.13 **PLASTIC WATER PIPE & FITTINGS** (continued)

All pipe shall have a metallic tape or similar device installed in accordance with manufacturer’s recommendation. The metallic device shall be Terra Tape or approved equal and shall be compatible with City location equipment.

3.14 **DUCTILE IRON FITTINGS** - All fittings shall be ductile iron manufactured in accordance with ANSI/AWWA 153/A21.53-94. Fittings shall be furnished with mechanical joints conforming to ANSI/AWWA C111/A21.11 and shall be cement lined with bituminous coating in accordance with ANSI/AWWA C104/A21.4. All fittings shall be furnished for 350 psi pressure rating. No full bodied fittings will be accepted unless otherwise directed.

3.15 **GATE VALVES** - All gate valves shall be resilient seated, manufactured to meet or exceed the requirement of AWWA C509 latest revision. All internal and external exposed surfaces shall be fusion-bonded epoxy coated with an approved epoxy coating to a minimum thickness of 6 mils, complying fully with AWWA 550 and certified to NSF61. Valves shall be furnished with mechanical joint ends in accordance with ANSI A21.11 unless otherwise shown or directed.

Valves shall be suitable for installation in an approximate vertical position in buried pipelines. Stem seal shall consist of three (3) 0-ring seals. All valves shall open to the left (counterclockwise) with non-rising stems and shall be provided with a 2-inch square operating nut. Gate valves shall be Mueller 2360 service resilient wedge gate valve or equal.

Valves shall be complete when shipped and the manufacturer shall use due and customary care in preparing them for shipment so as to avoid damage in handling or in transit. Particular care shall be taken to see that all valves are completely closed before shipment.

3.16 **BUTTERFLY VALVES (with underground operator)** - All butterfly valves shall be of the tight closing, rubber-seat type that fully complies with the latest revision of AWWA Standard C504 where applicable. Valves shall be bubble-tight at rated pressures in either direction, and shall be satisfactory for applications involving throttling service and/or operation and for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90° from the full open position to the tight shut position. Regardless of valve size, angular misposition of disc can be 1° off center without leakage. The manufacturer shall have manufactured tight-closing, rubber-seat butterfly valves for a period of at least five (5) years.

All valve bodies shall be cast iron ASTM A-126 Class B, narrow body design. Flange drilling shall be in accordance with ANSI B16.1 standard for cast iron flanges. Body thickness shall be in strict accordance with AWWA C504 where applicable.

All valve discs shall be constructed either of cast iron ASTM A-48 with stainless steel seating edge or ductile iron ASTM A-536 with stainless steel seating edge. The disc shall not have any hollow chambers that can entrap water. All surfaces shall be visually inspected and measurable to assure all structural members are at full design strength. Disc and shaft connection shall be made with stainless steel pins.
3.16 **BUTTERFLY VALVES** (with underground operator) (continued)

All shafts shall be turned, ground and polished and constructed of 18-8 Type 304 or Type 316 stainless steel. Shafts shall be two-piece, stub-type keyed for operator connection. Shaft diameters shall meet minimum requirements established by latest revision of AWWA Standard C504 for their class where applicable.

All seats shall be of a synthetic rubber compound. Seats shall be a full 360° without interruption and have a plurality of grooves mating with a spherical disc edge-seating surface. Valve seats shall be field adjustable around the full 360° circumference and replaceable without dismantling operator, disc or shaft and without removing the valve from the line. Manufacturer shall certify that rubber seat is field replaceable.

All valves shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating. Bearing load shall not exceed 1/5 of the compressible strength of the bearing or shaft material.

Valve operators shall conform to AWWA Standard C504 and shall be designed to hold the valve in any intermediate position between full open and fully closed without creeping and fluttering.

Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA Standard C504.

The manufacturer furnishing valves under the specification shall be prepared to show proof that the valves proposed meet the design requirements of AWWA Standard C504. Butterfly valves shall be Pratt Triton XR-70, Mueller Lineseal III, M & H 4500, DeZurik or approved equal.

3.17 **TAPPING SLEEVES AND VALVES** - Tapping sleeves shall consist of a heavy gauge stainless steel body with removable bolts, full gasket design giving 360° pipe coverage and stainless steel flange to accept standard tapping valve. Tapping sleeve shall be Ford Style FTSS or approved equal. Tapping valve shall conform to all applicable specifications for gate valves and shall be manufactured as tapping valves with line up groves. Tapping valve shall be M & H 4751.01 or approved equal.

3.18 **VALVE BOXES** – Valve boxes for the water distribution system shall be made of cast iron and shall be of the heavy roadway type. Base section shall be enlarged to enclose and protect valve-operating nut without being in contact with the valve or the pipe at any point. Top section shall be adjustable for elevation. Backfill around valves and box shall be tamped to maintain proper alignment of the box. Valve boxes that are not plumb or not properly centered will not be accepted.

All valve boxes shall be provided with covers on which the world “WATER” is cast in raised letters. Boxes shall be suitable for installation on mains laid at depths specified. Additional compensation will not be provided for deeper valve boxes made necessary by installation of mains at depths greater than minimum depths specified.

Valve boxes shall have an inside opening of not less than 11" by 13". Standard precast reinforced concrete boxes having the same opening shall be provided. Concrete boxes and footing blocks shall be made of 4,500 psi concrete by an approved manufacturer.
3.18 **VALVE BOXES** (continued)

Cast iron valve boxes shall be as manufactured by Bouchard Model No. 8006, Roadway Type “Nashville Standard” or equal.

3.19 **FIRE HYDRANTS** - Fire hydrants shall be iron bodied fully bronze mounted, hydrants manufactured to equal or exceed AWWA Standard C502-54. Hydrants shall be suitable for 150 psi working pressure and shall be subjected to a test pressure of 300 psi. Inlet connection shall be 6” mechanical joint. Main hydrant valve shall be compression type, closing with the pressure, with 5 1/4” valve opening. The hydrant shall have a 7.5” I.D. barrel. The bronze seat shall be threaded into mating threads of bronze for easy field removal.

All hydrants shall be equipped with two (2) 2½” hose nozzles, one pumper nozzle, breakable safety flange, and stem coupling. Bronze nozzles shall be securely locked to prevent them from blowing off. Hose and pumper nozzles shall be field replaceable. Hose threads shall be National Standard. Nozzle caps shall be equipped with non-kink chains.

Hydrants shall be of the "dry head" type with an oil or grease reservoir and provision for automatic lubrication of stem threads and bearing surfaces each time the hydrant is operated. Double O-ring seals shall be provided to keep water out of the hydrant top. Operating nut style shall be 1½” pentagon with direction of opening to the left and shall be equipped with a weather cap. The operating nut, main stem, coupling and main valve assembly shall be capable of withstanding input torque of 200 ft/lbs., in opening or closing directions.

Hydrants shall be provided with multi-port drain ports. A positive stop shall be provided on the operating stem to prevent over travel when operating valve. It should not be necessary to excavate to repair or inspect internal parts. It should be removable without disturbing line joint or nozzle section of hydrant.

Fire hydrants shall be supplied with a bituminous coating for buried portion of hydrant and an enamel finish for above ground portions of the hydrant.

3.20 **CASING PIPE** - Where called for on the drawings, water pipe shall be installed in casing pipe. Casing pipe shall be black steel pipe with minimum wall thickness as follows:

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Wall Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>6”</td>
<td>0.250”</td>
</tr>
<tr>
<td>8”</td>
<td>0.250”</td>
</tr>
<tr>
<td>10”</td>
<td>0.250”</td>
</tr>
<tr>
<td>12”</td>
<td>0.250”</td>
</tr>
<tr>
<td>14”</td>
<td>0.312”</td>
</tr>
<tr>
<td>16”</td>
<td>0.375”</td>
</tr>
<tr>
<td>18”</td>
<td>0.375”</td>
</tr>
<tr>
<td>20”</td>
<td>0.375”</td>
</tr>
<tr>
<td>24”</td>
<td>0.375”</td>
</tr>
<tr>
<td>30”</td>
<td>0.375”</td>
</tr>
</tbody>
</table>
3.21 **SERVICE INSTALLATIONS**

3.21.1 **Fittings** – All fittings shall be made of brass consisting of 85 percent copper, 5 percent tin, 5 percent lead, and 5 percent zinc. Corporation stop shall be FORD FB-1000, or approved equal. Meter cooper setter shall be FORD VB 72-7W-47-33 or approved equal.

3.21.2 **Meter Box** - Meter Boxes shall be plastic, 18” minimum depth, rectangular plastic box with rectangular cast iron lid. Meter box shall be Brooks – BR 10150-18B or approved equal. Meter box top shall be Russell 6015-B or approved equal.

4.3.1 **Water Meters** – Meters shall be furnished by the City.

4.3.2 **Service Saddle** – Service saddles shall be for installation on PVC and ductile iron pipe shall be Ford Style S-70 for PVC and Ford Style F202 for ductile iron or approved equal.

4.3.3 **Pipe** – Service pipe shall be type K copper.

3.22 **FLOWABLE FILL** – All flowable mortar shall be in accordance with the Standard Specifications for Road and Bridge Construction except as modified herein.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Type I</td>
<td>901.01</td>
</tr>
<tr>
<td>Fly Ash, Class C or Class F</td>
<td>AASHTO M295</td>
</tr>
<tr>
<td>Water</td>
<td>918.01</td>
</tr>
<tr>
<td>Chemical Additives</td>
<td>918.09</td>
</tr>
</tbody>
</table>

Fine aggregate shall conform to the requirements Subsection 903.01. Fine aggregate for concrete except that the gradation shall be as follows:

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT PASSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ - inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

Flowable fill mortar shall be proportioned as follows:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>PER CUBIC YARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Type I</td>
<td>100 lbs. (Maximum)</td>
</tr>
<tr>
<td>Fly Ash, Class C or Class F</td>
<td>250 lbs. (Minimum)</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>2800 lbs.</td>
</tr>
<tr>
<td>Water</td>
<td>60 gal (Approximate)</td>
</tr>
</tbody>
</table>

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

TSW 3 – 6
3.22 **FLOWABLE FILL** (continued)

Place an open-ended cylinder (pipe) three inches in diameter by six inches in height in an upright position on a smooth, level surface. Fill the cylinder with a representative sample of the flowable fill mortar proposed for use. Remove the cylinder by lifting it straight up thus allowing the sample to diffuse on the smooth, level surface. The flowable fill mortar should diffuse into a circular shape having an approximate diameter of not less than eight inches.
SECTION 4 - EXCAVATION & BACKFILL

4.01 GENERAL - The CONTRACTOR shall perform all required excavation and backfilling incidental to the installation of water mains and other appurtenances under this contract. Excavation shall be carried to the depths indicated on the drawings or as necessary to permit the installation of pipe, bedding, structures or appurtenances. Care shall be taken to provide a firm, undisturbed, uniform surface in the bottoms of trenches and excavations for structures. Where the excavation exceeds the required depth, the CONTRACTOR shall bring the excavation to proper grade through the use of an approved incompressible backfill material (generally crushed stone or fill concrete, depending upon the nature of the facility to be placed thereon). In the event unstable soil conditions are encountered at the bottom of the excavation, the INSPECTOR may direct the CONTRACTOR to continue the excavation to firm soil or to provide pilings or other suitable special foundations.

The CONTRACTOR shall take such precautions as may be necessary to avoid endangering personnel, pavement, adjacent utilities or structures through cave-ins, slides, settlement or other soil disturbance resulting from his operations.

Backfilling shall be carried out as expeditiously as possible, but shall not be undertaken until the INSPECTOR has been given the opportunity to inspect the work. The CONTRACTOR must carry out all backfilling operations with due regard for: the protection of pipes, structures and appurtenances; the use of prescribed backfill materials; and procedures to obtain the desired degree of compaction.

The CONTRACTOR shall be responsible for storage of excavated material, disposal of surplus excavated material, trench dewatering and other operations incidental to excavation and backfilling operations.

4.02 CLASSIFICATION OF EXCAVATION - Excavation shall be unclassified on this project.

4.03 TRENCH EXCAVATION - Trenches shall be neatly excavated to the alignment and depth required for the proper installation of pipe, bedding material and appurtenances. Trenches shall be opened up far enough ahead of pipe laying to reveal obstructions, but in general shall not include more than 300 feet of continuous open trench at any time. The CONTRACTOR will be required to follow up trenching operations promptly with pipe laying, backfill and clean-up, and in event of failure to do so, may be prohibited from opening additional trench until such work is completed.

The CONTRACTOR shall plan his operations so as to cause a minimum of inconvenience to property owners and to traffic. No road, street or alley may be closed unless absolutely necessary and then only if the following conditions are met:

1. Permit is secured from appropriate State, County or Municipal authorities having jurisdiction.
2. Fire and Police Departments are notified before road is closed.
3. Suitable detours are provided and are clearly marked.

No driveways shall be cut or blocked without first notifying the occupant of the property. Every effort shall be made to schedule the blocking of drives to suit the occupants convenience, and except in case of emergency, drives shall not be blocked for a period of more than eight (8) hours.
4.3  **TRENCH EXCAVATION** (continued)

The **CONTRACTOR** shall furnish and maintain barricades, signs, flashing lights, and other warning devices as necessary for the protection of public safety. Flagmen shall be provided as required on heavily traveled streets to avoid traffic jams or accidents.

Trench width shall be held to a minimum consistent with proper working space for assembly of pipe. Minimum trench width shall be diameter of pipe plus twenty inches (20"). Maximum trench width up to a point one foot above top of pipe shall be limited to the outside pipe diameter plus thirty inches (30"). Boulders, large stone, shale and rock shall be removed to provide clearance of six inches (6") below the pipe and replaced with crushed stone.

Trench walls shall be kept as nearly vertical as possible with due consideration to soil conditions encountered and when necessary, sheeting or bracing shall be provided to protect life and property.

Where unstable soil conditions are encountered at the trench bottom, the **CONTRACTOR** shall remove such additional material as may be directed by the **INSPECTOR** and replace the excavated material with crushed stone.

The **CONTRACTOR** shall excavate by hand wherever necessary to protect existing structures or utilities from damage or to prevent over-depth excavation in the trench subgrade. Excavated material shall be stored safely away from the edge of trench and in such a way as to avoid encroachment on private property.

The trench shall be excavated to sufficient depth to permit a minimum cover as indicated on drawings. The bottom of the trenches must be shaped by hand and bell holes must be dug so that the full length of pipe is resting on trench bottom. Blocking shall not be used and neither shall the pipe be laid on a trench bottom that has not been leveled to provide support throughout the full length of the pipe.

The **CONTRACTOR’S** attention is called to the fact that the thirty-six inches (36") depth of cover shown on plans is a minimum and may be exceeded in instances where obstructions are encountered in trenching operations as show on plans. The **CONTRACTOR** will be permitted to lay the water pipe above the obstruction only if the minimum cover required can be obtained while providing a cushion at least six (6") thick between the bottom of the pipe and the top of the obstruction. Where this minimum cover and the required clearance cannot be obtained the **CONTRACTOR** will be required to lay the pipe under the obstruction and will receive no additional compensation for the additional depth of trench required for constructing the line in this manner. The **CONTRACTOR** will also be required to gradually increase the depth of trench when approaching cuts, creek banks, or other changes in grade in order to avoid the use of fittings, wherever it is practical to do so.

4.04  **EXCAVATION FOR STRUCTURES** - Excavation for structure shall be only as large as may be required for the structure and for working room around the structure. In earth, excavation shall generally extend to the outer limits of the structure at the bottom, and shall slope outward at such angle as may be required for stability of excavated face. In rock, excavation shall be carried to a point six inches (6") outside the structure so that no rock is left within six inches (6") of the finished structure.
4.04 EXCAVATION FOR STRUCTURES (continued)

Care shall be taken as the excavation approaches the desired grade to avoid over-depth excavation and provide a firm and undisturbed soil surface on which footings, slabs or foundations are to be placed. Should the CONTRACTOR excavate below the desired grade level, the excavation shall be brought to grade by the use of concrete or compacted crushed stone at the expense of the CONTRACTOR. The use of tamped earth backfill under foundations, footings or slabs will not be acceptable.

Where structures rest partially or wholly upon rock, the rock shall be excavated to a point six inches (6") below bottom of structure and compacted crushed stone shall be used to bring the excavation back to grade, provided however, that where the structure will rest completely on sound solid rock, the ENGINEER may at his discretion permit the footing, foundation or slab to be placed directly upon the rock surface.

Where the CONTRACTOR is permitted to place concrete directly on the rock, all dirt and weathered rock shall be removed and any seams or crevices shall be cleaned and filled with grout or mortar prior to placement of the structural concrete.

Should the material found at the desired subgrade appear to be unstable or otherwise unsuitable for support of the structure, such condition shall be immediately called to the attention of the ENGINEER. The ENGINEER may direct that such unsuitable material be removed and replaced with compacted crushed stone.

The ENGINEER may modify the foundation design to suit the condition, or he may determine that the bearing capacity of the material is suitable for the load to be supported; but in any case he shall provide written instructions to the CONTRACTOR as to the procedure to be followed.

4.05 ROCK EXCAVATION - Rock excavation shall consist of loosening, removing and disposing of all rock larger than 9 cu. ft. in volume, which in the opinion of the ENGINEERS can only be removed by blasting or other equivalent methods. Such materials to be classified as solid rock shall include boulders, bedrock, or solid concrete but shall not include pavement or shoaly materials that can be loosened by other methods.

Where rock excavation is encountered in trenches the excavation shall be carried to a depth of six inches (6") below the bottom of the pipe. The rock shall also be removed to a width of at least the minimum trench width as delineated in Section 4.03 "Trench Excavation". Where rock is excavated in the bottom of the trench, the trench shall be brought back to grade by the use of crushed stone.

The CONTRACTOR shall exercise all necessary precautions in blasting operations. Suitable blasting mats shall be provided and utilized as required. Blasting shall be done only by experienced personnel. Careless shooting, resulting in the ejection of stones or other debris during blasting, shall be corrected immediately by the CONTRACTOR'S representative.
4.05 **ROCK EXCAVATION** (continued)

No blasting shall be done unless the CONTRACTOR shall have taken out the necessary insurance to fully protect the CITY OF GALLATIN from all possible damages resulting from the blasting operations. The blasting shall be done in accordance with all recognized safety precautions and in accordance with regulations of authorities having jurisdiction. In addition, the CONTRACTOR shall exercise the necessary care to safeguard and adequately protect stored blasting materials.

Where rock is encountered in the immediate vicinity of gas mains, telephone cables, building footings, gasoline tanks, or other hazardous areas the CONTRACTOR shall remove the rock by means other than blasting. Care shall be taken in blasting operations to see that pipe or other structures previously installed are not damaged by blasting. In general, blasting shall not be done within twenty-five feet (25') of the complete pipeline.

Excavated rock that cannot be utilized in trench backfill as permitted under Section 4.09 shall be removed from the site and disposed of as directed by the ENGINEERS.

4.06 **REMOVAL OF WATER** - The CONTRACTOR shall be responsible for handling run-off, and ground water in such a way as to maintain trenches and excavations in a dry condition until the work is completed. Pumps, piping, well points, labor, fuel, and other facilities necessary to control, intercept, remove and/or dispose of water shall be provided by the CONTRACTOR at his own expense.

Water shall be kept out of trenches and other excavations to the extent necessary to protect the supporting strength of the foundation material, permit efficient, and satisfactory assembly or replacement of facilities, and to prevent floating or misalignment. Water removed form trenches or holes shall be discharged to natural drains in such a way as to avoid danger or damage to adjacent property owners or sewers.

Where the CONTRACTOR fails, refuses, or neglects to control water in trenches or other excavations, and corrective work is deemed by the ENGINEER to be necessary as a consequence thereof, such work shall be at the CONTRACTOR'S expense.

4.07 **STORAGE OF EXCAVATED MATERIAL** - Excavated material shall be deposited in such a manner as to avoid danger to workmen, water line, or traffic, and to cause minimum inconvenience through blocking of drives, sidewalks, natural drains, etc. Where indicated on the drawings, or necessitated by conditions prevailing, the CONTRACTOR shall haul away and stockpile excavated material.

4.08 **DISPOSAL OF SURPLUS EXCAVATED MATERIAL** - Excavated material that is unsuitable or unnecessary for backfilling shall be removed from the job site and disposed of at the CONTRACTOR'S expense. The CONTRACTOR must not sell or give away surplus excavated material suitable for backfilling or surfacing until the excavation has been refilled and surfaced. CONTRACTOR shall have the approval of each property OWNER and the CITY OF GALLATIN prior to the removal of excess material. The CONTRACTOR shall make his own arrangements for disposal.
BACKFILL FOR TRENCHES

a. **General** - Backfilling of trenches will proceed as pipe laying progresses so that the trench will be filled in as rapidly as possible after the pipe has been assembled and inspected. The CONTRACTOR shall, however, afford the inspector ample opportunity for observing the assembled pipeline before placing the backfill and, if requested by the inspector shall delay the backfilling operation when the inspector is not present at the site.

Backfilling procedures will normally fall under three categories as follows:

1. Under streets and highways with permanent type pavement (hotmix, concrete, etc.).

2. In areas subject to light or occasional traffic, either under temporary paving such as surface treatment or in unpaved areas (this category will include shoulders, and driveways, except where permanent type pavement is used).

3. Open field or other areas not covered under Item 1 or Item 2 above.

b. **Backfill for water main trenches** - Backfill under streets, or highways having permanent type pavement as indicated in category one shall consist of crushed stone suitably compacted for the entire trench depth. The crushed stone shall be carefully placed by hand around and under the pipe in layers not to exceed nine inches (9") in depth and shall be compacted by means of hand tamps or other approved tamping procedure. The crushed stone backfill shall be placed by approved method up to a point twelve inches (12") above the top of the pipe and above this point may be placed by mechanical equipment. In any event the backfill shall be placed in layers not exceeding nine inches (9") and shall then be compacted by suitable mechanical means.

Flowable fill mortar shall be placed in locations shown on the Plans or as directed by the ENGINEER. The flowable fill mortar shall be covered by necessary means i.e., steel plans or any other approved means while in the plastic state. Backfill shall not be placed on the flowable fill mortar prior to final set or hardening as determined by the ENGINEER. Flowable fill mortar shall at no time come in direct contact with any utility lines. Flowable fill mortar shall commence six inches above top of pipe. Placement shall be in accordance with TDOT Standards for Road and Bridge Construction.

For categories two and three, the backfill around and up to a point ten inches (10") above the top of the pipe shall be crushed stone where rock is encountered and acceptable granular material elsewhere. When the backfill has been placed to a depth at least ten inches (10") above the top of the pipe, the remainder of the backfill in category two (areas subject to light traffic) shall consist of suitable excavated material placed and compacted in layers not exceeding twelve inches (12") in depth. **No rock larger than six inches (6") in any dimension may be included within the backfill.** The compaction shall be obtained by means of a suitable mechanical tamper.
4.09 BACKFILL FOR TRENCHES (continued)

Should the CONTRACTOR fail, refuse or neglect to systematically exclude or remove oversize rock from the backfill material, he may be required to place and compact the backfill material by other suitable methods, which will insure the rocks being removed.

The backfill for areas not ordinarily subjected to traffic, may consist of suitable excavated material placed by machine after the crushed stone backfill reaches a depth of twelve inches (12") over the top of the pipe, and the backfill shall be compacted by means of a suitable wheeled vehicle such as a tractor or front end loader running longitudinally along the trench. After the backfill has been compacted in this manner additional fill material shall be placed in the trench to restore the original grade and provide a slight mound over the trench. This material shall again be compacted by means of a suitable wheeled vehicle. No rock larger than six inches (6") in any dimension may be used in the backfill over the pipe and no rock larger than one half inch (1/2") may be used in the top six inches (6") of the backfill.

Backfill up to the spring line of the pipe shall be placed as pipe laying progresses in order to maintain proper grade and alignment. Additional backfill shall not be placed until after the pipe has been inspected by the ENGINEERS and approved for backfill.

4.10 ACCEPTABLE BACKFILL MATERIAL - Where crushed stone backfill is required the crushed stone shall be No. 67 size as designated by Tennessee Department of Transportation Specifications and shall meet all requirements of the TDOT Specifications for crushed stone used in road surfacing.

Where crushed stone is not required, but the excavated material is unsuitable for use in the backfill, the CONTRACTOR may use fine dry selected earth or clay as backfill material. Material containing excessive organic matter, stumps, roots, refuse or foreign matter or hard clay lumps that cannot readily be compacted will not be acceptable for use as backfill.
SECTION 5 - PAVEMENT REPLACEMENT

5.01 GENERAL - The CONTRACTOR shall be responsible for replacement of pavement removed or damaged by his operations. Pavement replacement shall be in accordance with this section of the specifications and in every case shall be equal to or better than the quality of pavement damaged or removed. The CONTRACTOR shall also be responsible for subsequent pavement failures during the warranty period, where such failures occur over or adjacent to trenches or other excavations by the CONTRACTOR and result from insufficient compaction of the backfill.

5.02 PAVEMENT REMOVAL - Where existing paved streets, roads, parking lots, drives or sidewalks must be disturbed during construction of the project the CONTRACTOR shall take the necessary steps to minimize damage. Permanent type pavement shall be cut or sawed in a straight line before removal and care shall be taken during excavation to avoid damage to adjacent pavement. Where trucks or other heavy equipment must cross curbs or sidewalks, such areas shall be suitably protected.

5.03 PAVEMENT REPLACEMENT - Before trenching in paved areas the CONTRACTOR shall cut through the pavement in a straight line along the sides of the proposed trench so that the pavement may be removed and the trench may be dug without damage to the adjacent pavement. During construction suitable precautions shall be taken to protect the pavement edges and surfaces and minimize damage.

As soon as the pipe has been installed the trench shall be backfilled as specified in Section 4.09 and a temporary pavement patch shall be provided in paved areas. The temporary pavement shall consist of a single or double surface treatment, which will protect the base, prevent "pot holes" or "chuck holes" and provide a reasonable smooth pavement surface until the permanent patch is made.

The permanent pavement patch shall not be made until the job is nearing completion in order to allow maximum time for any further settlement. The permanent pavement patch shall conform to the following schedule:

1. **Principal highways, including traffic lanes, and turn lanes** - Eight inches (8") thick reinforced concrete slab over excavated areas plus two inches (2") of hot plant mix. If allowed by the Tennessee Department of Transportation, fourteen inches (14") of binder may be used in lieu of eight inches (8") of reinforced concrete.

2. **City streets, paved parking areas, paved shoulders, turnouts and driveways with bituminous concrete or equivalent surfacing** - two inches (2") of hot plant mix over three inches (3") of binder.

3. **Secondary streets, parking areas, shoulders, turnouts and driveways with surface treatment or equivalent pavement** -double surface treatment over eight inches (8") crushed stone base. Replacement shall be of equal to the original.

4. **Concrete driveways, sidewalks, curbs and gutters, etc.** -Class A concrete of thickness equivalent to original construction.
5. **County roads** - Two inches (2") of TDOT 411 “E” Mix topping over eight inches (8") of TDOT 307 “B” modified binder in accordance with County Road requirements.

TSW 5 – 1
5.3 **PAVEMENT REPLACEMENT** (continued)

The hot mix and surface treatment applications shall be in accordance with standard specifications and recommended practices of the Tennessee Department of Transportation.

Pavement replacement shall extend a minimum of one foot (1') beyond the trench line and shall include replacement of all defective pavement resulting from the CONTRACTOR'S operations, regardless of whether caused by blasting, trenching, equipment operation, cave-in or other cause. Where the cut edge of pavement is less than one foot (1') from the edge of the trench or has been disturbed during construction, the CONTRACTOR shall cut through and remove existing pavement as required to permit a neat pavement patch. Irregular or uneven patches will not be permitted.

The CONTRACTOR shall be responsible for maintaining temporary patches during construction and shall promptly repair any defects. Upon completion of the work the paved surfaces shall be left in as good or better condition than before the start of construction.

The CONTRACTOR shall obtain a road cut permit and contract from the Highway Department for each crossing if required by controlling authority. The CONTRACTOR shall conform to all conditions of said permit and bear all costs associated with said permit.
SECTION 6 - INSTALLATION OF WATER PIPE AND ACCESSORIES

6.01 GENERAL - Water pipe shall be furnished and installed in accordance with details shown on the drawings. The work shall be done by experienced workmen employed by a general contractor licensed in the State of Tennessee with the appropriate classification. Pipe, fittings, valves and accessories shall be installed in strict accordance with these specifications and the recommendations of the manufacturer. Gaskets, bolts, lubricant and other accessories shall be furnished by or as recommended by the manufacturer.

The CONTRACTOR shall use top quality materials throughout and shall exercise care in the storage, handling and installation of the pipe and accessories. Trench bottoms must be carefully graded by hand to provide continuous support for the pipe except at bells where bell holes must be dug.

6.02 HANDLING PIPE AND ACCESSORIES - All water pipe, fittings, valves and other appurtenances shall be stored in a protected location where they will not be subject to physical damage or contamination. Pipe may be delivered to the trench site only if it is unloaded with suitable mechanical equipment and left in an area where it will not be a hazard or obstruction and will not be subject to flooding. Pipe, fittings, valves, hydrants shall not be rolled or dropped from trucks or trailers and shall not be left in roadside ditches.

Pipe clamps, slings, hooks, hoists, booms or other equipment as required for safe and efficient handling of pipe and accessories shall be provided at the trench site whenever pipe laying is in progress.

A suitable swab or brush shall be provided and shall be run through each and every joint of pipe to insure the removal of dirt and foreign objects. The pipe shall be inspected for defects immediately before being lowered into the ditch.

6.03 INSTALLATION OF DUCTILE IRON PIPE - Ductile iron pipe shall be installed in accordance with AWWA Standard C600 and the manufacturer's recommendations using Laying Condition Type 2.

After the pipe has been swabbed and inspected it shall be lowered into the trench. The spigot end of the pipe and the bell or socket of the previously laid pipe shall be wiped clean. The gasket shall be inserted, lubricant shall be applied and the joint shall be made up by shoving the pipe home. Care shall be taken to insure that the gasket is not twisted or dislodged and that the pipe spigot is inserted the proper distance into the socket. When making up mechanical joints the bolt shall all be tightened to the proper torque at the time the joint is made up to ensure proper torque and even spacing between the gland and the face of the flange at all points by partially tightening and alternating between top and bottom bolts in a stepwise manner.

Suitable wheel or squeeze cutters or a power saw shall be used for cutting gray iron pipe but squeeze cutters shall not be used on ductile iron.

Pipe shall be cut neat and true with cut being made perpendicular to pipe axis.

A coarse file or power grinder shall be used to smooth the face of the cut and bevel the outside edge to prevent damage to the gasket.
6.03 **INSTALLATION OF DUCTILE IRON PIPE** (continued)

Fittings and valves shall be installed in the line as shown on the drawings and as directed by the **ENGINEER**. Valves shall be installed in a horizontal run of pipe with valve stem in a vertical position. Buried valves shall have a two inch (2") square operating nut and extension stems shall be provided as required to bring the operating nut to within thirty inches (30") of the finished ground surface.

Pipes shall be laid to a reasonably uniform grade without kinks or other irregularities. Curves or changes in grade will be laid by making deflections at the pipe joints where feasible but the maximum permissible deflections shall be as shown in published tables of the Ductile Iron Pipe Research Association.

6.04 **INSTALLATION OF POLYVINYL CHLORIDE (PVC) PIPE** - PVC pipe shall be installed in strict accordance with manufacturer's recommendations. Fittings and valves shall be installed as described for Ductile Iron and in accordance with manufacturer's recommendations.

6.05 **INSTALLING FIRE HYDRANTS** - Fire hydrants shall be located as shown on the Plans and as directed by the **ENGINEER**. The hydrant shall be set in a vertical position at the edge of the street right-of-way with the pumper nozzle facing the street.

The hydrant shall be set on a poured in place concrete pad, which shall also serve as a kicker against the undisturbed trench face.

The concrete shall have horizontal and vertical bearing areas of at least 3 square feet against the undisturbed trench bottom and side respectively, but shall not cover the flanges or drain ports. At least 7 cu. ft. of crushed stone shall be provided around the hydrant for drainage.

Hydrants shall be set so that the finished ground level will be just below the breakable flange or at the bury level indicated on the hydrant.

The lower barrel of the hydrant shall be of sufficient length to enable the hydrant head to be installed horizontally even though the hydrant may be located in an embankment.

Installed hydrants shall have an undamaged enamel coating and oil reservoirs shall be filled.

6.06 **THRUST BLOCKS OR RESTRAINTS** - Poured in place concrete thrust blocks must be provided at all points of unbalanced pressure where the pipeline could pull apart. Thrust blocks shall conform to details and minimum bearing areas as shown on the drawings and shall bear against the undisturbed trench face. Contractors may elect to use an approved type of locked flexible joint extending on each side of bend as per standard drawings.

Where over bends (downward bends) cannot be avoided the fitting must be held in place by one of the following methods:

1. Poured concrete under pipe of sufficient volume to counteract unbalanced force with steel clamp and anchor bolts to hold fitting to concrete as per standard drawings.
6.06 **THRUST BLOCKS OR RESTRAINTS** (continued)

2. Approved type of locked flexible joint extending on each side of bend as per standard drawings.

6.07 **VALVE BOX INSTALLATIONS** - Valve boxes shall be centered over the valve-operating nut and installed in a vertical position. Box shall be of the proper length to extend to the ground surface and allow the adjustable upper section to be positioned approximately midway between upper and lower limits. Backfill shall be carefully tamped around valve box and suitable support shall be provided under and around the upper section to prevent future settlement.

6.08 **CONNECTIONS TO EXISTING MAINS** - The CONTRACTOR shall make connections to existing mains as shown on the drawings or described herein. Connections to existing mains presently in service shall be made with tapping sleeves and valves without taking the existing main out of service.

The CONTRACTOR shall make his own arrangements for use of a tapping machine.

Where connections are to be made to pipe previously installed but not placed in service, the CONTRACTOR shall remove existing plugs and make the tie in by use of mechanical joint sleeves. Plugs removed from existing mains shall remain the property of the CITY OF GALLATIN and shall be protected from damage or loss until they are turned over to the designated representative of the CITY OF GALLATIN.

Where existing mains must be valved off to make connections, the CONTRACTOR shall notify the Water Department not less than twenty-four (24) hours prior to the making of the connection and the actual time of the service interruption shall be subject to approval by the CITY OF GALLATIN.

It shall be the responsibility of the CONTRACTOR to measure outside diameters of existing pipes before ordering tapping sleeves, or other fittings intended for connecting to existing mains.

6.09 **SERVICES AND SERVICE RELOCATIONS** - Services shall be installed as indicated on drawings and at locations as directed by ENGINEER. The CONTRACTOR shall furnish and install 2" PVC casing pipe for service line that cross under streets. PVC casings shall be installed before road base stone is applied and excavation for casing shall be backfilled with crushed stone to the full depth. Care shall be taken to maintain minimum cover over service line, including ditch line crossings as shown on drawings. All service line casing crossings of paved roads shall be installed by boring and jacking. The cost of the 2" PVC casing pipe and the boring of the casing pipe shall be included in the cost of the service pipe.

6.10 **PROTECTION OF PIPE** - Whenever pipe laying operations are suspended for any reason, including lunch hour or temporary interruptions, a test plug shall be inserted in the open ends of the pipe.

The installed pipe shall be adequately protected at all times against the entrance of dirt, animals, mud, sewage or other foreign material. Pipe shall not be laid in a ditch containing standing water.
SECTION 7 - TESTING AND DISINFECTION - WATER MAIN

7.01 **GENERAL** - Upon completion of the construction work under this contract all water lines shall be disinfected and subjected to the necessary pressure and leakage tests. In the event the pressure or leakage test is unsatisfactory, or bacteriological tests indicate that disinfection is incomplete, corrective measures shall be taken and the tests repeated until satisfactory results are obtained.

7.02 **PRESSURE AND LEAKAGE TESTS** - All water lines shall be subjected to a hydrostatic pressure of 200 psi for a period of one hour, and any defective work revealed by the test shall be repaired or replaced by the CONTRACTOR.

The amount of leakage under the stated pressure shall not exceed 10 gallons per day for each mile of pipe for each inch of diameter. Should the amount of leakage exceed the above limit, the CONTRACTOR shall locate and repair the defective joints until the leakage is within the specified limits.

In no event shall the leakage exceed the allowable leakage for mechanical or push on joints as shown in Table 6 of the AWWA C600-87 Standard.

The CONTRACTOR shall provide all labor, tools, equipment and materials for making the tests.

CONTRACTOR should note that 200 psi test pressure is required although some large Butterfly Valves are bottle tight only to 150 psi across the valve. Attention should be given that at least 50 psi system pressure be on the low side or that valve be installed such that direction of pressure is on that face of the valve closure that provides the highest bottle tight pressure.

7.03 **DISINFECTION** - All water lines, including pipe, valves, meters, etc., shall be disinfected prior to being placed in service in accordance with AWWA C651-92, after the system has been flushed to remove dirt or foreign objects which may have been accidentally introduced into the line.

For this work, the CONTRACTOR shall furnish suitable plugs or caps for the pipe, injection pumps, pipe connections, chlorine and other equipment with all labor required.

While the disinfectant is being applied to any section of the system, the water shall be allowed to escape all extremities of this section. The method of chlorine residual testing shall be the DPD color comparator method. The disinfectant shall be allowed to remain in the pipe for 24 hours, after which the lines shall be thoroughly flushed until only the residual chlorine found in tap water is present.

Samples of water shall then be taken by CITY personnel and shall be submitted to the bacteriological laboratory at the CITY’S water plant laboratory. In the event any of the bacteriological samples show the presence of coliform organisms or an excessive total count, the disinfection procedure shall be repeated until samples of satisfactory quality can be obtained.
SECTION 8 - SPECIAL CONDITIONS

8.01 **GENERAL** - The **CONTRACTORS** attention is called to the special conditions indicated on the plans and described in this section of the specifications. Special conditions include construction on highway or railroad right-of-way, construction in the vicinity of existing utilities, and special surface restoration.

8.02 **WORK ON HIGHWAY RIGHT-OF-WAY** - The **CONTRACTOR** shall be responsible for complying with the requirements of the appropriate Highway Department. In the event a surety bond is required, such bond will be provided by the **CONTRACTOR**.

8.03 **WORK ON RAILROAD RIGHT-OF-WAY** - Should it be necessary to do any excavating or trenching on railroad rights-of-ways, the **CONTRACTOR** shall notify the railroad and shall conform to their requirements when performing work on their rights-of-way.

8.04 **COORDINATION WITH OTHER UTILITIES** - The **CONTRACTOR** shall cooperate with other utilities and shall take every reasonable precaution to avoid conflicts. In instances where the proposed water lines will be located near existing or proposed utility lines, the **CONTRACTOR** shall take the necessary steps to avoid damage to the utility lines and shall notify the **CITY** of any potentially hazardous situations.

8.05 **SEEDING** - In all areas damaged or disturbed by **CONTRACTOR’S** operations where established ground cover was present before beginning of construction, **CONTRACTOR** shall be responsible for restoring this ground cover after completion of construction. (Unless noted otherwise on drawings). In areas of established lawns, **CONTRACTOR** will be required to: separate and preserve best of excavated material or, if no acceptable material has been excavated, haul in an acceptable material for use in making top six inches (6") of finished grade. No rock will be permitted in this top six inches (6") of finished grade for established lawns. All areas seeded shall be graded smooth prior to seeding and **CONTRACTOR** shall be responsible for maintenance of this smooth finished grade until grass growth is established.

After designated areas have been carefully hand graded, soil shall be prepared for seeding. Where necessary, **CONTRACTOR** will sod slopes and embankments, and remaining areas may be seeded.

A well-made lawn is desired, and **CONTRACTOR** will be responsible for any necessary regrading or reseeding required to produce an acceptable grass as cover. The seed is to be of the same type of grass existing before construction.

The soil shall be fertilized with a commercial fertilizer of a grade and at a rate recommended by vendor of seed.

All seeded areas shall be covered with clean straw uniformly distributed to approved density.

8.06 **CASING PIPE** - Is intended to be installed by bore and jack. Installation may be made by open cut only if authorized in writing by the **CITY OF GALLATIN**, and generally only after an attempted bore is unsuccessful. In no event will construction method be contradictory of instruction of the Railroad or Highway Department. In the event of any unsuccessful bore attempts, the bore hole will be refilled according to instructions of the Railroad or Highway Department or outside their jurisdiction by leaving jacked casing in place and sealing end with brick and mortar.
TSW 8 – 1
8.07 SERVICE RELOCATIONS - The service relocations shall consist of installing a new service line from the proposed main to the new meter setting on the existing customer service line as directed by the CITY. All existing service regulators or control devices on the existing customer line shall be relocated. The CONTRACTOR shall be responsible for lowering customer service lines to depths as necessary for proper connection. The CONTRACTOR shall furnish a new corporation stop, yoke and meter box at each location. All service line installation shall be installed as delineated herein.

8.08 SLOPE PROTECTION AND EROSION CONTROL

A. General

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

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

B. Materials

1. Temporary Berms:

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

2. Temporary Slope Drains

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

3. Sediment Structures

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

4. Check Dams

(a). Check dams are barriers composed of logs and poles, large stones or other materials placed across a natural or constructed drainway.
8.08 **SLOPE PROTECTION AND EROSION CONTROL** (continued)

(b). Stone check dams shall not be utilized where the drainage area exceeds fifty (50) acres. Log and pole structures shall not be used where the drainage area exceeds five (5) acres.

5. **Temporary Seeding and Mulching**

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

6. **Brush Barriers**

a. Brush barriers shall consist of brush, tree trimmings, shrubs, plants and other approved refuse from the clearing and grubbing operations.

b. Brush barriers are placed on natural ground at the bottom of all slopes where the most likely erodible areas are located to restrain sedimentation particles.

7. **Baled Hay or Straw Checks**

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

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

8. **Temporary Silt Fences**

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

C. **EXECUTION**

1. **Project Review**

Prior to the pre-construction conference the CONTRACTOR shall meet with the ENGINEER and go over in detail the expected problem areas in regard to the erosion control work. Different solutions should be discussed so that the best method might be determined. It is the basic responsibility of the CONTRACTOR to develop an erosion control plan acceptable to the ENGINEER.
2. **Pre-Construction Conference**

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

3. **Construction Requirements**

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

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

3. **Construction Requirements**

   c. Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise erosion control measures may be required between successive construction stages. Under no conditions shall the surface area of erodible earth material exposed at one time by clearing and grubbing exceed 750,000 square feet without the approval of the **ENGINEER**.
d. The ENGINEER will limit the area of excavation, borrow and embankment operations in progress commensurate with the CONTRACTOR'S capability and progress in keeping the finish grading, mulching, seeding and other such permanent pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.

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

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

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

4. **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 with an approximate ten degree (10\(^\circ\)) angle perpendicular to the centerline. The top width of these berms may be wider and the side slope flatter on transverse berms to allow equipment to pass over these berms with minimal disruptions. When practical and until final roadway elevations are approached, embankments should be constructed with a gradual slope to one side of the embankment to permit the placement of temporary berms and slope drains on only one side of the embankment.
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 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 dissipators, sediment basins or other approved devices shall be constructed at the outlet end of the slope drains to reduce erosion downstream. An ideal dissipator 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.

Sediment Structures

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

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

e. **Temporary Seeding and Mulching**

Seeding and mulching shall be performed in accordance with Section 02828-Miscellaneous Seeding.

f. **Brush Barriers**

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

g. **Bales Hay or Straw Erosion Checks**

Hay or straw erosion checks shall be embedded in the ground four to six inches (4”-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 can remain in place until they rot or be removed after they have served their purpose, as determined by the ENGINEER. The CONTRACTOR shall keep the checks in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean out will be considered routine maintenance.
h. Temporary Silt Fences

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

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

D. MAINTENANCE

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

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

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

E. EROSION CONTROL OUTSIDE PROJECT AREA

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

F. MEASUREMENT AND PAYMENT

No separate Measurement and Payment will be made for this work. It will be considered a subsidiary obligation of the CONTRACTOR under other bid items to which it relates.
8.09 **VIDEO** - Prior to construction, **CONTRACTOR** shall color video tape the entire project including the route of the line construction, all easement areas, the full width of all rights-of-ways, and all service line areas. The **CONTRACTOR** shall identify the line designation and station number, all natural land marks, the street address of the area in view and all potential areas, structures, fences, trees, etc., subject to potential disturbance. The **CONTRACTOR** shall provide the **OWNER** with two (2) copies of the video with audio comments.
SECTION 9 - WARRANTY AND MAINTENANCE OBLIGATIONS

9.01 **WARRANTY** - The work to be performed under this contract shall be guaranteed against defects in materials or workmanship for a period of one year following the date of formal acceptance of the project. In the event defects in materials or workmanship should appear, the CONTRACTOR shall promptly make the necessary corrections. When the defects are not of an emergency nature, the CONTRACTOR will be notified and will be given a period of two weeks in which to make the necessary corrections. Should the defects be of an emergency nature, which in the opinion of the CITY OF GALLATIN requires immediate correction, the CONTRACTOR will be notified and requested to make the necessary repairs immediately. Should this be impractical or if the CONTRACTOR should fail to respond to the request for corrective action within the specified period, the CITY OF GALLATIN may proceed to have the defects corrected and shall bill the CONTRACTOR for all charges in connection therewith, including labor, lost water, materials and equipment rental. Such charges may be deducted from amounts due the CONTRACTOR if any of the CONTRACTOR'S money has been withheld. In the event the CONTRACTOR fails, refuses or neglects to pay the CITY OF GALLATIN the surety shall be liable for such charges.

9.02 **MAINTENANCE OBLIGATION** - The CONTRACTOR shall be fully responsible for maintenance of any and all portions of the work, which he performs under this contract for a period of 90 days. This maintenance obligation shall begin upon formal acceptance of the project and is intended to place a limit upon the CONTRACTOR'S responsibility for normal maintenance required for the routine operation of the system. This 90 day obligation shall not be construed as relieving the CONTRACTOR of the responsibility for maintenance or repair work resulting from defective materials or workmanship.
SECTION 10 - MEASUREMENT AND PAYMENT

10.01 GENERAL

The CONTRACTOR shall furnish all labor, tools, equipment, and materials to construct the proposed improvements complete as shown on the Plans and described in these specifications. The work shall be measured for payment in accordance with applicable provisions of these specifications and payment shall be made on the basis of the unit prices or lump sum prices bid. The sum of the payments for eligible pay items contained in the proposal form shall be the compensation to be paid for the completed project; provided however, that changes in the work covered by written change orders, properly executed may result in additions or deductions from the contract price.

The CONTRACTOR’S attention is called to the fact that although the pay items shown shall be the basis for establishing the contract price, the pay items do not necessarily reflect the total amount of work to be performed. The cost of incidental work such as clearing and grubbing, trenching, backfilling, testing, etc. which is necessary but which is not specifically listed as one of the pay items, shall be included in the prices bid for the eligible pay items to which the incidental work is most closely related.

10.02 WATER LINES

a. Measurement - Measurement for the length of pipe to be included for payment at the unit prices bid shall be the actual length laid in the trench measured along the centerline of the pipe and including the lengths of valves and fittings in the line. Measurement shall begin at the ends of existing pipes, valves or fittings to which the new pipe is connected or such other point as may be designated on the Plans.

b. Payment - Payment for installing only water pipe lines complete will be made at the contract unit price bid per linear foot for water pipe of the various sizes and classifications. Payment for installing water pipe shall constitute full compensation for trenching, rock excavation, crushed stone bedding and crushed stone backfill to 12" above pipe where rock excavation is encountered, installation, backfill, disinfecting and testing for the water line, together with other incidental and related work necessary for the completion of the water main installation except that fittings, valves, valve boxes, pavement replacement and such other items shall be paid for separately, if included as a pay item on the bid proposal.

10.03 FITTINGS

a. Measurement - Pipe fittings for cast iron, ductile iron, AC or PVC pipe will be measured for payment by multiplying the number of fittings in each classification by the standard weight of the fitting as shown in appropriate tables of ANSI specification A21.10, American Standard for Cast Iron Fittings 2” through 48” for water and other liquids. Weights of fittings shall be exclusive of gland, bolts, gaskets, or other appurtenances and shall be as shown in the above specification rather than actual invoice weights.

b. Payment - Payment for installing only pipe fittings complete in accordance with these specifications will be made on the basis of contract unit price bid per pound for pipe fittings (all fittings assumed to be cast iron for purpose of determining weight as noted above) and shall constitute compensation in full for installing the fittings together with all incidental and related work except as specifically covered by other pay items.
10.04 VALVES

a. Measurement - Valves will be measured by actual count of each size and type of valve installed in the completed system.

b. Payment - Payment for installing only valves of the various sizes and classifications, together with any necessary joint accessories, adapters, extension stems, or other required appurtenances, shall be made on the basis of the contract unit prices bid. Such payment shall constitute full compensation for installing the valves complete in full accordance with the Plans and Specifications.

10.05 VALVE BOXES

a. Measurement - Measurement of valve boxes for payment shall be made by actual count of valve boxes provided in the completed installation.

b. Payment - Payment for installing only valve boxes complete with lids, extensions, crushed stone and other appurtenances as required shall be based on the contract unit prices bid. Such payment shall constitute compensation in full for installing the valve boxes complete in full accordance with the Plans and Specifications.

10.06 FIRE HYDRANTS

a. Measurement - Measurement of fire hydrants for payment shall be made by actual count of fire hydrants provided in the completed installation.

b. Payment - Payment for installing fire hydrants complete shall be based on the contract unit prices bid. Such payment shall constitute compensation in full for installing the existing fire hydrant complete with the necessary barrel and stem extensions, concrete base and kicker and the required crushed stone for drainage.

10.07 ROCK EXCAVATION

Excavation is unclassified; therefore, separate measurement or payment will not be made.

10.08 CLASS B CONCRETE

a. Measurement - Class B concrete used in bracing pipe and fittings shall be measured for payment on the basis of the theoretical quantities required to provide the desired bearing area with a trench of the desired dimensions. The pay quantities for braces behind typical fittings shall be as follows:
10.08 **CLASS B CONCRETE** (continued)

**PAY QUANTITIES FOR THRUST BLOCKS - CF CLASS B CONCRETE**

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<td>279.45</td>
<td>109.32</td>
<td>36.80</td>
<td>87.00</td>
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</table>

In the event the type of soil is such that the bearing area must be increased, an appropriate adjustment will be made in the pay quantities; the adjustment being equal to the percentage adjustment in the bearing area required. For concrete used in over bends in the pipeline where no specified dimensions are shown for the thrust block, the measurement will be based on the actual quantity of concrete which the ENGINEER directs the CONTRACTOR to use.

b. **Payment** - Payment for Class B concrete shall be made on the basis of the unit price bid per cubic yard, and shall constitute full compensation for excavation, forming, furnishing and placing the concrete, and other incidental work required to complete the work. No separate payment will be made for Class B concrete included in fire hydrant bracing, or other structures where the price of such concrete is included in the unit price or lump sum price bid for the item.

10.09 **PAVEMENT REPLACEMENT**

a. **Measurement** - Measurement for pavement replacement shall be equal to the length of the pavement cut multiplied by the width of pavement actually replaced within a strip having a maximum width equal to the nominal pipe diameter plus 3'-6" centered over the pipe line. For pavement replacement on State or Federal highways where concrete base is required, the maximum pay width will be increased to 7'-6".

b. **Payment** - Payment for pavement replacement shall be made on the basis of the unit prices bid for various classifications of pavement as indicated in the proposal form. Such payment shall constitute full compensation for furnishing all labor, materials and equipment and replacing the damaged pavement, including the crushed stone base as required. The CONTRACTOR is advised that although the limits of payment shall be as described under paragraph (a) above he shall be responsible for replacing all pavement damaged during construction, so that the paved area is left in a condition as good as or better than before the start of construction.
10.09 **PAVEMENT REPLACEMENT** (continued)

Payment for pavement replacement shall also include compensation for providing temporary pavement patches until such time as the permanent pavement is placed inasmuch as no separate payment will be made for this work.

10.10 **CRUSHED STONE**

a. **Measurement** - Measurement of crushed stone for payment shall be based on weight, but in certain instances as outlined below, volume computations will be used to determine the eligible pay weight. In all other cases delivery tickets shall be furnished to the **ENGINEER** at the time of placement. Crushed stone used for bedding water mains in rock excavation or in backfill of water lines to a point twelve inches (12") above pipe and backfill around fire hydrants and valves shall not be measured for payment. Payment shall be included in the unit price for pipe, valves or fire hydrant.

Crushed stone used as base material for pavement replacement also will not be measured for payment inasmuch as payment for this material will be included in the payment for pavement replacement.

Crushed stone used in trench backfill under traveled areas will be measured for payment as follows:

a. Eligible width equal to 18" plus nominal diameter.

b. Eligible depth shall be measured vertically from a point 6" above top of pipe to bottom of crushed stone pavement base.

c. Eligible length equal to length of water main under traveled area, plus the eligible depth under (b) above, (to allow for slope at ends).

d. Volume as determined from the product of length times width times depth to be multiplied by 150 pounds per cubic foot to determine weight of crushed stone for payment.

Crushed stone required for maintenance of unpaved drives, roads, shoulders shall be at the **CONTRACTOR’S** expense and will not be measured for payment.

b. **Payment** - Payment for crushed stone, measured as provided above, which payment shall constitute full compensation for furnishing, hauling, placing and compacting the stone as specified.

10.11 **CONNECTIONS TO EXISTING LINES**

No additional compensation will be made for connections to existing lines as shown on drawings. Only those items employed in such connections and appear in this Section will be paid for separately.

10.12 **CASING PIPE**

a. **Measurement** - Measurement of casing pipe installed under pavement, railroad tracks, structures or other places shall be by the linear foot and shall be the centerline length of casing installed land accepted.
10.12 **CASING PIPE** (continued)

b. **Payment** - Payment shall be made on the basis of the application unit price bid for various diameters and for various methods of installation. This price shall constitute payment for furnishing and installing casing pipe by boring and jacking or by excavation and backfilling, whichever is shown on the Plans or directed by the **ENGINEER**, including all labor, tools and equipment, crushed stone, boring, rock excavation, rock boring, and pavement replacement required (water pipe shall be paid for at applicable unit price bid).

10.13 **BORE AND JACK WATER LINE**

a. **Measurement** - Measurement of casing pipe installed under pavement, railroad tracks or other places by boring and jacking shall be measured by the linear foot and shall be the centerline length of pipe installed and accepted.

b. **Payment** - Main water lines laid by the boring and jacking method shall be paid for at the unit price bid for installing pipe of various diameters. This price shall include all labor, tools, and equipment (except as noted above) necessary to complete the items. No extra compensation shall be paid for service line by Bore and Jack.

10.14 **SERVICE CONNECTIONS**

a. **Measurement** - Service connections will be measured by an actual count of each size and type of service installed, tested, disinfected and accepted. The unit price bid for this item shall include saddles, corporation stop, curb stops, yoke, meter box, water pressure regulator etc., as covered by Specifications and Plans.

b. **Payment** - Service connections assemblies placed and accepted, measured as provided above, will be paid for at the contract unit price per each, which price and payment shall constitute full compensation for furnishing, hauling and installing complete, testing and disinfection, for excavation, preparation of bed and backfilling, and for the furnishing of all equipment, tools, and incidentals necessary to complete the item.

10.15 **STANDARD BLOW-OFFS**

a. **Measurement** - Standard blow-offs include 2” tapped plug, 2” gate valve, 2” bronze pipe, meter box, concrete brace, #77 mainguard hydrant, and 2” fittings. This item will be measured by an actual count of blow-offs installed, tested, sterilized and accepted.

b. **Payment** - Standard blow-off assemblies, installed and accepted will be paid for on the basis of the unit price per each and payment shall constitute full compensation for furnishing, hauling, installing complete, testing and sterilizing, for excavation, preparation of bed and backfilling, and for the furnishing of all equipment, tools and incidentals necessary to complete the item.

10.16 **SERVICE RELOCATIONS AND RECONNECTIONS**

a. **Measurement** - Service relocations will be measured by an actual count of each installed and accepted. The unit price bid for this item shall include tapping new mains, corporation stop, curb stop, yokes, meter box, and other fittings as covered by
Specifications and Plans.

TSW 10 – 5
10.16 **SERVICE RELOCATIONS AND RECONNECTIONS** (continued)

b. **Payment** - Services relocated and accepted will be paid for on the basis of the unit price per each and payment shall constitute full compensation for furnishing all materials, installing, excavation, and for the furnishing of all equipment, tools, labor and incidentals necessary to complete the item.

10.17 **SERVICE PIPE**

a. **Measurement** – Measurement for the length of service pipe used for service installations and service relocations included for payment at the unit prices bid shall be the actual length installed and measured from the main to center of the meter box without deductions for meter couplings, and curb stops, etc.

b. **Payment** – Payment for installing only water service lines completed will be made at the contract unit price bid per linear foot for water service pipe of the various sizes, types and classifications. Payment for installing service pipe shall constitute full compensation for excavation, installation, road borings with 2" PVC casing, backfill, disinfecting, testing, and other incidentals and related work necessary for the completion of the bid item.

10.18 **AIR RELEASE VALVE ASSEMBLY**

a. **Measurement** – Air release valve assemblies will be measured by an actual count of each size and type installed and accepted. The unit price bid for this item shall include tapping the main saddle, corporation stop, bronze gate valve, air release valve, manhole and cover, crushed stone and other fittings as covered by Specifications and Plans.

b. **Payment** – Air release valve assemblies installed and accepted will be paid on the basis of the unit price per each and payment shall constitute full compensation for furnishing all materials and supplies, and installing complete, testing, excavation and for the furnishing of all equipment, tools and incidentals necessary to complete the item.
SECTION 1 - SCOPE OF PROJECT

1.01 The CONTRACTOR shall furnish all materials, equipment, machinery, labor, etc., necessary for the construction of the facilities more particularly described elsewhere in the specifications and shown on the drawings.

The CONTRACTOR shall perform all necessary clearing, staking, excavating, backfilling, grading, cleanup, restoration of damage to property, testing, etc., for the proper and complete installation of the system and restoration of the surface to its original condition.

1.02 WORK AREA AND ORDER OF WORK

The CONTRACTOR shall prepare and submit a detailed schedule showing this proposed sequence of work on the project for discussion at the pre-construction conference. The CONTRACTOR shall coordinate the work schedule with the OWNER so as to disrupt traffic and sewer line service as little as possible. The schedule of work shall be approved by the ENGINEER.

1.03 CONTRACTOR QUALIFICATIONS

The CONTRACTOR must have the proper equipment and qualified personnel to accomplish the work required. He must be prepared to provide the ENGINEER with satisfactory evidence that: (a) he has completed similar work with similar equipment and materials on at least five (5) previous projects, or (b) his crews and equipment can perform satisfactorily as established by actual demonstration to the ENGINEER.

Failure to perform the work satisfactorily shall be grounds to cancel the contract and for the OWNER to proceed in whatever manner available to satisfactorily complete the work.

1.04 SEWAGE BYPASSING

Where sewage flow exceeds the maximum allowance in performance of the various work items, the CONTRACTOR shall provide pumps and bypass pipelines as required to divert any excess flow around the work area. Nevertheless, all sewage must remain in the system. Under no circumstances will the CONTRACTOR be allowed to discharge sewage into natural streams, drainage ditches or other locations that could endanger the public health, violate laws and regulations or cause a public nuisance.
TS - 1.1
1.05 **TRAFFIC CONTROL**

The CONTRACTOR shall maintain sufficient warning lights, traffic signs, road barriers, traffic cones, flagmen, etc., on or along any or all portions of any street or alley which due to the CONTRACTOR'S operations, are not in their normal condition for handling vehicular or pedestrian traffic. Traffic is to be maintained on all roads and streets that must be crossed by work operations. The CONTRACTOR has to adhere to all applicable local and state highway regulations regarding traffic control during construction operations including the latest manual of uniform traffic control. There will be no separate pay item for traffic control and all costs thereof shall be included in the costs of the various project bid items.

1.06 **DISPOSAL OF MATERIAL**

The CONTRACTOR shall be responsible for obtaining an area that will be suitable for disposal of all materials removed from the sewers during the cleaning operation.

1.07 **INCREASE OR REDUCTION OF WORK** - The project has a limited budget. In order to insure that the budget is met, the OWNER reserves the right to increase or decrease the quantities of work shown in the BID form to make the project costs conform to the available funds.
SECTION 2 - PRELIMINARY WORK

2.01 LOCATION AND PROTECTION OF UNDERGROUND UTILITIES

Prior to trenching, the CONTRACTOR shall determine insofar as possible, the actual location of all underground utilities possible, the actual location of all underground utilities in the vicinity of his operations and shall clearly mark their location so that they may be avoided by equipment operators. Where such utility lines or services appear to lie in the path of construction they shall be uncovered in advance to determine the exact location and depth and to avoid damage due to trenching operations. Existing facilities shall be protected during construction or removed and replaced in equal condition, as necessary.

Should any existing utility line or service be damaged during, or as a result of the CONTRACTOR'S operations, the CONTRACTOR shall take such emergency measures as may be necessary to minimize damage and shall immediately notify the utility involved. The CONTRACTOR shall then repair the damage to the satisfaction of the utility or shall pay the utility for making the necessary repairs. In all cases, the restoration and/or repair shall be such that the damaged structure will be in as good or better condition as before the damage occurred.

2.02 SURVEYING, STAKING AND CUT SHEETS

The ENGINEER will provide adequate benchmarks and control lines for sewers, but offset staking shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall prepare cut sheets and submit them in quadruplicate for the ENGINEERS approval. Two sets of the approved cut sheets will be returned to the CONTRACTOR.

Cut sheets shall indicate: invert elevation, ground elevation above sewer center line, offset hub elevation, offset hub cut, and offset distances and direction. For sewers laid by batterboard, stringline and gradepole method the offset stations shall be set at points in and out of manholes and at fifty (50) foot minimum for grades of 1% or more, and at twenty five (25) foot minimum for grades less than 1%. For sewers laid by laser offset stations shall be set at points in and out of manholes with one offset station located twenty (20) feet upstream from manhole or an alternate system approved by the ENGINEERS.

2.03 SAFEGUARDING OBSTRUCTIONS

The CONTRACTOR shall be responsible for the removal, safeguarding and replacement of fences, walls, structures, culverts, street signs, private utilities, billboards, shrubs, flowers and small trees, mailboxes or other obstruction which must be restored to at least their original condition. Notification of all required fence cuts shall be given to property owner 48 hours prior to construction on property.
TS - 2.1
2.04 **CLEARING AND GRUBBING**

The **CONTRACTOR** shall be responsible for cutting, removing and disposing of all trees, brush, stumps, roots, and weeds within the construction area. Disposal shall be by means of chippers, landfills, or other approved methods not in conflict with State or local ordinances.

Care shall be taken to avoid unnecessary cutting or damage to trees. The **CONTRACTOR** will be responsible for loss or damage to trees located more than three (3) feet from the sewer centerline.
SECTION 3 - MATERIALS

3.01 GENERAL

All materials to be incorporated in the project shall be first quality, new and undamaged material conforming to all applicable portions of these specifications.

When a material, equipment, or system is specified by the name of one or more manufacturer, such material, equipment, or system shall become an essential element of the Contract. If the CONTRACTOR desires to use another material, equipment, or system in lieu thereof, he shall request approval in writing and shall submit samples and data as required for the ENGINEER'S consideration. The ENGINEER will be the final judge of the acceptability of the substitution. No substitution shall be made without authority in writing from the ENGINEER.

3.02 CEMENT

Cement shall be Portland cement of a brand approved by the ENGINEERS and shall conform to "Standard Specifications for Portland Cement", Type, 1 ASTM Designation C150, latest revision. Cement shall be furnished in undamaged 94 pound, one (1) cubic foot sacks, and shall show no evidence of lumping.

3.03 CONCRETE FINE AGGREGATE

Fine aggregate shall be clean, hard, uncoated natural sand conforming to ASTM Designation C33, latest revision, "Standard Specifications for Concrete Aggregate".

3.04 CONCRETE COARSE AGGREGATE

Coarse aggregate shall consist of clean, hard, dense particles of stone or gravel conforming to ASTM Designation C33, latest revision, "Standard Specifications for Concrete Aggregate". Aggregate shall be well graded between 1-1/2" and #4 sieve sizes.

3.05 WATER

Water used in mixing concrete shall be clean and free from organic matter, pollutants and other foreign materials.

3.06 READY MIX CONCRETE

Ready-mix concrete shall be secured only from a source approved by the ENGINEERS and shall conform to ASTM Designation C94, latest revision, "Specifications for Ready-Mix Concrete". Before any concrete is delivered to the job site, the supplier must furnish a statement of the proportions of cement, fine aggregate and coarse aggregate to be used for each mix ordered, and must receive the ENGINEERS approval of such proportions.
3.07 **CLASS "A" CONCRETE**

Class "A" concrete shall have a minimum compressive strength of 4,000 pounds per square inch in 28 days and shall contain not less than six (6) sacks of cement per cubic yard.

3.08 **CLASS "B" CONCRETE**

Class "B" concrete shall have a minimum compressive strength of 2000 pounds per square inch in 28 days and shall contain not less than 4-1/2 sacks of concrete per cubic yard.

3.09 **METAL REINFORCING**

Reinforcing bars shall be intermediate grade steel conforming to ASTM Designation A15, latest revision, "Standard Specifications for Billet Steel Bars for Concrete Reinforcement". Bars shall be deformed with a cross sectional area at all points equal to that of plain bars of equal nominal size.

3.10 **CRUSHED STONE**

Crushed stone for bedding or backfill shall be Tenn. State Highway Standard size No. 67 and shall meet State Highway Department Standards for road surfacing.

Crushed stone for base shall conform to Section 303, Highway Department Specifications and shall be Class A, Grade D.

3.11 **PEA GRAVEL**

Pea gravel for shaping cradle bedding shall be #4 to 1/2" size Ohio River, or approved local gravel of similar character.

3.12 **MANHOLE FRAMES & COVERS**

1. **General:** Manhole frames and covers shall be gray cast iron conforming to ASTM A48-64, Class 20, unless shown otherwise below, and shall be first quality castings free from blow-holes, shrinkage, distortion or other defects. After cleaning, casting shall be painted with a bituminous coating, giving tough, smooth surface not tacky or having tendency to scale or "alligator". Frames and covers shall be as shown on Detail Drawings. Unless shown otherwise on Plans, covers to be solid with words "SANITARY SEWER" cast in cover, with pick hole cast in cover. Frames and covers for traffic conditions shall have machined contact surfaces to prevent rocking.
3.12 **MANHOLE FRAMES & COVERS** (continued)

2. **Standard Manhole Frames and Covers**: Manhole frames shall be furnished and set in a bed of mastic and bolted to the concrete manhole. The standard frame and cover shall be traffic type of gray cast iron ASTM Designation A 48-64 with a 24-inch diameter opening weighing not less than 400 pounds as shown on the Plans. The covers shall be the solid self-sealing type with no holes except watertight pick notches or a heavy lifting ring. The surface between the cover and frame shall fit smoothly without rocking and shall be thoroughly cleaned. Special attention shall be given to insure the proper installation of the rubber gasket in the self-sealing cover. The gasket shall have at least 1/4-inch diameter cross-section. The frame shall be attached to the manhole barrel by means of four (4) 5/8-inch anchor bolts and shall be set in a bed of mastic so as to constitute a watertight seal between the barrel and the frame.

3. **Watertight Manholes Frames & Covers**: The manhole frames shall be set in the same manner prescribed for standard frames except special attention shall be paid to securing a watertight connection to the manhole barrel.

The watertight manhole frame and cover shall be a traffic type of gray cast iron ASTM Designation A 48-64 with a twenty-four inch (24") diameter minimum clear opening weighing not less than 450 pounds and shall be of the two-cover design as shown on the Plans.

The surface cover shall be the solid type with no holes except watertight pick notches or a heavy lifting ring. The surface between this cover and frame shall fit without rocking. The inner cover shall be of the solid type with no holes, shall have not less than two (2) lifting handles and shall have a neoprene sealing gasket at least 7/16-inch diameter cross-section with a hollow center. The inner cover shall be mechanically sealed by means of a removable metal bar located over the inner cover with a centrally located bronze or stainless steel tightening bolt. This bolt shall have a tee-handle or benthandle for turning. The bolt shall have appropriate reinforcing ribs to prevent cracking or distortion when tightened. The inner cover shall have sufficient clearance to allow easy removal from the frame. The frame shall be attached to the manhole barrel by means of four (4) 5/8-inch anchor bolts and shall be set in a bed of mastic so as to constitute a watertight seal between the barrel and frame. Watertight manholes shall be vented at 1000 foot intervals.

3.13 **MANHOLE STEPS**

Manhole steps shall be made of copolymer polypropylene plastic meeting the latest revision of ASTM 2146-68, Type II, Grade 16906 and shall have a 1/2-inch diameter Grade 60 reinforcing rod meeting the latest revision of ASTM Designation A-615 through its center.

Each step shall be twelve inches (12") in width and capable of carrying a load of 1,000 pounds in the center of the step when projected six inches (6") from the wall. Each step shall be equipped with non-skid grooves.
3.14 **MORTAR MATERIALS**

Mortar for manholes shall consist of one part of Portland cement to two parts of sand. Sand shall be a clean natural river sand. When dry 100% of the sand shall pass a #8 sieve and not more than 35% shall pass a #50 sieve.

3.15 **PRECAST CONCRETE MANHOLES**

In order to prevent excessive leakage of water into manholes, special care is warranted in the design and construction of manholes, therefore, this design requires high quality watertight precast manholes. Special emphasis is placed on the connection of the pipeline to the manhole in such a manner as to preclude shearing and/or leakage. Connection of pipeline to manhole shall be with approved rubber boot cast in manhole. Manholes shall have an inside diameter of 4'-0". Precast concrete manholes shall conform to ASTM Designation C-478, latest revision.

3.16 **CONCRETE SEWER PIPE - REINFORCED**

Reinforced concrete sewer pipe shall conform to ASTM Designation C76, latest revision, with "B" wall thickness.

Class of pipe shall be in accordance with the designation on the drawings or the schedule shown in the Construction section of these specifications. Where no class designation is given in either the plans or specifications, Class IV pipe shall be used.

Pipe shall be clearly marked to identify manufacturer and indicate date of manufacture and pipe class. Lift holes are not permitted.

Joints shall be of a type prepared for and utilizing a continuous gasket made of special composition rubber of such size and cross section as to completely fill the recess prepared for it.

Joints shall be in accordance with ASTM Designation C443, latest revision or AWWA Specification C-302, and shall be of the "O" ring type. The pipe shall be inspected, tested and labeled by a competent independent testing laboratory with copies of test reports being furnished to the **ENGINEERS** in triplicate. The number of test specimens shall be the maximum number indicated by the ASTM Specifications. The manufacturers name shall be clearly shown on the pipe.

3.17 **CAST IRON PIPE**

Cast iron pipe shall be manufactured in accordance with ASA Standard A21.6 or A21.8 for centrifugally cast iron pipe. The pipe shall be manufactured of iron having 21/45, or stronger, metal characteristics. Class of pipe shall be as indicated on the drawings or in the absence of specified class shall be Class 22, with minimum thickness as follows:

- 6".................0.38" Wall Thickness
- 8".................0.41" Wall Thickness
- 10"..............0.44" Wall Thickness
- 12"..............0.48" Wall Thickness

TS - 3.4
3.17 **CAST IRON PIPE**  (continued)

Pipe shall be furnished in lengths of 18' to 20' and unless otherwise indicated shall be provided with a compression type slip joint equal to Fastite joint as manufactured by American, Super Beli-Tite as manufactured by Clow, or equal.

Pipe shall be furnished with standard thickness cement lining on the inside with a bituminous seal coat and a bituminous coating on the outside. Cement lining shall conform to ASA Standard A21.4. The exterior or the pipe shall be clearly marked to indicate the manufacturer, date of manufacture, pipe class and weight.

3.18 **DUCTILE IRON PIPE**

Ductile iron pipe shall be manufactured in accordance with ASA Standard A21.51 for centrifugally cast ductile iron pipe. The pipe shall be manufactured of iron having acceptance values of 60-42-10. Pipe shall be as indicated on the BID Proposal or shall be at least minimum. Wall thickness for Class 52 pipe shall be as follows:

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<th>Size</th>
<th>Wall Thickness</th>
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<tr>
<td>8&quot;</td>
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<tr>
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<tr>
<td>12&quot;</td>
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<td>0.40&quot;</td>
</tr>
<tr>
<td>18&quot;</td>
<td>0.41&quot;</td>
</tr>
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</table>

Pipe shall be furnished in lengths of 18' to 20' and unless otherwise indicated shall be provided with a compression type slip joint equal to the Fastite joint as manufactured by American. Gaskets and lubricant shall be furnished with the pipe.

Pipe shall be furnished with standard thickness cement lining on the inside with a bituminous seal coat and a bituminous coating on the outside. Cement lining shall conform to ASA Standard A21.4. The exterior of the pipe shall be clearly marked to indicate the manufacturer, date of manufacture, the pipe class and weight. Exterior markings shall also positively identify the pipe as being Ductile Iron.

3.19 **CAST IRON FITTINGS**

All cast iron fittings shall be cement lined, bituminous coated manufactured in accordance with ASA Standard A21.10-1964. Fittings shall be furnished with mechanical joints conforming to ASA A21.11-1964, unless otherwise indicated or directed.

3.20 **SEWER FITTINGS AND ADAPTERS**

Fittings and adapters for use with sewer pipe shall be manufactured to be compatible with piping and pipe joints. Fitting and adapter engineering data shall be submitted to the **ENGINEER** for approval.
TS - 3.5
3.21 POLYVINYL CHLORIDE (PVC) SEWER PIPE

PVC sewer pipe shall be manufactured of Polyvinyl chloride material as defined and described in ASTM D-1784 and shall be solid wall conforming to ASTM D-3034, latest revision except that the standard dimension ratio (SDR) of the outside diameter of the pipe to wall shall not exceed thirty five (35), for sizes 4” through 15”; and ASTM F-679 for 18” through 27”.

Joints shall be of bell and spigot type. The bell shall contain and elastomeric gasket which is firmly retained. Solvent weld joints will not be permitted except in an emergency situation when approved by the ENGINEER.

Fittings and plugs shall be supplied by pipe suppliers with equivalent joints. Plugs shall be suitable to withstand test pressures.

Pipe laying lengths shall not exceed twenty (20) feet in length. Shorter lengths will be required if the CONTRACTOR experiences difficulty in maintaining proper pipe alignment.

A suitable designed water stop shall be utilized with PVC pipe at each manhole connection.

All PVC pipe shall be stored at the project site in strict accordance with the manufacturer's recommendations and at all times prior to actual installation of the pipe the CONTRACTOR shall be responsible for providing uniform support for each length of pipe stored at the site. PVC pipe that has been bowed by the sun shall not be laid until it has straightened and lies flat without restraint.

3.22 POLYVINYL CHLORIDE (PVC) SEWER FORCE MAIN

All sewer pipe shall be made from clean, virgin, NSF-approved, Type I, Grade I polyvinyl chloride (PVC), conforming to ASTM resin specification D-1784. All pipe shall meet or exceed minimum requirements of commercial standard CS 256-63 and ASTM D-2241 for type 1120 material. SDR classifications as called for on the BID Proposal or minimum SDR-21 wall thickness.

Pipe length shall not exceed twenty one (21) feet unless approved by ENGINEER. Provision must be made for proper transporting, handling and storage of pipe. Pipe and fittings to be assembled with non-toxic lubricant as recommended by manufacturer and approved by ENGINEER. Pipe shall be as manufactured by Johns-Manville, Ethyl Corp., Clow Corp., Certain-Teed, or equal.

Pipe joints shall be the coupling or bell and spigot type utilizing rubber ring compression gasket(s) (ASTM D 1869). Provision shall be made for thermal expansion and contraction to be taken up at the joint.

All pipe shall have a metallic tape or similar device installed in accordance with manufacturer's recommendation. The metallic device shall be Terra Tape or equal and shall be compatible with City location equipment.
3.22 **POLYVINYL CHLORIDE (PVC) SEWER FORCE MAIN** (continued)

Manufacturer shall have pipe tested in accordance with provisions of Commercial Standard CS256-63. manufacturer shall furnish ENGINEERS three (3) copies of certified statements to the effect that all items have met or exceeded requirements of the applicable specification. Test certificates will be required unless noted otherwise on drawings and shall cover all pipe used on this project.

All pipe shall be subjected to a rigid inspection after delivery to the site and before being placed in the work. Any item found defective by such field inspection will be rejected and shall be immediately removed from the premises.

Marking shall include the following on each length of pipe: manufacturer's name, nominal size, pressure rating, dimension ratio number, "PVC 1120", ASTM designation number, and NSF seal of approval.

Pipe shall be suitable for use with gray or ductile iron fittings when used with a transition gasket.

3.23 **COMPRESSION COUPLINGS**

When joining different types of pipe together, the CONTRACTOR shall use compression couplings that are resistant to corrosion by soil and sewage and that will provide a permanent watertight joint. The compression coupling shall meet the physical test and joint-leak requirements specified in ASTM C-425 and the bands for attaching slipliner pipe shall be stainless steel conforming to ASTM C-425. Each coupling shall bear the manufacturer's name and an indication of its size.

3.24 **HIGH DENSITY POLYETHYLENE SEWER PIPE**

The pipe and fittings shall be made of high density, high molecular weight polyethylene pipe material meeting the requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D-1248 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials. The pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties. The pipe shall be manufactured by the continuous winding of a special profile onto suitably sized mandrels. It shall be produced to constant internal diameters. The pipe shall be Spirolite or equal.

The pipe shall be produced with bell and spigot end construction.

Joining will be accomplished by rubber gasket, or thermal welding, as determined by the design ENGINEER in accordance with the manufacturer's recommendations.

The integral bell and spigot gasketed joint is designed so that when assembled, the elastomeric gasket, contained in a machined groove on the pipe spigot, is compressed radially in the pipe bell to form a positive seal.
3.24 **HIGH DENSITY POLYETHYLENE SEWER PIPE** (continued)

Rubber gaskets shall comply in all respects with the physical requirements specified in the non-pressure requirements of ASTM Specification C-443. They shall be molded or produced from an extruded shape approved by the manufacturer and spliced into circular form. The lubricant used for assembly shall have no detrimental effect on the gasket or on the pipe.

The selection and conditioning of pipe samples for testing shall be as established by the *ENGINEER*. Three (3) specimens of pipe, a minimum of twelve (12) inches long, shall be flattened between parallel plates in a suitable press until the distance between the plates is forty percent (40%) of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within two (2) to five (5) minutes.

Remove the load and examine the specimens for splitting, cracking or breaking. There shall be no evidence of splitting, cracking or breaking.

The pipe ring stiffness constant shall be determined utilizing procedures outlined in ASTM D-2412. Test specimens shall be a minimum of two pipe diameters or four (4) feet in length, whichever is less. Ring Stiffness Constant (RSC) values for the pipe can be directly related to the pipe's class designation. When tested, the minimum RSC shall be ninety percent (90%) of the nominal.

All pipe shall be clearly marked to show the pipe size, class and profile number and the production code.

3.25 **FLOWABLE FILL**

All flowable fill mortar shall be in accordance with the Standard Specifications for Road and Bridge Construction except as modified herein.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SUBSECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Type I</td>
<td>901.01</td>
</tr>
<tr>
<td>Fly Ash, Class C or Class F</td>
<td>AASHTO M 295</td>
</tr>
<tr>
<td>Water</td>
<td>918.01</td>
</tr>
<tr>
<td>Chemical Additives</td>
<td>918.09</td>
</tr>
</tbody>
</table>

Fine Aggregate shall conform to the requirements Subsection 903.01. Fine aggregate for Concrete except that the gradation shall be as follows:

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT PASSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ - inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

Flowable fill mortar shall be proportioned as follows:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>PER CUBIC YARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Type I</td>
<td>100 lbs (Maximum)</td>
</tr>
<tr>
<td>Fly Ash, Class C or Class F</td>
<td>250 lbs (Minimum)</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>2800 lbs</td>
</tr>
<tr>
<td>Water</td>
<td>60 gal (Approximate)</td>
</tr>
</tbody>
</table>

TS - 3.8
3.25 **FLOWABLE FILL** (continued)

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

Place an open-ended cylinder (pipe) three inches in diameter by six inches in height in an upright position on a smooth, level surface. Fill the cylinder with a representative sample of the flowable fill mortar proposed for use. Remove the cylinder by lifting it straight up thus allowing the sample to diffuse on the smooth, level surface. The flowable fill mortar should diffuse into a circular shape having an approximate diameter of not less than eight inches.
SECTION 4 - EXCAVATION & BACKFILL

4.01 GENERAL

The CONTRACTOR shall perform all required excavation and backfilling incidental to the installation of force mains, sewers, manholes, and other appurtenances under this contract. Excavation shall be carried to the depths indicated on the drawings or as necessary to permit the installation of pipe, bedding, structures of appurtenances. Care shall be taken to provide a firm, undisturbed, uniform surface in the bottoms of trenches and excavations for structures. Where the excavation exceeds the required depth, the CONTRACTOR shall bring the excavation to proper grade through the use of an approved incompressible backfill material (generally crushed stone or fill concrete, depending upon the nature of the facility to be placed thereon). In the event unstable soil conditions are encountered at the bottom of the excavation, the ENGINEER may direct the CONTRACTOR to continue the excavation the firm soil or to provide pilings or other suitable special foundations.

The CONTRACTOR shall take such precautions as may be necessary to avoid endangering personnel, pavement, adjacent utilities or structures through cave-ins, slides, settlement or other soil disturbance resulting from his operations.

Backfilling shall be carried out as expeditiously as possible, but shall not be undertaken until the ENGINEER has been given the opportunity to inspect the work. The CONTRACTOR must carry out all backfilling operations with due regard for: the protection of pipes, structures and appurtenances; the use of prescribed backfill materials; and procedures to obtain the desired degree of compaction.

The CONTRACTOR shall be responsible for storage of excavated material, disposal of surplus excavated material, trench dewatering and other operations incidental to excavation and backfilling operations.

4.02 CLASSIFICATION OF EXCAVATION

Excavation shall be classified only as earth excavation and solid rock excavation. Solid rock excavation shall consist of the removal of all rock larger than nine (9) cu. ft. in volume that cannot be removed by normal trenching or excavating equipment. Material that can be loosened or separated with a pick or that can be excavated with a trencher or backhoe will not be classified as solid rock excavation.

4.03 TRENCH EXCAVATION

Trenches shall be neatly excavated to the alignment and depth required for the proper installation of pipe, bedding material and appurtenances. Trenches shall be opened up far enough ahead of pipe laying to reveal obstructions, but in general shall not include more than 300 feet of continuous open trench at any time. the CONTRACTOR will be required to follow up trenching operations promptly with pipe laying, backfill and clean-up, and in the event of failure to do so, may be prohibited from opening additional trench until such work is completed.
4.03 **TRENCH EXCAVATION (continued)**

The **CONTRACTOR** shall plan his operations so as to cause a minimum of inconvenience to property owners and to traffic. No road, street or alley may be closed unless absolutely necessary, and then only if the following conditions are met:

1. Permit is secured from appropriate State, County or Municipal authorities having jurisdiction.
2. Fire and Police Departments are notified before road is closed.
3. Suitable detours are provided and are clearly marked.

No driveways shall be cut or blocked without first notifying the occupant of the property. Every effort shall be made to schedule the blocking of drives to suit the occupants convenience, and except in cases of emergency, drives shall not be blocked for a period of more than 8 hours.

The **CONTRACTOR** shall furnish and maintain barricades, signs, flashing lights, and other warning devices as necessary for the protection of public safety. Flagmen shall be provided as required on heavily traveled streets to avoid traffic jams or accidents.

Trench width shall be held to a minimum consistent with proper working space for assembly of pipe. Maximum trench width up to a point one foot (1') above top of pipe shall be limited to the outside pipe diameter plus eighteen inches (18”). Boulders, large stone, shale and rock shall be removed to provide clearance of six inches (6") below and on each side of the pipe.

Trench walls shall be kept as nearly vertical as possible with due consideration to soil conditions encountered and when necessary, sheeting or bracing shall be provided to protect life and property.

Where unstable soil conditions are encountered at the trench bottom, the **CONTRACTOR** shall remove such additional material as may be directed by the **ENGINEER** and replace the excavated material with approved backfill.

The **CONTRACTOR** shall excavate by hand wherever necessary to protect existing structures or utilities from damage or to prevent overdepth excavation in the trench subgrade.

Excavated material shall be stored safely away from the edge of trench and in such a way as to avoid encroachment on private property.

The trench shall be excavated to sufficient depth to permit a minimum of thirty inches (30") of cover to be maintained over the top of sewer force mains. The bottom of the trenches must be shaped by hand and bell holes must be dug so that the full length of pipe is resting on trench bottom. Blocking shall not be used and neither shall the pipe be laid on a trench bottom that has not been leveled to provide support throughout the full length of the pipe.
4.03 **TRENCH EXCAVATION** (continued)

The **CONTRACTOR**'s attention is called to the fact that the thirty inch (30") depth of cover is a minimum and may be exceeded in instances where obstructions are encountered in trenching operations. The **CONTRACTOR** will be permitted to lay the sewer force main above the obstruction only if the minimum cover required can be obtained while providing a cushion at least six inches (6") thick between the bottom of the pipe and the top of the obstruction. Where this minimum cover and the required clearance cannot be obtained the **CONTRACTOR** will be required to lay the pipe under the obstruction and will receive no additional compensation for the additional depth of trench required for constructing the line in this manner. The **CONTRACTOR** will also be required to gradually increase the depth of trench when approaching cuts, creek banks, or other changes in grade in order to avoid the use of fittings, wherever it is practical to do so.

Trenches for sewers shall be carefully excavated to maintain the desired grade and alignment. Depth of finished trench shall be adequate to accommodate the bedding as specified in Section 6.

4.04 **EXCAVATION FOR STRUCTURES**

Excavation for manholes, junction boxes, piers or other structures shall be only as large as may be required for the structure and for working room around the structure. In earth, excavation shall generally extend to the outer limits of the structure at the bottom, and shall slope outward at such angle as may be required for stability of excavated face.

In rock, excavation shall be carried to a point six inches (6") outside the structure so that no rock is left within six inches (6") of the finished structure.

Care shall be taken as the excavation approaches the desired grade to avoid overdepth excavation and provide a firm and undisturbed soil surface on which footings, slabs or foundations are to be placed. Should the **CONTRACTOR** excavate below the desired grade level, the excavation shall be brought to grade by the use of concrete or compacted crushed stone at the expense of the **CONTRACTOR**. The use of tamped earth backfill under foundations, footings or slabs will not be acceptable.

Where structures rest partially or wholly upon rock, the rock shall be excavated to a point six inches (6") below bottom of structure and compacted crushed stone shall be used to bring the excavation back to grade, provided however, that where the structure will rest completely on sound solid rock, the **ENGINEER** may at his discretion permit the footing, foundation or slab to be placed directly upon the rock surface. Where the **CONTRACTOR** is permitted to place concrete directly on the rock, all dirt and weathered rock shall be removed and any seams or crevices shall be cleaned and filled with grout or mortar prior to placement of the structural concrete.

Should the material found at the desired subgrade appear to be unstable or otherwise unsuitable for support of the structure such condition shall be immediately called to the attention of the **ENGINEER**. The **ENGINEER** may direct that such unsuitable material be removed and replaced with compacted crushed stone, he may modify the foundation design to suit the condition, or he may determine that the bearing capacity of the material is suitable for the load to be supported; but in any case he shall provide written instructions to the **CONTRACTOR** as to the procedure to be followed.
TS - 4.3
4.05 ROCK EXCAVATION

Rock excavation shall consist of loosening, removing and disposing of all rock larger than nine (9) cu. ft. in volume, which in the opinion of the ENGINEERS can only be removed by blasting or other equivalent methods. Such materials to be classified as solid rock shall include boulders, bed rock, or solid concrete but shall not include pavement or shaly materials that can be loosened by other methods.

Where rock excavation is encountered in trenches the excavation shall be carried to a depth of six inches (6") below the bottom of the pipe. The rock shall also be removed to a width of at least six inches (6") beyond the outside of the pipe on each side so that no rock is left within six inches (6") of the outside wall of the pipe. Where rock is excavated in the bottom of the trench, the trench shall be brought back to grade by the use of crushed stone that shall be compacted to form a stable base for the pipe laying operation.

The CONTRACTOR shall exercise all necessary precaution in blasting operations. Suitable blasting mats shall be provided and utilized as required. Blasting shall be done only by experienced men. Careless shooting, resulting in the ejection of stones or other debris during blasting, shall be corrected immediately by the CONTRACTOR'S representative.

No blasting shall be done until the CONTRACTOR has taken out the necessary insurance to fully protect the OWNER from all possible damages resulting from the blasting operations. If blasting is required, an acceptable pre-blast survey shall be conducted.

The blasting shall be done in accordance with all recognized safety precautions and in accordance with regulations of authorities having jurisdiction.

Where rock is encountered in the immediate vicinity of gas mains, telephone cables, building footings, gasoline tanks, or other hazardous areas the CONTRACTOR shall remove the rock by means other than blasting. Care shall be taken in blasting operations to see that pipe or other structures previously installed are not damaged by blasting. In general, blasting shall not be done within twenty five feet (25') of the completed pipe line.

Excavated rock that cannot be utilized in trench backfill as permitted under Section 5.10 shall be removed from the site and disposed of as directed by the ENGINEERS.

4.06 SHEETING AND SHORING

The CONTRACTOR shall provide such bracing, sheeting or shoring as may be necessary for the protection of life and property, or the completed structure. Sheetin will be required where necessary to restrict the trench width to acceptable limits above the top of pipe.
TS - 4.4
4.06 **SHEETING AND SHORING** (continued)

Sheeting, shoring or bracing shall conform to applicable safety codes, and shall be left in place until the pipe is laid, checked and backfilled to a safe level at or above top of pipe. The bracing or sheeting may then be removed in an approved manner unless the ENGINEER specifically directs that the sheeting be left in place. Where the sheeting is left in place either at the direction of the ENGINEER or option of the CONTRACTOR, the sheeting shall be cut off at least eighteen inches (18") below the finished ground level.

Care shall be taken in removing sheeting to avoid weakening the trench, increasing the backfill load or endangering adjacent property. Voids left by the removal of sheeting shall be filled in and compacted with suitable material using tamps intended for this purpose.

4.07 **REMOVAL OF WATER**

The CONTRACTOR shall be responsible for handling run-off, ground water and sewage in such a way as to maintain trenches and excavations in a dry condition until the work is completed. Pumps piping, well points, labor, fuel, and other facilities necessary to control, intercept, remove and/or dispose of water shall be provided by the CONTRACTOR at his own expense.

Water shall be kept out of trenches and other excavations to the extent necessary to protect the supporting strength of the foundation material, permit efficient and satisfactory assembly or replacement of facilities, and to prevent floating or misalignment.

Water removed from trenches or holes shall be discharged to natural drains in such a way as to avoid danger or damage to adjacent property owners or sewers.

Where the CONTRACTOR fails, refuses, or neglects to control water in trenches or other excavations, and corrective work is deemed by the ENGINEER to be necessary as a consequence thereof, such work shall be at the CONTRACTOR'S expense.

4.08 **STORAGE OF EXCAVATED MATERIAL**

Excavated material shall be deposited in such a manner as to avoid danger to workmen, sewer, or traffic, and to cause minimum inconvenience through blocking of drives, sidewalks, natural drains, etc. Where indicated on the drawings, or necessitated by conditions prevailing, the CONTRACTOR shall haul away and stockpile excavated material.

4.09 **DISPOSAL OF SURPLUS EXCAVATED MATERIAL**

Excavated material that is unsuitable or unnecessary for backfilling shall be removed from the job site and disposed of at the CONTRACTOR'S expense. The CONTRACTOR must not sell or give away surplus excavated material without first offering said material to the OWNER, but if the OWNER does not have a need for the material at a location within one mile of the job site, the CONTRACTOR shall make his own arrangements for disposal.
TS - 4.5
4.10 **BACKFILL FOR TRENCHES**

a. **General**

Backfilling of trenches will proceed as pipe laying progresses so that the trench will be filled in as rapidly as possible after the pipe has been assembled and inspected. The CONTRACTOR shall, however, afford the inspector ample opportunity for observing the assembled pipe line before placing the backfill and, if requested by the inspector shall delay the backfilling operation when the inspector is not present at the site. It is intended that the CONTRACTOR will backfill trenches and place base stone on the same day that the trench is excavated. All streets and walks shall be broomed to remove all earth and loose rock and shall be watered as necessary to prevent a dust problem.

Within 14 days of excavation, all excess material shall be removed and effected area shall be maintained in an acceptable condition.

Backfilling procedures will normally fall under two (2) categories as follows:

1. Under highway, streets, drives and areas subject to traffic, either under paving, or in unpaved areas (this category will include shoulders and driveways).

2. Open fields or other areas not covered under Item 1.

b. **Backfill for Sewer Trenches**

In highways, streets, driveways, all areas subject to traffic, and certain areas as designated on the drawings, the backfill shall consist entirely of crushed stone which shall be placed in layers or lifts not exceeding twelve inches (12") in thickness and shall then be carefully compacted to maximum density or minimum volume. The backfill around the pipe and up to a depth of twelve inches (12") above the top of the pipe shall be placed by hand to avoid damage to or misalignment of the sewer. After the backfill has been placed to a depth of at least twelve inches (12") above the top of the pipe the additional crushed stone backfill may be placed by means of front end loaders, bulldozers or other suitable mechanical equipment subject to the twelve inch (12") limitation on maximum thickness of layers placed before compaction. Flowable fill mortar shall be placed in locations shown on the plans or as directed by Engineer. The flowable fill mortar shall be covered by necessary means i.e. steel plates or any other approved means while in the plastic state. Flowable fill mortar shall not be placed on the flowable fill mortar prior to final set or hardening as determined by the engineer. Flowable fill mortar shall at no time come in direct contact with any utility lines. Flowable fill mortar shall commence 6-inch above top of pipe. Placement shall be in accordance with TDOT Standards for Road and Bridge Construction.
b. Backfill for Sewer Trenches (continued)

For category two, the backfill up to a point twelve inches (12") above the top of the pipe shall be crushed stone and shall be placed by hand as specified in the preceding paragraph. The backfill for category two in areas not ordinarily subjected to traffic, may consist of suitable excavated material placed by machine after the backfill reaches a depth of twelve inches (12") over the top of the pipe, and the backfill shall be compacted by means of a suitable wheeled vehicle such as a tractor or front end loader running longitudinally along the trench. After the backfill has been compacted in this manner additional fill material shall be placed in the trench to restore the original grade and provide a slight mound over the trench. This material shall again be compacted by means of a suitable wheeled vehicle. No rock over the pipe and no rock larger the 1/2" may be used in the top six inches (6") of the backfill. Top soil may be required on all lots or similar areas if suitable material is not available on site.

Backfill up to the spring line of the pipe shall be placed as pipe laying progresses in order to maintain proper grade and alignment. Additional backfill shall not be placed until after the pipe has been inspected by the ENGINEERS and approved for backfill.

In wide deep trenches the ENGINEER may at his discretion permit the use of rock larger than six inches (6") in the backfill, provided such rock is carefully placed in such manner that the final position of the rock will not be within the vertical prism lying directly over the pipe or within three feet (3') on either side of the pipe.

In all instances sufficient care must be exercised to avoid leaving any holes or voids over, around or under stones, boulders, or other backfill material that may later be filled by leaching or settlement of surrounding material thereby causing future trench settlement. Where the CONTRACTOR desires to use excavated rock for backfill material and such rock meets the dimensional requirements as specified herein, the CONTRACTOR shall provided additional backfill material of a suitable nature to fill the voids.

In locations not subject to traffic where excavated material is permitted in the backfill such material shall be brought up to the original ground level as indicated above and shall then be mounded over to provide for additional settlement. The CONTRACTOR shall exercise care to confine the mound to the area immediately over the trench and shall be responsible from time to time during the one year warranty period to fill in areas where excessive settlement has occurred.

The CONTRACTOR shall be responsible for and shall protect all sewers, storm sewers, and electric, telephone, water or other pipes or conduits against danger or damage while the trenches are being backfilled and from future settlement of the backfill. Where such damage should occur as a result of the CONTRACTOR'S operations, he shall repair such damage promptly to the ENGINEER'S satisfaction.
b. **Backfill for Sewer Trenches** (continued)

The **CONTRACTOR’S** attention is called to the fact that he will be held completely responsible for any damage to pavement, sidewalks, curbs, gutters, meter or valve boxes, street inlets, or other structure or appurtenances as a result of the **CONTRACTOR’S** operations. It should be specifically noted that the **CONTRACTOR** shall be responsible for damage even though the character or nature of the original pavement or structure was such that it was not capable of carrying the load of the construction equipment regardless of the construction methods used.
SECTION 5 - INSTALLATION OF SEWER PIPE AND RELATED ITEMS

5.01 GENERAL

The CONTRACTOR shall use only experienced men in the final assembly of pipe in the trench, and all pipe shall be laid in accordance with these specifications and the recommended practice of the pipe manufacturer. Trench bottoms shall be carefully prepared, shall be free of water and bedding as specified shall be in place.

Care shall be exercised to insure that pipe of the proper strength or classification meeting the specifications in every respect is provided at the site of pipe laying operations. Recommended tools, equipment, lubricant and other accessories needed for proper assembly or installation of the pipe shall be provided at the site of the work. Any damaged or defective pipe discovered during the pipe laying operations shall be discarded and removed from the site of the pipe laying operations.

Alignment and grade shall be carefully maintained during the laying operations. The method used for maintaining grade and alignment must be acceptable to the ENGINEERS and must produce the desired results. The top of the bedding material must be brought to the exact grade and must be shaped so as to provide effective support for the bottom quadrant of the pipe except at the bells.

5.02 HANDLING PIPE AND ACCESSORIES

The CONTRACTOR shall exercise care in the storage and handling of pipe, both on the storage yard and at the site of laying operations. Suitable clamps, slings, or other lifting devices shall be provided for handling pipe and fittings. Pipe and fittings shall be inspected for defects and for dirt or other foreign material immediately before placing them in the trench. Suitable swabs shall be available at the site of laying operations, and any dirt or foreign material shall be removed from the pipe before it is lowered into the trench.

5.03 LAYING CONCRETE PIPE

Where concrete pipe is shown, specified or designated by the ENGINEER, the concrete pipe shall be furnished in accordance with Section 3.16 for reinforced concrete pipe. Reinforced concrete pipe shall be Class 3, Class 4 or Class 5 as indicated or as required for the depth of cover.

It is desired that trench width from a point one foot (1') above the top of the pipe down to the bottom of the trench be held to a minimum consistent with the provision of the necessary working space for proper assembly of the pipe. In general, it is anticipated that the trench width will not exceed the nominal pipe diameter plus eighteen inches (18”).

A minimum of six inches (6") of crushed stone bedding shall be placed in the bottom of the trench to provide continuous support of the bottom quadrant of the pipe. The CONTRACTOR shall bring the crushed stone bedding up to the required level to provide support of the bottom quadrant and shall then shape the bedding to receive the pipe. Bell holes shall be dug so that the bottom of the bells will not support the pipe.
5.03 **LAYING CONCRETE PIPE** (continued)

After the bedding has been shaped and the pipe has been installed, crushed stone backfill shall be carefully placed by hand and compacted on both sides of the pipe and up to a level twelve inches (12") above the top of the pipe.

The selection of pipe has been based upon the limiting trench width, the use of crushed stone backfill on the sides of the pipe extending up to a point twelve inches (12") above the top of the pipe. It is therefore essential that these conditions be observed in the installation of the pipe. Maximum depths of backfill for pipe installed under these conditions shall be as follows:

**REINFORCED CONCRETE PIPE**

<table>
<thead>
<tr>
<th>PIPE SIZES</th>
<th>CLASS</th>
<th>TRENCH WIDTH*</th>
<th>MAX. COVER OVER TOP OF PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>24&quot;</td>
<td>4</td>
<td>3'-8&quot;</td>
<td>23'</td>
</tr>
<tr>
<td>18&quot;</td>
<td>3</td>
<td>2'-9&quot;</td>
<td>9'</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3'-0&quot;</td>
<td>7'</td>
</tr>
<tr>
<td>18&quot;</td>
<td>4</td>
<td>2'-9&quot;</td>
<td>19'</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>3'-0&quot;</td>
<td>15'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3'-6&quot;</td>
<td>11'</td>
</tr>
<tr>
<td>18&quot;</td>
<td>5</td>
<td>3'-6&quot;</td>
<td>22'</td>
</tr>
<tr>
<td>15&quot;</td>
<td>3</td>
<td>2'-6&quot;</td>
<td>13'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2'-9&quot;</td>
<td>10'</td>
</tr>
<tr>
<td>15&quot;</td>
<td>4</td>
<td>2'-6&quot;</td>
<td>18'</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2'-9&quot;</td>
<td>14'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3'-0&quot;</td>
<td>11'</td>
</tr>
<tr>
<td>15&quot;</td>
<td>5</td>
<td>3'-0&quot;</td>
<td>26'</td>
</tr>
<tr>
<td>12&quot;</td>
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<td>7'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2'-6&quot;</td>
<td>6'</td>
</tr>
<tr>
<td>12&quot;</td>
<td>4</td>
<td>2'-3&quot;</td>
<td>15'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2'-6&quot;</td>
<td>11'</td>
</tr>
<tr>
<td>12&quot;</td>
<td>5</td>
<td>2'-9&quot;</td>
<td>20'</td>
</tr>
</tbody>
</table>

* Trench width measured 1'-0" above top of pipe

After the pipe has been cleaned and inspected for defects and lowered into the trench, the gasket shall be coated with lubricant of the type supplied by the pipe manufacturer and inserted in the groove provided for the purpose. The pipe shall then be assembled with due care being taken to insure that the spigot end of the pipe is shoved home and that the pipe is left in proper grade and alignment.

Installation of concrete pipe including make up and assembly of joints shall conform to recommendations of the pipe manufacturer. Wye branches or tees or other fittings shall be placed in the sewer line as shown on the plans or as directed by the **ENGINEER**.

Whenever pipe laying operations are to be discontinued for a period of time exceeding two (2) hours, the end of the pipe shall be carefully secured to avoid displacement or misalignment and a tight fitting plug or stopper shall be place in the line. Upon resumption of laying operations ,the plug or stopper shall not be removed from the line until any water, mud or other debris has been removed to avoid entry into the completed section of the sewer.

TS - 5.3
5.04 **LAYING CAST OR DUCTILE IRON PIPE**

Where cast iron or ductile iron pipe is shown, specified or directed by the ENGINEER, the pipe shall be of the type and class as indicated. Cast iron pipe, either ductile or gray iron to be installed in trenches shall be laid on crushed stone bedding as specified for Concrete or Clay Sewer Pipe, and shall be backfilled with compacted crushed stone around and above the pipe as specified for other pipe materials. The bedding material shall be shaped to provide continuous support for the cast iron pipe throughout its length except at bells.

Unless otherwise indicated cast iron pipe shall be laid with slip type compression joints, equal to the manufacturers standard for pressure water pipe and assembly of the joints shall be in accordance with manufacturer's recommendations using lubricant and accessories as provided by the pipe manufacturer.

Whenever it is necessary to cut a joint of pipe in order to fit the trench conditions, the cutting shall be done using the equipment as recommended by the manufacturer for the specific type of pipe involved. The cut shall be made so as to leave a smooth end at right angles to the axis of the bore and the end shall be beveled or finished as required to make the joint without risk of damage to the gasket.

In stream crossings, ravines, shallow cuts and other locations where the pipe will not be laid on bedding placed on original subgrade the pipe shall be supported on concrete piers as detailed on the drawings or as directed by the ENGINEERS. Piers shall be of Class A concrete with reinforcing as shown. The tops of piers shall be carefully set at the exact elevation and shall be shaped so as to provide support for the bottom half of the pipe with allowance being made for the outside diameter of the pipe plus the thickness of a layer of tarred felt around the outside of the pipe. After the concrete has obtained satisfactory strength the cast iron pipe may be installed across the piers using one or more layers of tarred felt between the surface of the concrete and the outside diameter of the pipe. The CONTRACTOR may, at his option, install the pipe to exact grade and alignment using temporary supports and then construct the permanent piers for the pipe, provided suitable precautions are taken to avoid any misalignment during the construction of the piers.

5.05 **LAYING (PVC) SEWER PIPE**

All PVC sewer pipe used on the project shall conform to provisions in Section 3.21 under MATERIALS. It is desired that trench widths from a point one foot above the top of the pipe down to the bottom of the trench be held to a minimum consistent with the provision of necessary space for proper assembly of the pipe. In general, it is not anticipated that the trench width will exceed the nominal pipe diameter plus eighteen inches (18").

A minimum of six inches (6") of crushed stone bedding shall be placed in the bottom of the trench to provide continuous support of the bottom quadrant of the pipe. The CONTRACTOR shall bring the crushed stone bedding up to the required level to provide support of the bottom quadrant and shall then shape the bedding to receive the pipe.

After the bedding has been shaped and the pipe has been installed, crushed stone backfill shall be carefully placed by hand and compacted on both sides of the pipe and up to a level twelve inches (12") above the top of the pipe.
5.05 **LAYING (PVC) SEWER PIPE** (continued)

After the pipe has been cleaned and inspected for defects and lowered into the trench, the mating surfaces of the compression joint shall be wiped clean and coated with lubricant of a type supplied by the pipe manufacturer. The pipe shall then be assembled with due care being taken to insure that the spigot end of the pipe is shoved home and that the pipe is left in proper grade and alignment.

Whenever pipe laying operations are to be discontinued for a period of time exceeding two (2) hours, the end of the pipe shall be carefully secured to avoid displacement or misalignment and a tight fitting plug or stopper shall not be removed from laying operations, the plug or stopper shall not be removed from the line until any water, mud or other debris has been removed to avoid entry into the completed section of the sewer.

5.06 **LAYING POLYETHYLENE SEWER PIPE**

All polyethylene sewer pipe used on the project shall conform to provisions in Section 3.24 under **MATERIALS**. It is desired that trench widths from a point one foot (1') above the top of the pipe down to the bottom of the trench be held to a minimum consistent with the provision of necessary space for proper assembly of the pipe. In general, it is not anticipated that the trench width will exceed the nominal pipe diameter plus eighteen inches (18").

A minimum of six inches (6") of crushed stone bedding shall be placed in the bottom of the trench to provide continuous support of the bottom quadrant of the pipe. The **CONTRACTOR** shall bring the crushed stone bedding up to the required level to provide support of the bottom quadrant and shall then shape the bedding to receive the pipe.

After the bedding has been shaped and the pipe has been installed, crushed stone backfill shall be carefully placed by hand and compacted on both sides of the pipe and up to a level twelve inches (12") above the top of the pipe.

After the pipe has been cleaned and inspected for defects and lowered into the trench, the mating surfaces of the compression joint shall be wiped clean and coated with lubricant of a type supplied by the pipe manufacturer. The pipe shall then be assembled with due care being taken to insure that the spigot end of the pipe is shoved home and that the pipe is left in proper grade and alignment.

Whenever pipe laying operations are to be discontinued for a period of time exceeding two (2) hours, the end of the pipe shall be carefully secured to avoid displacement or misalignment and a tight fitting plug or stopper shall be placed in the line. Upon resumption of laying operations, the plug or stopper shall not be removed from the line until any water, mud or other debris has been removed to avoid entry into the completed section of the sewer.

All construction methods and procedures shall be in strict accordance with manufacturers recommendations. The **CONTRACTOR** shall furnish ten (10) "Cut-in" Service Tees for each size line furnished, in addition to the Tees set up in the Bid form.
5.07 COUPLINGS AND CONNECTIONS

Unless otherwise indicated or directed by the ENGINEERS, fittings shall be of the same material as the pipe line in which they are to be installed. Fittings shall be furnished with joints of the same type used throughout the rest of the pipe line unless such joint shall not be available and the ENGINEER should approve a substitute type joint. Fittings shall be of the type indicated on the drawings and shall be the manufacturers standard conforming to all applicable standard specifications and dimensional tolerances appropriate for the material of construction. Fittings for PVC pressure pipe to be gray or ductile iron only. Couplings for gravity sewers are specified herein in Section 3.24.

Connections of pipes to manholes or other large structures shall be made using short lengths of pipe to avoid stressing the pipe at the point where it is placed in the wall of the structure.

Pipes entering or leaving masonry or concrete walls shall have one flexible joint located not more than 2'-0" in length with another flexible joint at the end of the 2'-0" pipe length in such a way as to provide for limited lateral or vertical movement of the pipe line as well as limited deflection. Ordinary compression type joints of the types specified for gravity sewers shall be considered as having sufficient flexibility for this purpose. The supplier of the pipe for the sewer lines shall furnish with the pipe order the required number of specials and short lengths of pipe for the CONTRACTOR to install the required flexible connections without improvising.

5.08 SPECIAL LAYING CONDITIONS

In wet or mucky areas where the subgrade or the trench walls have insufficient stability to support the installed sewer the CONTRACTOR will be directed to remove such unstable material and replace same with incompressible backfill.

Where the wet or mucky condition is caused by the CONTRACTOR'S failure or neglect to properly handle ground water or protect against the entrance of storm water the CONTRACTOR will be required to remove and replace the unstable material at his own expense.

Cradle or encasement concrete shall be provided in locations as shown on the drawings or where the nature of the work requires such protection in the event the cradle or encasement concrete is required but is not shown on the drawings. The CONTRACTOR shall obtain written authorization from the ENGINEER for the installation of such protection which authorization shall also include the pay limits for the special protection.

5.09 MANHOLES

Consideration will be given to the use of either cast in place manholes or precast manholes on this project. In the event the CONTRACTOR elects to use precast manholes, he shall submit details of the proposed manholes together with the name of the supplier to the ENGINEERS for approval before any of the precast manholes are shipped to the job site.
5.09 MANHOLES (continued)

a. **PRECAST** - Manholes may be used with precast floors, or with structural concrete floors poured in place. Precast risers shall be furnished with blocked out openings for pipes entering and leaving the manhole. Individual riser sections shall be furnished for the exact conditions to be encountered in the field and shall be constructed so as to suit field conditions and to line up properly with the pipes and manhole steps in other riser sections. Misalignment of steps or improperly located holes for incoming pipes shall be cause for rejection of the manhole sections. Precast manhole sections shall be joined together in such a way as to present a smooth uniform joint that shall be structurally sound and water tight.

b. **CAST-IN-PLACE** - Manholes shall be constructed in place in accordance with the details shown on the drawing in these specifications with forms equal to ABS plastic forms as marketed by Improved Construction Methods, Inc., P.O. Box 685, Jacksonville, Arkansas.

The base shall be cast monolithically with the rest of the manhole. The invert and flow channel shall be formed during or immediately after the placing of the concrete and brush-finished as soon as the concrete has sufficiently set.

The base concrete shall be 3,000 psi, maximum slump four inches (4"), vibrated or tamped on undisturbed bearing. The base shall have a minimum diameter eight inches (8") greater than the outside diameter of the manhole, and a minimum thickness including the area under the pipe as follows:

<table>
<thead>
<tr>
<th>MANHOLE DEPTH</th>
<th>BASE DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>0' to 8' manhole</td>
<td>8&quot;</td>
</tr>
<tr>
<td>8' to 12' manhole</td>
<td>10&quot;</td>
</tr>
<tr>
<td>12' &amp; deeper manhole</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

All invert channels shall be smooth and accurately shaped to a semi-circular bottom conforming to the inside of the adjacent sewer section. Inverts shall extend up at least half of the diameter of the pipe. Changes in the direction of the sewer and entering branches shall have a true curve of as large a radius as the size of the manhole will permit.

The vertical forms, wall spacers, steps and placing cone must be carefully positioned and firmly clamped in place before any placement is made.

The wall spacers must be located ninety degrees (90°) from each other. The manhole shall be cast of 3,000 psi concrete with a maximum slump of four inches (4"). Concrete must be carefully vibrated on each side of each pipe as concrete is deposited in evenly distributed layers of about 18" with each layer vibrated to bond it to the preceding layer. The wall spacers must be raised as the placements are made with the area from which the spacer is withdrawn being carefully vibrated. Excessive vibration is to be avoided. A maximum of two percent (2%) Calcium Chloride may be added to the concrete, at the CONTRACTOR’S option, to speed the set. The forms may be removed as soon as the concrete has sufficiently set.
5.09 **MANHOLES** (continued)

b. **CAST-IN-PLACE** (continued)

Form marks and offsets up to one inch (1") will be permitted on the outside surface of the manhole. Form marks and offsets up to one-half inch (1/2") will be permitted inside of the manhole. All offsets on the inside surface of the manhole will be smoothed and plastered so there is no projection or irregularity capable of scratching a worker or catching and holding water or solid materials.

Honeycomb will be plastered with a mortar consisting of three (3) parts of masonry sand to one (1) part Portland cement immediately upon removal of the forms.

The specific ring and cover and the method of installing it will be approved by the **ENGINEER**.

Manhole frames, covers and steps shall conform to Section 3.12 and 3.13 of these specifications. Manhole steps shall be staggered with even spacing of approximately sixteen inches (16") between steps.

5.10 **SERVICE CONNECTIONS**

Sewer service lines shall be provided as shown on the Plans or as directed by the **ENGINEERS**. Service connections shall consist of tees or wyes with branch connection, curves and service pipe. Pipe and fitting joints shall be compression type as used on the main sewer. Service pipe and fittings shall be of the same material as used for the main sewer. Service pipe shall be laid on a slope of at least 1/8" per foot. Sewer service lines shall conform to details as shown on the drawings and shall terminate at the property line with a tight compression stopper.

Vertical stacks as detailed on the drawings shall be used for service connections wherever the sewer depth exceeds eight feet (8') and only where directed by Engineer.

Services to be installed across State Highways, Railroads and other designated areas shall be installed by boring and jacking and six inch (6") PVC pipe shall be used where pipe is installed by boring and jacking.

In the event that it should be necessary to install a service connection where a tee has not been provided, saddles must be such a way as to effect a permanent water tight joint as recommended by the pipe manufacturer.

Excavation, laying and backfilling for service lines shall conform to the applicable specifications for main sewers.

The **CONTRACTOR** shall make connections to the existing sewers in accordance with details shown on the drawings and as described herein.
5.11 **CONNECTIONS TO EXISTING SEWERS**

New manholes shall be constructed over the existing sewer at points where the proposed sewer will connect and the top of the pipe shall be cut out to provide for flow channels for both existing and proposed sewers.

The **CONTRACTOR** shall make the necessary provisions to keep the existing sewer in operation without bypassing to the ditch or creek or ground surface.

5.12 **CONCRETE**

Concrete is to be proportioned in two classes according to use as follows:

**Class "A"** for reinforced concrete structures, non-reinforced portions of manholes control chambers and interceptor structures, curbs and gutter driveways, sidewalks and surface and base courses for highway and street paving.

**Class "A"** for encasement around sewers and branches and for cradle or refill under sewers and tunnel backfill.

**Class "A"** concrete is to be proportioned one 94 lb. sack Portland cement, 195 lbs. sand, and 270 lbs. coarse aggregate. These proportions may be varied by the **ENGINEERS** after the materials supplied have been tested and proportions for the greatest density and workability determined provided that no more than 7.25, nor less than 6.0 bags of cement per cubic yard of concrete will be required.

**Class "A"** concrete shall have a minimum compressive strength of 4,000 lbs. per square inch in 28 days.

**Class "B"** concrete shall have a minimum compressive strength of 2,000 lb. per square inch and shall contain not less than 4.5 sacks of cement per cubic yard of concrete. The relative amounts of fine and coarse aggregate shall be comparable to that for **Class "A"** concrete.

The water used in mixing must be minimum required for a plastic mix. No water will be permitted to be used for purpose of hastening mixing and reducing of tamping and vibration.

The water content that is allowed will be at all times subject to regulations by the **ENGINEERS**.

In the case of **Class "A"** concrete, not more than 5-1/2 gallons of water to the bag of cement will be allowed in mixing concrete (or proportionately less when slump is above 4" and/or mix is wet) except in cases where, in the judgment of the **ENGINEERS**, additional water is necessary to obtain proper results.

Batching equipment shall include scales for weighing contents of wheelbarrows and a device for accurately measuring water by the gallon, to be used for proportioning each batch.
5.12 **CONCRETE** (continued)

In case of ready-mixed concrete, specifications for proportioning of mixes shall be the same, except from manufacturer's experience with his own aggregates whereas he shall vary proportions of sand and coarse aggregates for the greatest density and workability of mix.

Prior to actual delivery of concrete, and at any change of proportioning, the manufacturer shall furnish a statement to the **ENGINEERS** giving the proportions of weight (dry) or cement, and of fine and coarse aggregates, that will be used in the manufacture of each mix ordered. Proportions must be approved by the **ENGINEERS**. Otherwise, proportioning of mix and batching plant shall be according to ASTM Designation C94 (latest revision) specifications for Ready-Mixed Concrete.

Forms of concrete with exposed surfaces shall consist of dressed and sized lumber, or metal, and must match on edges sufficiently to prevent leakage of mortar. Forms shall be built to such accuracy and braced to such extent that they shall not vary from true lines and surfaces, where exposed, more than 1/4" before pouring concrete, nor more than 3/4" after pouring. Angle strips (3/4" size) shall be placed in all exposed corners of forms.

All steel reinforcement shall be delivered in new condition, either clean or with only a slight coating of rust. If stored on the works it must be kept under shelter or supported at least twelve inches (12") above the ground to prevent its becoming coated with dirt and when placed in forms it must be free from scale or dirt.

When placing in forms, it must be tied together to form a rigid frame before pouring concrete and must be secured in the walls of slabs in such a manner as to insure its holding the position designed for it in the finished work, by use of form stands, steel or concrete chairs or spacers. As a rule, steel bars must have a covering of 1-3/4" of concrete unless otherwise noted on the Plans. All splices shall be 36 bar diameters long and 1" between spliced bars.

Concrete shall be thoroughly mixed at least two minutes after all materials, including water are in the mixer drum having a capacity of at least one (1) sack batch.

Concrete must be poured into forms slowly enough to permit all thorough tamping and vibrating to eliminate any honeycombed surfaces.

Concrete pouring will not be permitted under conditions where there is danger of freezing, or when materials are frozen. After pouring, concrete must be protected from freezing weather for at least 72 hours.

Ready-mixed concrete delivery facilities pledged to the concrete pour shall be approved by the **ENGINEERS** before permission will be given to start the pour.

The period between termination of placing by one truck and starting by the next shall not be longer than ten (10) minutes at temperatures above 70°F, nor longer than 20 minutes below 70°F. The concrete in a truck mixer or agitator must be totally discharged with 1-1/2 hours after the introduction of mixing water to the cement and aggregates. The mixing operation shall begin within thirty (30) minutes after the cement has been intermingled with the aggregates.
Otherwise, mixing, mixers, agitators and inspection shall be according to ASTM Designation C94 (latest revision) Specifications for Ready-Mixed Concrete. Non-agitating trucks for hauling concrete from central mixing plant will not be accepted.

After the removal of the forms, all surfaces that will show in the finished work shall be immediately rubbed down with a coarse carborundum stone or wooden float (if concrete is soft enough for the use of the wood) and left in this condition until concrete has thoroughly hardened. At such time as there is no longer any danger of its subsequent damage from the progress of the work these exposed surfaces must be rubbed with a fine carborundum stone until the finish is similar and equal to that required by the State Highway department for bridges and railing surfaces. Cement or mortar coating will not be permitted. Rubbing is not required below ground.

All concrete must be kept wet or moist for a period of at least forty eight (48) hours after pouring, in order to prevent too rapid drying out.

In dry weather wooden forms must be thoroughly wet before concrete is placed in them and must also be kept in this condition during the period above mentioned. Concrete must be covered and kept damp to protect it from the sun as soon as the surfaces are firm enough to allow the placing of such covering or protection.

At least one slump test shall be made before first concrete pour, at start of pouring any concrete and at each five (5) cubic yards deposited during one operation. These shall be made from same samples as those taken for cylinder tests and records of same kept therewith. Tests shall be made according to ASTM-C143 and as required under ASTM Designation C94 for Ready-Mix Concrete. Mix is designed for a slump test of two inches (2") and not more than four inches (4"), except in cases where thin sections would indicate, in the opinion of the ENGINEERS, that a wetter mix is more desirable. The CONTRACTOR shall furnish necessary equipment for the slump tests.

Ordinarily on sewer and water line jobs requiring only small amounts of concrete per pour, the cylinder tests will be waived. However, should the ENGINEERS have reason to doubt that the concrete being furnished meets the strength specifications, they shall have the right to order cylinder tests according to the following specifications.

At the start of concreting, or before if practical, the CONTRACTOR shall make from a single batch a set of four (4) cylinders per ASTM C31. Two shall be tested seven (7) days and two at twenty eight (28) days per ASTM C-39.

At each time when 20 or more cubic yards of concrete are placed during one operation, and when the sum of smaller deposits of concrete equal 30 cubic yards since previous test, and at any change in mix, four (4) cylinder tests will be required, two tested at seven (7) days, and the other two at twenty nine (29) days per ASTM C39. In case of Ready-Mix Concrete, requirement for testing of ASTM Designation C94 and C172 shall be added.

The CONTRACTOR shall furnish all equipment for sampling and curing on the job and shall bear cost of laboratory curing and testing.
SECTION 6 - PAVEMENT REPLACEMENT

6.01 GENERAL

The CONTRACTOR shall be responsible for replacement of pavement removed or damaged by his operations. Pavement replacement shall be in accordance with this section of the specifications and in every case shall be equal to or better than the quality of pavement damaged or removed. The CONTRACTOR shall also be responsible for subsequent pavement failures during the warranty period, where such failures occur over or during the warranty period, where such failures occur over or adjacent to trenches or other excavations by the CONTRACTOR and result from insufficient compaction of the backfill.

6.02 PAVEMENT REMOVAL

Where existing paved streets, roads, parking lots, drives or sidewalks must be disturbed during construction of the project the CONTRACTOR shall take the necessary steps to minimize damage. Permanent type pavement shall be cut or sawed in a straight line before removal and care shall be taken during excavation to avoid damage to adjacent pavement. Where trucks or other heavy equipment must cross curbs or sidewalks, such areas shall be suitably protected.

6.03 PAVEMENT REPLACEMENT

Before trenching in paved areas the CONTRACTOR shall cut through the pavement in a straight line along the sides of the proposed trench so that the pavement may be removed and the trench may be dug without damage to the adjacent pavement. During construction suitable precautions shall be taken to protect the pavement edges and surfaces and minimize damage.

As soon as the pipe has been installed the trench shall be backfilled as specified in Section 4.10.

The permanent pavement patch shall not be made until the job is nearing completion in order to allow maximum time for any further settlement. The permanent pavement patch shall conform to the following schedule:

(1) Type “A” - Principal highways, including traffic lanes, and turn lanes - eight inch (8") thick reinforced concrete slab over excavated areas plus two inches (2") of hot plant mix. (Hot Mix). If allowable by the Tennessee Department of Transportation, fourteen inches (14") of Binder may be used instead of the eight inch (8") reinforced concrete.

(2) Type “B” - Parking areas, shoulders, turnouts and driveways with equivalent pavement - Minimum two inch (2") hot plant mix over 3 inch (3") binder.

(3) Type “C” - Crushed stone driveways or roadways shall be eight inch (8") crushed stone base.

TS - 6.1
6.03 PAVEMENT REPLACEMENT (continued)

The hot mix and surface treatment applications shall be in accordance with standard specifications and recommended practices of the Tennessee Highway Department.

Pavement replacement shall extend a minimum of one foot (1') beyond the trench line, and shall include replacement of all defective pavement resulting from the CONTRACTOR'S operations, regardless of whether caused by blasting, trenching, equipment operation, cave-in or other cause. Where the cut edge of pavement is less than one foot (1') from the edge of the trench, or has been disturbed during construction, the CONTRACTOR shall cut through and remove existing pavement as required to permit a neat pavement patch. Irregular or uneven patches will not be permitted.

The CONTRACTOR shall be responsible for maintaining temporary patches during construction and shall promptly repair any defects. Upon completion of the work the paved surfaces shall be left in as good or better condition than before the start of construction.

Concrete driveways, sidewalks, curbs and gutters, etc., shall be of Class "A" Concrete of dimensions equivalent to original construction.

The type and nature of any pavement replacement shall at a minimum meet the standards and specifications of the governing authority.
SECTION 7 - TESTING AND ACCEPTANCE

7.01 GENERAL

Testing and acceptance of work shall be conducted as work proceeds and upon completion of the various work operations. Acceptance of the project shall involve a visual inspection and/or a leakage test. The procedures shall be as outlined hereinafter. The work will not be accepted until the visual inspection and/or the leakage test results are satisfactory.

7.02 CLEANING

Upon completion of cleaning of any line or manhole the ENGINEER shall make a visual inspection to verify the quality of workmanship. Any defects such as grease or roots shall be removed by means of further cleaning operations until the line or manhole is in a condition satisfactory to the ENGINEER.

7.03 MANHOLES

Once all manholes have been constructed or repaired and proper curing time for materials has elapsed, a vacuum test shall be conducted on the manholes. The test shall be conducted by the CONTRACTOR in coordination with the ENGINEER as specified hereinafter.

To test the manhole, all sewer lines in it shall be plugged and the test head placed in the cone section of the cone for manholes in paved areas or the casting for manholes in non-traffic areas. A vacuum of 10-inches of mercury shall be imposed on the manhole. The time for the vacuum to drop to 9-inches of mercury shall be recorded. The time to drop to 9-inches of mercury shall be no less than .5 seconds/cubic foot of volume inside the manhole. Manholes that have test times less than this formula fail the vacuum test and must be repaired and tested again until passing the vacuum test after the ENGINEER has inspected the manhole to attempt to determine the cause. All manholes that are tested must be tested after castings are installed even if tested previously without castings. Exterior of manhole shall be sealed with approved material during vacuum test. If the source of the problem is something other than that originally specified for the manhole, then that problem shall be corrected in accordance with the methods prescribed in these specifications, and the CONTRACTOR shall receive additional payment for this work based on the method of repair used. If, however, the source of the problem is related to the original problem, then it shall be corrected by the CONTRACTOR as prescribed in these specifications at no additional cost to the OWNER.

7.04 GRAVITY SEWER LINES & SEWER LINE REPLACEMENT

(1) GENERAL - Upon completion of construction the CONTRACTOR shall remove all sand, dirt, brick and other foreign materials from the sewers and shall conduct his own inspection to locate any defects and determine when the sewers are ready for final inspection, testing and acceptance by the ENGINEER.
After all apparent defects have been corrected, the CONTRACTOR shall notify the ENGINEER and request a final inspection.

No final inspection will be scheduled by the ENGINEERS until the CONTRACTOR advises that he has conducted his own inspection and believes the project to be ready for such final inspection. Should the ENGINEER begin a final inspection at the request of the CONTRACTOR and find that the sewers have not been cleaned or defects have not been corrected, the inspection will be terminated and will not be rescheduled until the CONTRACTOR again advises that the project is ready for inspection.

Acceptance of the project shall involve visual inspection leakage test and a deflection test. The procedures shall be as outlined hereinafter. The work will not be accepted until the visual inspection, leakage test, deflection, and test results are satisfactory. A deflection test will be required for PVC sewer lines running a full manhole to manhole length. Deflection test shall be by pulling a 9-arm mandrel sized at 95% of the internal diameter through the sewer. Test shall be performed after the sewer has been backfilled for at least 24 hours. PVC sewer lines failing mandrel test must be relayed.

**VISUAL INSPECTION** - The ENGINEER will, as a part of the final inspection, make the necessary visual inspections to verify the quality of workmanship.

Such inspections shall include examination of manholes, "lamping" or "flashing" sewer lines and observation of clean-up, pavement replacement, etc.

Any defects such as misalignment of sewers, visible leaks, obstructions, cracked or broken pipe, or failure to restore the surface to a satisfactory condition must be corrected to the ENGINEER’S satisfaction before acceptance. Any sags, humps, bends or other evidence of misalignment regarding of type of pipe shall be cause for rejection.

**LEAKAGE TESTS** - After completion of sewer construction and following the visual inspection a low pressure air test shall be performed on all sewers to determine leakage. The CONTRACTOR will furnish all equipment and facilities and all personnel for conducting the test. The test shall be observed by a representative of the ENGINEER.

The air test will be made after all services have been installed and backfilling has been completed and compacted.

All ties and end of sewer services shall be plugged with flexible joint plugs or caps securely fastened to withstand the internal test pressures.

Such plug or cap shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two (2) minutes shall be allowed for temperature stabilization.
TS - 7.2
7.04 **GRAVITY SEWER LINES & SEWER LINE REPLACEMENT** (continued)

The requirements of this specification shall be considered satisfied if the time required in seconds for the pressure to decrease from 3.5 to 2.5 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe is not less than what is shown on the "Allowable Time Table" listed below.

If the pipe installation fails to meet these requirements, the **CONTRACTOR** shall determine at his own expense the source or sources of leakage; and he shall repair or replace all defective materials or workmanship.

Procedures for Conducting Acceptance Air Tests shall be as follows:

(a) Clean Pipe to be tested.

(b) Plug all pipe outlets with suitable test plugs. Brace each plug securely.

(c) Increase gauge pressure in the test by the amount of ground water pressure at the crown of the pipe.

(d) Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 pounds per square inch greater than the average back pressure above the crown of the pipe.

(e) After the above internal pressure is obtained, allow at least two (2) minutes for air temperature to stabilize adding only the amount of air required to maintain pressure.

(f) After the two minute period, disconnect air supply.

(g) When pressure decreases to 3.5 psig, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. This time interval should then be compared with the time shown in the "Allowable Time Table". If the time is more than that shown in the table the test will be assumed to be acceptable.

**ALLOWABLE TIME TABLE**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Time, $T$</th>
<th>Allowable Air Loss, $Q$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches</td>
<td>(sec/100 ft.)</td>
<td>(ft$^3$/min)</td>
</tr>
<tr>
<td>6</td>
<td>42</td>
<td>2.0</td>
</tr>
<tr>
<td>8</td>
<td>72</td>
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<tr>
<td>30</td>
<td>288</td>
<td>7.0</td>
</tr>
</tbody>
</table>

TS - 7.3
Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug that can become a high velocity projectile. Gauges, air piping manifolds and valves shall be located at the top of the ground. No one shall be permitted to enter a manhole where a plugged pipe is under pressure. Four pounds (4#) air pressure develops a force against the plug in a 12-inch (12") diameter pipe of approximately 450 pounds (450#).

A safety release device set to release at ten pounds (10#) per square inch is to be provided between the air supply and the sewer under test.

In addition to the leakage tests above, an infiltration leakage test will be made to insure compliance with the infiltration limitations. Infiltration shall not exceed 25 GPD per inch diameter per mile of sewer and in no case shall it exceed 750 GPD per mile of sewer. The infiltration test shall be made a maximum ground water table.

The CONTRACTOR shall furnish all labor, tools, equipment and materials for the test. The test must be scheduled at a time acceptable to the ENGINEER and shall be witnessed by his representative.

7.05 **FORCE MAINS**

(1) **GENERAL** - Upon completion of the construction work under this contract all force mains shall be subjected to the necessary pressure and leakage tests. In the event the pressure or leakage test is unsatisfactory corrective measures shall be taken and the tests repeated until satisfactory results are obtained. Force mains shall be tested and accepted only in accordance with AWWA C-600 and these Specifications

(2) **PRESSURE AND LEAKAGE TESTS** - All lines shall be subjected to a hydrostatic pressure of 200 psi for a period of one hour, and any defective work revealed by the test shall be repaired or replaced by the CONTRACTOR.

The amount of leakage under the stated pressure shall not exceed the following formula:

\[
L = \frac{SD(P)^{1/2}}{133,200}
\]

Where:

- **L** = Allowable leakage, in gallons per hour
- **S** = Length of pipe tested, in feet
- **D** = Nominal diameter of the pipe, in inches
- **P** = Average test pressure during the leakage test, in pounds per square inch.

Should the amount of leakage exceed the above limit, the CONTRACTOR shall locate and repair the defective joints until the leakage is within the specified limits.
TS - 7.4
SECTION 8 - WARRANTY AND MAINTENANCE OBLIGATIONS

8.01 WARRANTY

The work to be performed under this contract shall be guaranteed against defects in materials or workmanship for a period of one year following the date of formal acceptance of the project. In the event defects in materials or workmanship should appear, the CONTRACTOR shall promptly make the necessary corrections. When the defects are not of an emergency nature, the CONTRACTOR will be notified and will be given a period of two (2) weeks in which to make the necessary corrections. Should the defects be of an emergency nature that in the opinion of the OWNER or the ENGINEER requires immediate correction, the CONTRACTOR will be notified and requested to make the necessary repairs immediately. Should this be impractical or if the CONTRACTOR should fail to respond to the request for corrective action within the specified period, the OWNER may proceed to have the defects corrected and shall bill the CONTRACTOR for all charges in connection therewith including labor, materials and equipment rental. Such charges may be deducted from amounts due the CONTRACTOR if any of the CONTRACTOR'S money has been withheld. In the event the CONTRACTOR fails, refuses or neglects to pay the OWNER, the surety shall be liable for such charges.

8.02 MAINTENANCE OBLIGATION

The CONTRACTOR shall be fully responsible for maintenance of any and all portions of the work that he performs under this contract for a period of ninety (90) days. This maintenance obligation shall begin upon formal acceptance of the project and is intended to place a limit upon the CONTRACTOR'S responsibility for normal maintenance required for the routine operation of the system. This ninety (90) day obligation shall not be construed as relieving the CONTRACTOR of the responsibility for maintenance or repair work resulting from defective materials or workmanship.
TS - 8.1
SECTION 9 - SPECIAL CONDITIONS

9.01 GENERAL

The CONTRACTOR’S attention is called for the special conditions indicated on the plans and described in this Section of the specifications. Special conditions include construction on highway rights-of-way, and construction in the vicinity of existing utilities. The OWNER will make application to the Highway Department for the necessary permits and the utilities involved will be notified of the proposed construction. The plans and specifications reflect the type of construction that is anticipated in the various locations requiring special attention but it shall be the responsibility of the CONTRACTOR to contact the various agencies including the State Highway Department, the gas company, telephone company and other utilities involved when working in areas where they will be concerned, and for coordinating construction with their requirements in such a way to avoid conflicts, damage or interruptions in service.

9.02 WORK ON STATE HIGHWAY DEPARTMENT RIGHTS-OF-WAY

Plans and specifications for this project will be submitted to the State Highway Department and an application will be made for a permit to construct and/or repair sewers on Highway rights-of-way. In the event that a bond is required, said bond will be provided by the OWNER at no cost to the CONTRACTOR, but the CONTRACTOR will be required to conform to the conditions of the permit and bond.

Where it is necessary to make cuts in pavement along or across U.S. Highways, replacement of the pavement shall conform to Section 6.03 of these specifications.

When working in or near lanes of traffic, the CONTRACTOR shall provide warning signals or flagmen as required by the Highway Department and shall prosecute the work in such a way as to cause a minimum of inconvenience to the traveling public.

9.03 DISPOSAL OF WASTE MATERIALS

The CONTRACTOR shall dispose all waste debris generated as a result of cleaning operations and line repair at an area approved by the OWNER and ENGINEER.

9.04 SEPARATION OF WATER MAINS AND SEWERS

a. General - The following factors should be considered in providing adequate separation:

1. Materials and type of joints for water and sewer pipes;
2. Soil conditions;
3. Service and branch connections into the water main and sewer lines;
4. Compensation variations in the horizontal and vertical separations;
9.04 **SEPARATION OF WATER MAINS AND SEWERS** (continued)

5. Space for repair and alterations of water and sewer pipes;
6. Off-setting of pipes around manholes.

b. **Parallel Installation**

1. **Normal conditions** - Water mains shall be laid at least ten feet (10') horizontally from any sanitary sewer, storm sewer or sewer manhole, whenever possible. The distance shall be measured edge-to-edge.

2. **Unusual conditions** - When local conditions prevent a horizontal separation of ten feet (10'), a water main may be laid closer to a storm or sanitary sewer provided that:

   (i) The bottom of the water main is at least eighteen inches (18") above the top of the sewer;

   (ii) Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure watertightness prior to backfilling.

c. **Crossing**

1. **Normal conditions** - Water mains crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least eighteen inches (18") between the bottom of the water main and the top of the sewer, whenever possible.

2. **Unusual conditions** - When local conditions prevent a vertical separation as described in Section 9.04-b-2 above, the following construction shall be used:

   (i) Sewers passing over or under water mains should be constructed of the materials described in Section 9.04-(b)-2-ii.

   (ii) Water mains passing under sewers shall, in addition, be protected by providing:

   (I) A vertical separation of at least eighteen inches (18") between the bottom of the sewer and the top of the water main;

   (II) Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains;

   (III) That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer;

   (IV) Both the sewer and the water main shall be constructed of iron pipe and tested in accordance with Section 7.

TS - 9.2
9.04 **SEPARATION OF WATER MAINS AND SEWERS** (continued)

d. **Sewer manholes** - No water pipe shall pass through or come into contact with any part of a sewer or sewer manhole.

9.05 **REPAIR OF MANHOLES**

The work consists of repairing leaks found during high groundwater table conditions. The **CONTRACTOR** shall take precautions in insuring that all defects are repaired when the manholes are first scheduled for work. Should the manhole be found to be leaking anytime during the warranty period from a leak type repaired by the **CONTRACTOR**, the manhole will be repaired at no additional cost to the **OWNER**.

9.06 **ABANDON MANHOLE**

Wherever shown, the **CONTRACTOR** shall remove existing casting and deliver such to City's inventory. In areas subject to traffic, manhole shall be filled with crushed stone, and repair pavement. In yards and fields **CONTRACTOR** shall remove top two feet (2') of manhole, fill manhole with approved material and seed disturbed area. **CONTRACTOR** to be responsible for settlement. Inlet and out lines to be plugged with concrete as directed by **ENGINEER**.

9.07 **MANHOLE CONNECTIONS**

**CONTRACTOR** shall construct all manhole connections as shown on detail sheet of these specifications for the various methods (A, B, & C). For Method D, the **CONTRACTOR** shall make connections to existing manholes as shown on plans, reroute, reform and rebuild inverts, plug and seal existing lines as directed, repair all defects within manhole, plug and seal all leaks.

9.08 **RECONDITION MANHOLES**

Contract shall plug and seal existing lines as shown on Plans, reconstruct or recondition invert as required, repair all defects, plug and seal all leaks and plaster manhole in accordance with approved system.

9.09 **SLOPE PROTECTION AND EROSION CONTROL**

A. **General**

This section shall consist of temporary control measures as shown in the Plans or directed by the **ENGINEER** during the life of the Contract to control erosion and water pollution through the use of berms, dikes, dams, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other control devices.
SLOPE PROTECTION AND EROSION CONTROL  (continued)

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

B. Materials

1. Temporary Berms:

A temporary berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes or transverse to centerline on fills.

These berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.

2. Temporary Slope Drains

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

3. Sediment Structures

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

4. Check Dams

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

b. Stone check dams shall not be utilized where the drainage area exceeds fifty (50) acres. Log and pole structures shall not be used where the drainage area exceeds five (5) acres.

5. Temporary Seeding and Mulching

Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes including waste sites and borrow pits shall be seeded when and where necessary to eliminate erosion.
6. **Brush Barriers**
   a. Brush barriers shall consist of brush, tree trimmings, shrubs, plants and other approved refuse from the clearing and grubbing operations.
   b. Brush barriers are placed on natural ground at the bottom of all slopes where the most likely erodible areas are located to restrain sedimentation particles.

7. **Baled Hay or Straw Checks**
   a. Baled hay or straw erosion checks are temporary measures to control erosion and prevent siltation. Bales shall be either hay or straw containing five (5) cubic feet or more of material.
   b. Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches or other areas where siltation erosion or water run-off is a problem.

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

C. **EXECUTION**

1. **Project Review**
Prior to the pre-construction conference the **CONTRACTOR** shall meet with the **ENGINEER** and go over in detail the expected problem areas in regard to the erosion control work. Different solutions should be discussed so that the best method might be determined. It is the basic responsibility of the **CONTRACTOR** to develop an erosion control plan acceptable to the **ENGINEER**.

2. **Pre-Construction Conference**
At the pre-construction conference the **CONTRACTOR** shall submit for acceptable his schedule for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing, grading, bridges and other structures at watercourses, construction and paving. He shall also submit for acceptance his proposed method of erosion control on haul roads and borrow pits and his plan for disposal of waste materials. No work shall be started until the erosion control schedules and methods of operations have been accepted by the **ENGINEER**.
3. **Construction Requirements**
   
   a. The **ENGINEER** has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface of erodible earth material exposed by excavation, borrow and fill operations and to direct the **CONTRACTOR** to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other water impoundment.

   Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of mulches, mats, seeding or other control devices or methods as necessary to control erosion. Cut and fill slopes shall be seeded and mulched as the excavation proceeds to the extent directed by the **ENGINEER**.

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

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

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

   e. Under no conditions shall the amount of surface area or erodible earth material exposed at one time by excavation or fill within the project area exceed 750,000 square feet without prior approval by the **ENGINEER**.
f. The **ENGINEER** may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project conditions.

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

4. **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 with an approximate ten degree (10°) angle perpendicular to the centerline. The top width of these berms may be wider and the side slope flatter on transverse berms to allow equipment to pass over these berms with minimal disruptions. When practical and until final roadway elevations are approached, embankments should be constructed with a gradual slope to one side of the embankment to permit the placement of temporary berms and slope drains on only one side of the embankment.

   b. **Temporary Slope Drains**

      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 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 dissipators, sediment basins or other approved devices shall be constructed at the outlet end of the slope drains to reduce erosion downstream. An ideal dissipator would be dumped rock or a small sediment basin that 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 outlet; at the bottom as well as in the ditch lines atop waste sites; in the ditch lines or borrow pits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long at 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 shown in the standard plans.

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

e. **Temporary Seeding and Mulching**

Seeding and mulching shall be performed in accordance with Section 02828-Miscellaneous Seeding.
TS - 9.8
f. **Brush Barriers**

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

g. **Bales Hay or Straw Erosion Checks**

Hay or straw erosion checks shall be embedded in the ground four to six inches (4”-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 can remain in place until they rot or be removed after they have served their purpose, as determined by the **ENGINEER**. The **CONTRACTOR** shall keep the checks in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.

h. **Temporary Silt Fences**

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

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

D. **MAINTENANCE**

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

b. In the event that temporary erosion and pollution control measures are required due to the **CONTRACTOR’S** negligence, carelessness or failure to install permanent controls as a part of work as scheduled, and are ordered by the **ENGINEER**, such work shall be performed by the **CONTRACTOR** at his own expense.
TS - 9.9
9.09 **SLOPE PROTECTION AND EROSION CONTROL** (continued)

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

E. **EROSION CONTROL OUTSIDE PROJECT AREA**

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

F. **MEASUREMENT AND PAYMENT**

No separate Measurement and Payment will be made for this work. It will be considered a subsidiary obligation of the CONTRACTOR under other bid items to which it relates.

9.10 **VIDEO**

Prior to construction, CONTRACTOR shall color video tape the entire project area including the route of the line construction, all easement areas, the full width of all rights-of-ways, and all service line areas. The CONTRACTOR shall identify the line designation and station number, all natural landmarks, the street address of the area in view and all potential areas, structures, fences, trees, etc., subject to potential disturbance. The CONTRACTOR shall provide the owner with two (2) copies of the video with audio comments.

9.11 **FINAL CLEAN-UP AND RESTORATION**

In all areas damaged or disturbed by CONTRACTOR’S operations where established ground cover was present before beginning of construction, CONTRACTOR shall be responsible for restoring this ground cover after completion of construction. (Unless noted otherwise on drawings). In areas of established lawns, CONTRACTOR will be required to: separate and preserve best of excavated material or, if no acceptable material has been excavated, haul in an acceptable material for use in making top six-inches (6") of finished grade. No rock will be permitted in this top six-inches (6") of finished grade for established lawns. All areas seeded shall be graded smooth prior to seeding and CONTRACTOR shall be responsible for maintenance of this smooth finished grade until grass growth is established.

After Designated areas have been carefully hand graded, soil shall be prepared for seeding. Where necessary, CONTRACTOR will sod slopes and embankments and remaining areas may be seeded.

TS - 9.10
9.11 **FINAL CLEAN-UP AND RESTORATION** (continued)

A well made lawn is desired, and **CONTRACTOR** will be responsible for any necessary regrading or reseeding required to produce an acceptable grass as cover. The seed shall be the same type of grass existing before construction.

The soil shall be fertilized with a commercial fertilizer of a grade and at a rate recommended by vendor of seed.

All seeded areas shall be covered with clean straw uniformly distributed to an approved density.
SECTION 10 - MEASUREMENT AND PAYMENT

10.01 GENERAL

The CONTRACTOR shall furnish all labor, tools, equipment and materials to construct the proposed improvements complete as shown on the drawings and described in the specifications. The work shall be measured for payment in accordance with applicable provisions of these specifications and payment shall be made on the basis of the unit prices or lump sum prices bid. The sum of the payments for eligible pay items contained in the proposal from shall be the compensation to be paid for the completed project; provided however, that changes in the work covered by written change orders, properly executed may result in additions or deductions from the contract price.

The CONTRACTOR’S attention is called to the fact that although the pay items shown shall be the basis for establishing the contract price, the pay items do not necessarily reflect the total amount of work to be performed. The cost of incidental work such as clearing and grubbing, trenching, backfilling, testing, etc., which is necessary, but which is not specifically listed as one of the pay items, shall be included in the prices bid for the eligible pay items to which the incidental work is most closely related.

10.02 SEWER PIPE

a. Measurement - Sewer pipe shall be measured for payment by horizontal measurements or station distances along the sewer lines from transition in type of pipe, center of manholes, or center of fittings without deduction for space occupied by manholes or fittings. Sewer size shall be based on the nominal pipe diameter indicated for the respective locations.

Measurement for establishing cut classification shall be the vertical distance from undisturbed ground elevation to the invert of the sewer as determined by the ENGINEERS plans.

b. Payment - Sewer pipe shall be paid for on the basis of the respective unit prices bid per linear foot for pipe of the various sizes, materials and cut classifications.

Payment for sewer pipe shall constitute compensation in full for furnishing all labor, tools, equipment and materials and installing the sewer complete, including incidental work such as location and protection of existing utilities, clearing, excavation (including rock), dewatering trenches, bedding with crushed stone, crushed stone backfill up to a point 12” above pipe, crushed stone backfill in all roads, drives or areas subject to traffic, disposal of surplus excavated material, seeding, sodding or sprigging, cleaning, inspection and testing.

The cost of furnishing and installing adapters for transitions between pipe materials if required, shall also be included in the bid prices for sewer pipe inasmuch as no separate payment will be made.

Crushed stone and pavement replacement are covered in sections 11.12 and 11.11 respectively.
10.03 **SERVICE PIPE**

a. **Measurement** - Service pipe shall be measured for payment by horizontal measurements along the service lines from center of fittings to end of service without deduction for space occupied by fittings.

No classification of cut depth shall be made for service lines.

b. **Payment** - Service pipe shall be paid for on the basis of the respective unit prices bid per linear foot for pipe as provided in the bid form.

Payment for service pipe shall constitute compensation in full for furnishing all labor, tools, equipment and materials and installing the service pipe complete, including incidental work such as location and protection of existing utilities, clearing, excavation, dewatering trenches, bedding with crushed stone, crushed stone backfill up to a point twelve inches (12") above pipe, crushed stone backfill in all areas subject to traffic, disposal of surplus excavated material, seeding, sodding or sprigging, cleaning, inspection and testing. The cost of furnishing and installing adapters for transition from one material or joint type to another shall also be included in the service line bid price inasmuch as no separate payment will be made.

10.04 **SEWER PIPE FITTING**

a. **Measurement** - Bends, reducers and wyes or tees shall be measured by actual count of each of the various sizes.

b. **Payment** - Payment for fittings shall be made on the basis of the unit price bid for each and shall reflect cost of fittings over and above cost of sewer.

10.05 **MANHOLEs**

a. **Measurement** - Manholes shall be measured by actual count. Manhole depth shall be measured vertically from the invert at the center of the manhole to the top of the casting or cover.

Measurement of watertight manhole covers shall be by actual count of such covers actually installed.

b. **Payment** - Payment for manholes shall be made on the basis of the unit prices bid for each and shall constitute payment in full for furnishing all materials and constructing the manholes complete, including excavation, concrete, brick, plastering, castings, and other incidentals, with all manholes being considered as standard manholes. For manhole depth greater than 6'-0", extra payment shall be made per foot for the extra depth over 6'-0". Extra Payment for drop manholes shall be made per vertical foot as shown on Standard Detail (SD-3).

Payment for watertight manhole covers shall be made on the basis of the unit prices bid for each such cover, and shall constitute payment in full for the extra cost of furnishing and installing such covers over and above the cost of conventional covers as specified. Crushed stone and pavement replacement are covered in Sections 11.10 and 11.09 respectively.
10.06 **ROCK EXCAVATION**

a. **Measurement** - No measurement required.

b. **Payment** - No compensation shall be made for rock excavation. The cost of such rock excavation shall be included in the various unit items. Included in the Bid Proposal.

10.07 **CLASS A CONCRETE**

a. **Measurement** - Concrete work will be measured by calculating the actual volumes in structures or from invoice records, whichever is appropriate, to the nearest 0.1 cubic yard.

b. **Payment** - Payment for Class A concrete shall be made on the basis of the unit price bid per cubic yard and shall constitute full compensation for concrete, reinforcement, forms, anchor bolts, nuts, rods, excavation (except rock), backfilling, and other incidentals required to complete the work.

10.08 **CLASS B CONCRETE**

a. **Measurement** - Class B concrete used in bracing pipe and fittings shall be measured for payment on the basis of the theoretical quantities required to provide the desired bearing area with a trench of the desired dimensions. The pay quantities for braces behind typical fittings shall be as follows:

<table>
<thead>
<tr>
<th>PIPE DIA.</th>
<th>TEE</th>
<th>90°</th>
<th>45°</th>
<th>22-1/2°</th>
<th>DEAD END</th>
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<tbody>
<tr>
<td>6&quot;</td>
<td>3.0</td>
<td>4.0</td>
<td>2.3</td>
<td>2.3</td>
<td>11.3</td>
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<td>8&quot;</td>
<td>5.4</td>
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<td>3.3</td>
<td>12.5</td>
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<td>10&quot;</td>
<td>9.7</td>
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<td>16&quot;</td>
<td>28.6</td>
<td>41.3</td>
<td>22.9</td>
<td>11.8</td>
<td>17.7</td>
</tr>
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In the event the type of soil is such that the bearing area must be increased an appropriate adjustment will be made in the pay quantities, the adjustment being equal to the percentage adjustment in the bearing area required. For concrete used in over bends in the pipe line where no specified dimensions are shown for the thrust block, the measurement will be based on the actual quantity of concrete that the **ENGINEER** directs the **CONTRACTOR** to use.

Class B concrete used in cradling or encasement of sewers will be measured by computing the theoretical volume of concrete required within a ditch having a width equal to the nominal pipe diameter plus eighteen inches (18”). The length shall be the actual length of such concrete installed at the **ENGINEERS** direction. The depth shall be such as to extend from the spring line of the pipe to a point four inches (4”) above the pipe to a point six inches (6”) below the bottom for encasement.
10.08 **CLASS B CONCRETE** (continued)

Measurement for Class B concrete used in pads, low piers, or blocks shall be based on the theoretical volume required for the dimensions of the structure as shown on the plans or as directed by the **ENGINEER**.

**Payment** - Payment for Class B concrete shall be made on the basis of the unit price bid per cubic yard, and shall constitute full compensation for excavation (except rock), forming, furnishing and placing the concrete, and other incidental work required to complete the work. No separate payment will be made for Class B concrete included in manholes, drop pipes, service risers, or other structures where the price of such concrete is included in the unit price of lump sum price bid for the item.

10.09 **PAVEMENT REPLACEMENT**

a. **Measurement** - Measurement for pavement replacement shall be equal to the length of the pavement cut multiplied by the width of pavement actually replaced with a strip having a maximum width equal to the nominal pipe diameter plus 3'-6" centered over the pipe line.

Around manholes, measurement of pavement replacement for payment shall be limited to an area 8' x 8', with appropriate deduction for pavement measured over trenches.

b. **Payment** - Payment for pavement replacement shall be made on the basis of the unit prices bid for various classifications of pavement as indicated in the proposal form. Such payment shall constitute full compensation for furnishing all labor, materials, and equipment and replacing the damaged pavement, including the crushed stone base as required. The **CONTRACTOR** is advised that although the limits of payment shall be as described under paragraph a, above, he shall be responsible for replacing all pavement damaged during construction, so that the paved area is left in a condition as good as or better than before the start of construction.

Payment for pavement replacement shall also include compensation for providing temporary pavement patches as required by the specifications and for maintaining the patches until such time as the permanent pavement is placed inasmuch as no separate payment will be made for this work.

10.10 **CRUSHED STONE**

a. **Measurement** - Measurement of crushed stone for payment shall be based on weight. In all cases delivery tickets shall be furnished to the **ENGINEER** at time of placement.

Crushed stone used in bedding and backfilling up to a point twelve inches (12") above the top of the sewer shall be included in the payment for sewer pipe and will not be measured for payment.

Crushed stone used in trench backfill under all roads, areas subject to traffic and other designated areas will **not** be measured for payment. Payment for this crushed stone backfill material will be included in the payment for sewer pipe.
10.10 **CRUSHED STONE** (continued)

Crushed stone used as base material for pavement replacement also will not be measured for payment inasmuch as payment for this material will be included in the payment for pavement replacement.

Crushed stone used as surface replacement in stone driveways, street shoulders, etc., shall be measured and paid for by the same method as pavement replacement.

Crushed stone required for maintenance of unpaved drives, roads, shoulders shall be at the **CONTRACTOR'S** expense and will not be measured for payment.

b. **Payment** - Payment for crushed stone, measured as provided above, will be made on the basis of the unit price bid per ton, which payment shall constitute full compensation for furnishing, hauling, placing and compacting the stone as specified.

10.11 **EXTRA DEPTH TRENCH EXCAVATION**

a. **Measurement** - Measurement of extra depth trench excavation required to remove mucky or unstable material will be based on the linear feet of excavation involved multiplied by the maximum allowable trench width (O.D. + 18") and the actual depth of such extra excavation as ordered by the **ENGINEER** giving a volume to the nearest 0.1 C.Y.

b. **Payment** - Payment for extra depth trench excavation will be made on the basis of the unit price bid per cubic yard and shall constitute full compensation for all associated items including disposal of unstable material and incompressible material required to bring trench back to grade. Crushed stone and pavement replacement are covered in Sections 11.10 and 11.09 respectively.

10.12 **OTHER WORK**

The method of payment for the project shall be as described in the preceding items of this section and as set out in the Bid Form. Any other items of work necessary to complete the project in accordance with the plans and specifications shall be included in the prices bid for the herein listed pay items and no separate payment will be made for such work.
STANDARD DETAILS
STANDARD PRECAST MANHOLE

BUILD MANHOLE TO HEIGHT OF CASTING ELEVATION (C.E.)
INDICATED ON DRAWING OR AS DIRECTED BY RESIDENT INSPECTOR.

1- BUTYL RESIN CONSEAL - 102 & 202

PAVEMENT

24" CLEAR OPENING

TRAFFIC

BACKSTEP

USE ECCENTRIC CONE UNLESS OTHERWISE PERMITTED BY ENGINEER

5"

EXTerior OF MANHOLE TO BE COATED WITH M.R. MEADOWS TROWEL - MASTIC FIBRED ASPHALTIC COMPOUND OR EQUAL

MANHOLE STEPS 16" O.C.

24" MAX.

4"-0" DIA.

SLOPE 3"/FT.

CLASS "A" CONC.

18" MAX.

CLASS "A" CONC.

INVERT CHANNEL AT LEAST 1/2 DIAM. OF PIPE

CLASS "A" CONCRETE

IMPERMEABLE MEMBRANE TO BE PLACED ON POROUS SOIL BEFORE POURING CONC.

CASTING SHALL BE:

TRAFFIC - JOHN BOUCHARD & SONS, CO. NO. 1150 OR EQUAL
FIELD - JOHN BOUCHARD & SONS, CO. NO. 1155 OR EQUAL
WATER TIGHT - JOHN BOUCHARD & SONS, CO. NO. 1123 OR EQUAL

AS DIRECTED BY THE ENGINEER OR SHOWN ON THE DRAWINGS.

SD-1
STANDARD "CAST-IN-PLACE" CONCRETE MANHOLE

BUILD MANHOLE TO HEIGHT OF CASTING ELEVATION (C.E.)
INDICATED ON DRAWING OR AS DIRECTED BY RESIDENT INSPECTOR

EXTERIOR OF MANHOLE
TO BE COATED WITH
M.R. MEADOWS
TROWEL - MASTIC FIBRED
ASPHALTIC COMPOUND
OR EQUAL

CASTING SHALL BE:

TRAFFIC - JOHN BOUCHARD & SONS, CO. NO. 1150 OR EQUAL
FIELD - JOHN BOUCHARD & SONS, CO. NO. 1155 OR EQUAL
WATER TIGHT - JOHN BOUCHARD & SONS, CO. NO. 1123 OR EQUAL

AS DIRECTED BY ENGINEER OR SHOWN ON THE DRAWINGS

SD-2
NOTE:
USE DROP MANHOLE CONSTRUCTION WHENEVER "IN ELEV.- OUT ELEV." EXCEED 30" OR WHEN INDICATED ON PLANS OR DIRECTED BY ENGINEER.
SEWER SERVICE DETAIL

SERVICE LINE TO BE RUN TO PROPERTY LINE OR AS DIRECTED BY ENGINEER, PLUG OR CONNECT TO EXISTING SERVICE.

2" x 2" CREOSOTED POST MARKER

12" CRUSHED STONE COVER

45° BEND

BACKFILL

TEE FITTING

6" CRUSHED STONE BEDDING

EXCAVATE BELL HOLES

CRUSHED STONE TO BE PLACED AT ALL EXCAVATED AREAS.

ELEVATED SERVICE LINE DETAIL

SERVICE LINE DETAIL

18" MIN. COVER USE CONC. ENCASEMENT IF SO DIRECTED BY ENGINEER

12" CRUSHED STONE COVER

1/8"/FT. MIN.

6" CRUSHED STONE BEDDING

EXCAVATE BELL HOLES

TEE OR WYE (SEE BID FORM FOR ITEM TO BE USED ON THIS PROJECT)

NOTES:

1. BACKFILL ON SERVICE LINES TO BE AS DESCRIBED IN PROJECT SPECIFICATIONS.
2. ELEVATED SERVICE LINE TO BE USED WHERE SHOWN ON PLANS OR DIRECTED BY ENGINEER.
3. BATTER BOARDS NOT REQ'D. FOR PIPE LAYING, BUT GRADE TO BE REASONABLY UNIFORM AND ALIGNMENT STRAIGHT. GRADE SHALL BE THAT SUFFICIENT TO PROVIDE SERVICE TO BUILDING OR AS DIRECTED BY ENGINEER WITH MINIMUM TO BE THAT ALLOWED BY LOCAL PLUMBING CODE OR 1/8" MINIMUM.
CONCRETE TO BE TIED IN TO ROCK SECURLEY ON EACH SIDE

LIMIT TRENCH WIDTH
AT TOP OF PIPE TO O.D. + 18" UNLESS PERMITTED TO DO OTHERWISE BY ENGINEER

CLASS "B" CONC.
CRUSHED STONE
O.D.

INSTALL CONCRETE CAP WHERE DIRECTED BY ENGINEER OR AS SHOWN IN PLANS GENERALLY, CAP SHALL BE IN CREEKS TO RESTORE CREEK ROCK BOTTOM AND PREVENT PIPE WASHOUT.

CONCRETE CAP
LIMIT TRENCH WIDTH
AT TOP OF PIPE TO O.D. + 18"
UNLESS PERMITTED TO DO OTHERWISE BY ENGINEER

CLASS "B" CONC. TO BE POURED IN SUCH A MANNER AS TO PREVENT PIPE FROM FLOATING. ALLOW CONC. TO CURE 48 HRS. BEFORE BACKFILLING

INSTALL ENCASEMENT WHERE DIRECTED BY ENGINEER OR AS SHOWN IN PLANS. GENERALLY, CONC. ENCASEMENT SHALL BE USED ON ALL BUT CAST IRON SEWERS WHERE DEPTH OF COVER IS LESS THAN 2' IN AREAS NOT SUBJECT TO TRAFFIC AND WHERE DEPTH OF COVER IS LESS THAN 3' IN AREAS SUBJECT TO VEHICULAR TRAFFIC LOADS.

CONCRETE ENCASEMENT
CONCRETE PAVEMENT

$\frac{1}{2}"$ Ø BARS AT 8" C.C.

$\frac{5}{8}"$ Ø BARS AT 8" C.C.

6" OR CRUSHER RUN STONE

EXCAVATED AREA

SIDEWALK

JOINTS

SIDEWALKS TO BE REMOVED IN COMPLETE SECTIONS BETWEEN JOINTS.

CURB OR CURB AND GUTTER

6" OR CRUSHER RUN STONE

EXCAVATED AREA

NOTES:

1. PAVEMENT, CURBS OR GUTTERS SHALL BE CUT FIRST AT EDGE OF EXCAVATION. AFTER BACKFILL HAS BEEN MADE AND TAMPERED, THE PAVEMENT SHALL AGAIN BE CUT 3" BACK OF EXCAVATION LINE BEFORE REPLACING.

2. CONCRETE BASES, WITH BITUMINOUS SURFACE SHALL BE CUT SAME AS PAVEMENT AND SURFACING MATERIAL REMOVED $\frac{1}{2}$ FOOT BACK OF FINAL CUT.

3. EXISTING PAVEMENT, BASES, CURBS, CURB & GUTTERS AND SIDEWALKS SHALL BE CUT AND BROUGHT TO A NEAT LINE BY USE OF AN AIR HAMMER OR OTHER SUITABLE EQUIPMENT.

4. WHEREVER TRENCHES ARE EXCAVATED WITHIN TRAVELED AREAS, PERMANENT REPAIRS TO BE MADE WITHIN FIVE DAYS.

5. BACKFILL FOR TRENCHES WITHIN PAVED AREAS SHALL BE PLACED IN 6" LAYERS AND EACH LAYER SHALL BE THOROUGHLY COMPACTION BY MEANS OF MECHANICAL TAMPS.

6. EARTH BACKFILL, EVEN OF A TEMPORARY NATURE, SHALL NOT BE PLACED ABOVE AN ELEVATION 6" BELOW THE BOTTOM OF ANY CONCRETE PAVEMENT, BITUMINOUS PAVEMENT OR CRUSHED STONE OR GRAVEL BASE.

7. EXPANSION JOINTS REMOVED SHALL BE REPLACED.

8. ALL CONCRETE TO BE CLASS "A".

STANDARD METHOD

OPENING TRENCHES THROUGH HIGHWAYS AND REPLACING PAVEMENT, ETC.

(TENNESSEE HIGHWAY DEPARTMENT STANDARD)

SD-7
WATERTIGHT MANHOLE FRAME & COVER

4 - 3/4" Ø HOLES FOR ANCHOR BOLTS

TIGHTENING SCREW WITH OPERATING HANDLE

"U" IRON OR IRON BAR

1 1/2" NEOPRENE GASKET

INNER LID W/ TWO LIFTING HANDLES

APPORX. WEIGHT OF FRAME & COVER SHALL NOT BE LESS THAN 535 LBS. AS SPECIFIED ACTUAL SAMPLE FRAME AND COVER MAY BE REQUIRED.

STANDARD MANHOLE FRAME & COVER

(SELF SEALING)
Typical Sewer Line Detail

Traffic Areas

- Pavement Replacement as per specifications
- 2'' Topping, 3'' Binder
- Exist. Pavement

- Flowable Fill
- Backfill as per specifications
- Crushed Stone Bedding

Non-Traffic Areas

- Restoration and Seeding to match original
- 6'' Top Soil or Approved Material
- Backfill as per specifications
- Crushed Stone
- Crushed Stone Bedding

Traffic Areas

Non-Traffic Areas
CLAY STOP-GRAVITY SEWERS
PLACE EVERY 500 FEET OR AS DIRECTED

TRENCH @ CLAY STOP

NORMAL TRENCH
NOTES:
1. LOCATE 4" VENT PIPE OUT OF TRAVELED WAY IN BACK OF CURB OR SIDEWALK OR AS CALLED FOR ON PLANS. PIPE TO BE PAINTED WITH ONE COAT OF RED LEAD PRIMER, AND TWO COATS OF DARK GREEN ENAMEL.
2. TOP OF VENT TO BE MINIMUM OF 8'-0" ABOVE GRADE OR HIGHER IF ELEVATION IS SHOWN ON PLANS.

STANDARD MANHOLE VENT
VALVE BOX

NOTES:

1. FOUR (4) CONCRETE BLOCKS OF THE SIZE AND SHAPE SHOWN ARE TO BE PLACED UNDER EACH BOX, ONE UNDER EACH CORNER OF BOX.

2. NO REINFORCING STEEL IN FOOTING BLOCKS. CONCRETE MIX TO BE (1) PART CEMENT, (2) PARTS SAND AND (4) PARTS NO. 2 CRUSHED STONE OR GRAVEL. VOLUME FOR ONE BLOCK = .333 CU. FT. WEIGHT OF ONE BLOCK = 50 LBS. WEIGHT FOR ALL FOUR BLOCKS = 200 LBS. BEARING AREA ON SOIL = 576 SQ. IN.

STANDARD CONCRETE VALVE BOX

WD-3
DO NOT POUR CONC. AROUND OR IN FRONT OF PLUG

M.J. PLUG OR RETAINER TYPE PLUG

CONC. TO EXTEND MIN. "A" INTO UNDISTURBED EARTH ON SIDES, BOTTOM OR TRENCH & ABOVE PIPE

BLOCK MUST BE POURED AGAINST UNDISTURBED EARTH (TYP.)

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>90° BEND</th>
<th>45° BEND</th>
<th>22 1/2° BEND</th>
<th>TEE</th>
<th>DEAD END</th>
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<td>6&quot; OR UNDER</td>
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<td>2'-0&quot; 2'-0&quot; 1'-6&quot;</td>
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CONC. THRUST BLOCK (BRACE)

WD-4
CONC. THRUST BLOCK (BRACE)

$\frac{3}{4}''$ RODS - DEAD END
TYPICAL TRENCH SECTION
TYPICAL STREAM CROSSING DETAIL

IN ROCK

IN EARTH

CREEK BED
ROCK
2500 P.S.I. CONC.
CRUSHED STONE OR 2500 P.S.I. CONC. AS DIRECTED
DUCTILE IRON PIPE

RIP-RAP
CREEK BED
EARTH
COMPACTED DIRT
2500 P.S.I. CONC.
DUCTILE IRON PIPE

1'-6" MIN.
6"
3'-0" MIN.
6"
SEE PROJECT SPECS. FOR SIZE & TYPE OF OPERATING NUT

SEE SPECS. FOR HYDRANT MANUFACTURER, SIZE & TYPE

PUMPER NOZZLE TO FACE STREET

SEE PROJECT SPECS. FOR SIZE AND TYPE OF OPERATING NUT

6" NRS GATE VALVE w/. BOX. LOCATE AS DIRECTED BY RESIDENT INSPECTOR

TEE

CONC. BRACE POUR AS DIRECTED

7 C.F. GRAVEL PLACED & TAMPERD AROUND HYDRANT FOR DRAIN

RESTRAINED JOINT AS REQUIRED

CONC. BRACE POUR AS DIRECTED

TYPICAL FIRE HYDRANT INSTALLATION

WD-9
LENGTH OF RESTRAINED JOINT - $L_{RH}$
HORIZONTAL BENDS AND VERTICAL UP BEND
LENGTH OF RESTRAINED JOINT - $L_{RH}$

VERTICAL DOWN BENDS

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<tr>
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</table>
NOTE:
USE DROP MANHOLE CONSTRUCTION WHENEVER "IN ELEV. - OUT ELEV." EXCEED 24" OR WHEN INDICATED ON PLANS OR DIRECTED BY ENGINEER.
4 - ¾" Ø HOLES FOR ANCHOR BOLTS

AS REQ'D. BY MFG.

"U" IRON OR IRON BAR

INNER LID W/ TWO LIFTING HANDLES

7/16" NEOPRENE GASKET

TIGHTENING SCREW WITH OPERATING HANDLE

APPROX. WEIGHT OF FRAME & COVER SHALL NOT BE LESS THAN 535 LBS. AS SPECIFIED ACTUAL SAMPLE FRAME AND COVER MAY BE REQUIRED.

WATERTIGHT MANHOLE FRAME & COVER

4 - ¾" Ø HOLES FOR ANCHOR BOLTS

SOLID COVER

APPROX. WEIGHT OF FRAME AND COVER SHALL NOT BE LESS THAN 415 LBS. AS SPECIFIED.

STANDARD MANHOLE FRAME & COVER

(SELFF SEALING)
DROP MANHOLE CONSTRUCTION

NOTE:
USE DROP MANHOLE CONSTRUCTION WHENEVER "IN ELEV. - OUT ELEV." EXCEED 24" OR WHEN INDICATED ON PLANS OR DIRECTED BY ENGINEER.
SEWER SERVICE DETAIL

SERVICE LINE TO BE RUN TO PROPERTY LINE OR AS DIRECTED BY ENGINEER, PLUG OR CONNECT TO EXIST. SERVICE.

12" CRUSHED STONE COVER

45° BEND

BACKFILL

6" CRUSHED STONE BEDDING

EXCAVATE BELL HOLES

CRUSHED STONE TO BE PLACED AT ALL EXCAVATED AREAS.

ELEVATED SERVICE LINE DETAIL

2" x 2" CREOSOTED POST MARKER

2" x 2" CREOSOTED POST MARKER

MAIN SEWER

6" CRUSHED STONE BEDDING

EXCAVATE BELL HOLES

TEE OR WYE (SEE BID FORM FOR ITEM TO BE USED ON THIS PROJECT)

SERVICE LINE DETAIL

NOTES:

1. BACKFILL ON SERVICE LINES TO BE AS DESCRIBED IN PROJECT SPECIFICATIONS.
2. ELEVATED SERVICE LINE TO BE USED WHERE SHOWN ON PLANS OR DIRECTED BY ENGINEER.
3. BATTERBOARDS NOT REQ'D FOR PIPE LAYING, BUT GRADE TO BE REASONABLY UNIFORM AND ALIGNMENT STRAIGHT; GRADE SHALL BE THAT SUFFICIENT TO PROVIDE SERVICE TO BUILDING OR AS DIRECTED BY ENGINEER WITH MINIMUM TO BE THAT ALLOWED BY LOCAL PLUMBING CODE OR 1/8" MINIMUM.
CONCRETE TO BE TIED IN TO ROCK SECURLEY ON EACH SIDE

LIMIT TRENCH WIDTH
AT TOP OF PIPE TO O.D. +18''
UNLESS PERMITTED TO DO OTHERWISE BY ENGINEER

INSTALL CONCRETE CAP WHERE DIRECTED BY ENGINEER OR AS SHOWN IN PLANS GENERALLY, CAP SHALL BE IN CREEKS TO RESTORE CREEK ROCK BOTTOM AND PREVENT PIPE WASHOUT.

CONCRETE CAP
INSTALL ENCASEMENT WHERE DIRECTED BY ENGINEER OR AS SHOWN IN PLANS. GENERALLY, CONC. ENCASEMENT SHALL BE USED ON ALL BUT CAST IRON SEWERS WHERE DEPTH OF COVER IS LESS THAN 2' IN AREAS NOT SUBJECT TO TRAFFIC AND WHERE DEPTH OF COVER IS LESS THAN 3' IN AREAS SUBJECT TO VEHICULAR TRAFFIC LOADS.

CONCRETE ENCASEMENT
CONCRETE PAVEMENT

SIDEWALK

CURB OR CURB AND GUTTER

NOTES:
1. PAVEMENT, CURBS OR GUTTERS SHALL BE CUT FIRST AT EDGE OF EXCAVATION. AFTER BACKFILL HAS BEEN MADE AND TAMPERED, THE PAVEMENT SHALL AGAIN BE CUT 3" BACK OF EXCAVATION LINE BEFORE REPLACING.

2. CONCRETE BASES, WITH BITUMINOUS SURFACE SHALL BE CUT SAME AS PAVEMENT AND SURFACING MATERIAL REMOVED 1/2 FOOT BACK OF FINAL CUT.

3. EXISTING PAVEMENT, BASES, CURBS, CURB & GUTTERS AND SIDEWALKS SHALL BE CUT AND BROUGHT TO A NEAT LINE BY USE OF AN AIR HAMMER OR OTHER SUITABLE EQUIPMENT.

4. WHEREVER TRENCHES ARE EXCAVATED WITHIN TRAVELED AREAS, PERMANENT REPAIRS TO BE MADE WITHIN FIVE DAYS.

5. BACKFILL FOR TRENCHES WITHIN PAVED AREAS SHALL BE PLACED IN 6" LAYERS AND EACH LAYER SHALL BE THOROUGHLY COMPACTED BY MEANS OF MECHANICAL TAMPS.

6. EARTH BACKFILL, EVEN OF A TEMPORARY NATURE, SHALL NOT BE PLACED ABOVE AN ELEVATION 6" BELOW THE BOTTOM OF ANY CONCRETE PAVEMENT, BITUMINOUS PAVEMENT OR CRUSHED STONE OR GRAVEL BASE.

7. EXPANSION JOINTS REMOVED SHALL BE REPLACED.

8. ALL CONCRETE TO BE CLASS "A".

STANDARD METHOD
OPENING TRENCHES THROUGH HIGHWAYS AND REPLACING PAVEMENT, ETC.
(TENNESSEE HIGHWAY DEPARTMENT STANDARD)
4 - ¾" Ø HOLES FOR ANCHOR BOLTS

SANITARY SEWER

AS REQ'D. BY MFG.

TIGHTENING SCREW WITH OPERATING HANDLE

"U" IRON OR IRON BAR

INNER LID W/ TWO LIFTING HANDLES

7/16" NEOPRENE GASKET

APPROX. WEIGHT OF FRAME & COVER SHALL NOT BE LESS THAN 535 LBS. AS SPECIFIED. ACTUAL SAMPLE FRAME AND COVER MAY BE REQUIRED.

WATERTIGHT MANHOLE FRAME & COVER

4 - ¾" Ø HOLES FOR ANCHOR BOLTS

SOLID COVER

APPROX. WEIGHT OF FRAME AND COVER SHALL NOT BE LESS THAN 415 LBS. AS SPECIFIED.

STANDARD MANHOLE FRAME & COVER

(RIGHT SEALING)

SD-8
NOTES:

1. LOCATE 4" VENT PIPE OUT OF TRAVELED WAY IN BACK OF CURB OR SIDEWALK OR AS CALLED FOR ON PLANS. PIPE TO BE PAINTED WITH ONE COAT OF RED LEAD PRIMER, AND TWO COATS OF DARK GREEN ENAMEL.

2. TOP OF VENT TO BE MINIMUM OF 5'-0" ABOVE GRADE OR HIGHER IF ELEVATION IS SHOWN ON PLANS.

STANDARD MANHOLE VENT