GENERAL CONDITIONS AND TECHNICAL SPECIFICATIONS

for

Construction of

SEWER SYSTEM IMPROVEMENTS

for the

CITY OF GALLATIN

In

SUMNER COUNTY, TENNESSEE

December 2022

JAMES C. HAILEY & COMPANY
Consulting Engineers
1619 Galleria Blvd
Brentwood, TN 37027
(615) 883-4933

WPN 23.0311

Gallatin Standard Sewer Specifications

APPROVED FOR CONSTRUCTION

TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION

DIVISION OF WATER RESOURCES

AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

Adrian Baboun

07/26/2023

THIS APPROVAL SHALL NOT BE CONSTRUED AS CREATING A PRESUMPTION OF CORRECT OPERATION OR AS WARRANTING BY THE COMMISSIONER THAT THE APPROVED FACILITIES WILL REACH THE DESIGNED GOALS.

APPROVAL EXPIRES FIVE YEARS FROM ABOVE DATE

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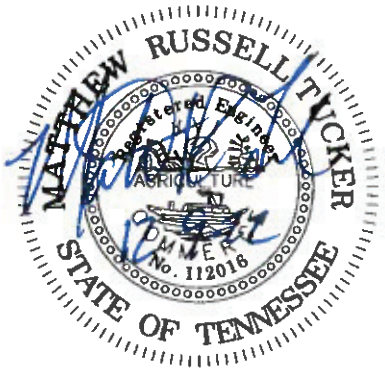

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Project #22208

Set No. _____

CITY OF GALLATIN
STANDARD SEWER SYSTEM TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS – WASTEWATER FACILITIES (continued)

TECHNICAL SPECIFICATIONS – WASTEWATER FACILITIES (continued)

CITY OF GALLATIN

GENERAL CONDITIONS

TABLE OF CONTENTS

CITY OF GALLATIN

GENERAL CONDITIONS

TABLE OF CONTENTS

GC-1 **DEFINITIONS**

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**.

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.

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**.

GC-2 ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

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 or the **WORK**.

GC-4 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.

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**.

GC-6 MATERIALS, SERVICES, AND FACILITIES

GC-6.01 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.

GC-6.02 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.

GC-6.03 Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

GC-6.04 Materials, supplies and equipment shall be in accordance with samples submitted by the **CONTRACTOR** and approved by the **ENGINEER**.

GC-6.05 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.

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 the **CONTRACTOR'S** expense.

GC-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 e 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.

GC-8 SUBSTITUTIONS

GC-8.01 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**.

GC-9 PATENTS

GC-9.01 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 SURVEYS, PERMITS, REGULATIONS

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 PROTECTION OF WORK, PROPERTY AND PERSONS

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.

GC-12 SUPERVISION BY CONTRACTOR

GC-12.01 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-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**.

GC-14 CHANGES IN CONTRACT PRICE

GC-14.01 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.

GC-15 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-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**.

GC-17 **SUBSURFACE CONDITIONS**

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 SUSPENSION OF WORK, TERMINATION AND DELAY

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.

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**.

GC-18.03 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**.

GC-18.04 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.

GC-18.05 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**.

GC-18.06 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**.

GC-19 PAYMENT TO CONTRACTOR

GC-19.01 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.

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-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-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 INSURANCE

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 **OWNER**.

GC-21.03 The **CONTRACTOR** shall procure and maintain, at his own expense, during the **CONTRACT TIME**, liability insurance as hereinafter specified;

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**.

GC-21.04 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.

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 CONTRACT SECURITY

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**.

GC-23 ASSIGNMENTS

GC-23.01 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-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.

GC-26 SUBCONTRACTING

GC-26.01 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**.

GC-26.02 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**.

GC-26.03 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.

GC-26.04 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**.

GC-26.05 Nothing contained in this **CONTRACT** shall create any contractual relation between any **SUBCONTRACTOR** and the **OWNER**.

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 LAND AND RIGHTS-OF-WAY

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.

GC-29 **GUARANTY**

GC-29.01 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-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.

SPECIAL CONDITIONS

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.

TECHNICAL SPECIFICATIONS

CITY OF GALLATIN

STANDARD SANITARY SEWER SPECIFICATIONS

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.

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. The **CONTRACTOR** shall work with the City of Gallatin to plan necessary detour routes and signage as needed during road closures, etc.

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** - 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.

1.08 **GRINDER PUMP STATEMENT** Pursuant to TDEC Rule 0400-40-05 and 0400-40-06, the City of Gallatin does not allow the installation of Grinder pumps for new construction as a course of normal operations. Any new sewer installations shall be designed and constructed such that gravity mains are utilized for the collection system. Should the topography dictate, the gravity collection system may be transported to a sewer lift station for transport over into another collection basin.

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.

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 **grouted** into 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 and unless otherwise specified shall be a **John Bouchard & Sons Co. No. 1150 or approved equal**. 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 grouted in and fixed directly to the manhole barrel by 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 a **John Bouchard & Sons Co. No. 1123 or approved equal** unless otherwise specified 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, Precast manholes shall have tub bottoms with cored openings and shall use an A-LOK, Kor-N-Seal, or other approved pipe seal. Manholes shall have an inside diameter of 4'-0", Precast concrete manholes shall conform to ASTM Designation C-478, latest revision. Manholes shall be cast using Xypex C-1000 admixture or department approved equivalent. Precast joints shall be sealed using butyl rubber gaskets and Conseal CS-212 external wrap seals.

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 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:

8".....0.33"
10".....0.35"
12".....0.37"
14".....0.39"
16".....0.40"
18".....0.41"

3.17 **DUCTILE 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 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. All Ductile Iron Pipe shall have Protecto 401 Ceramic Epoxy Coating factory applied to the inside of the pipe, or owner approved equal.

3.18 **DUCTILE 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. All Ductile Iron fitting shall have Protecto 401 Ceramic Epoxy Coating factory applied to the inside of the pipe, or owner approved equal.

3.19 **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.

3.20 **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 ration (SDR) of the outside diameter of the pipe to wall shall not exceed twenty six (26), for sizes 4” through 15”; and ASTM F-679 for 18” through 48”.

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.

3.20 **POLYVINYL CHLORIDE (PVC) SEWER PIPE** (cont)

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.

3.21 **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 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 F-477). 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.

3.21 **POLYVINYL CHLORIDE (PVC) SEWER FORCE MAIN** (continued)

Manufacturer shall have pipe tested in accordance with provisions of applicable ASTM Standard. 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.

3.22 **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. Flexible couplings shall ***NOT*** be used unless approved by Owner or Engineer for main line connections. Rigid couplings shall be used for main connections. Flexible couplings may be used ONLY as approved by Owner or Engineer on the customer side of the Clean-out.

3.23 **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 ISCO or equal.

Joining will be accomplished by thermal welding in accordance with the manufacturer's recommendations.

Pipe for Bursting is to be DR-17 HDPE, DIPS, grey in color, **GREEN** stripe required.

3.23 **HIGH DENSITY POLYETHYLENE SEWER PIPE** (continued)

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.

3.24 **FLOWABLE FILL**

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

MATERIAL	SUBSECTION
Portland Cement, Type I	901.01
Fly Ash, Class C or Class F	AASHTO M 295
Water	918.01
Chemical Additives	918.09

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

SIEVE SIZE	PERCENT PASSING
¾ - inch	100
No. 200	0-10

Flowable fill mortar shall be proportioned as follows:

MATERIAL	PER CUBIC YARD
Portland Cement, Type I	100 lbs (Maximum)
Fly Ash, Class C or Class F	250 lbs (Minimum)
Fine Aggregate	2800 lbs
Water	60 gal (Approximate)

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.

3.26 **MANHOLE REHAB MATERIAL**

3.26.1 **SUMMARY**

A. Section includes:
   1. This Section includes, but is not necessarily limited to, restoration and corrosion barrier composite liner for concrete and brick structures as indicated on the Drawings, as specified herein, and as necessary for the proper and complete performance of the Work.
B. Unless specifically noted, CONTRACTOR shall procure the materials and services described in this section; therefore, all requirements of Part 1, Part 2 and Part 3 of this specification are the responsibility of the CONTRACTOR.
C. CONTRACTOR is responsible for bypass pumping during installation of the manhole lining system.
D. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to:
      a. General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.

3.26.2 **REFERENCES**

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
1. ASTM Standard Test Methods:
   a. C78 - Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
   b. C109 - Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
   c. C157 - Length Change of Hardened Hydraulic-Cement, Mortar and Concrete.
   d. C876 - Half-Cell Potentials of Uncoated Reinforcing Steel in Concrete.
   e. D4138 - Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means.
2. International Concrete Repair Institute (ICRI) Technical Guideline:
   a. No. 03730 – Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting From Reinforcing Steel Corrosion.
3. ACI Standard:
   a. 305R - Hot Weather Concreting.
   b. 503R - Use of Epoxy Compounds for Coating Concrete.

3.26.3 **SUBMITTALS**

A. Submit in accordance with Section 01 33 00 - Submittals.

B. Manufacturer's literature:

1. Submit for coating products.
2. Required information:
a. Name of Manufacturer.
b. Physical properties.
c. Surface preparation.
d. Application instructions.
e. Curing instructions.

C. Certification:
1. Manufacturer's statement that the applicator is trained and approved in the application of the specified products.

3.26.4 **QUALITY ASSURANCE**

A. Qualifications:
1. Fabrication and installation personnel:
a. Trained and experienced in the fabrication and installation of the materials and equipment.
b. Knowledgeable of the design and the reviewed submittals.

3.26.5 **DELIVERY, STORAGE AND HANDLING**

A. Receiving and storage:
1. All materials shall be delivered in original, unbroken, brand marked containers or wrapping as applicable.
2. Handle and store materials:
a. In a manner which will prevent:
1) Deterioration or damage.
2) Contamination with foreign matter.
3) Damage by weather or elements.
b. In accordance with Manufacturer's directions.
1) Storage temperature of Corrosion Barrier Mortar: 40 to 80 degrees F.

B. Rejected material and replacements:
1. Reject damaged, deteriorated or contaminated material and immediately remove from the Site.
2. Replace rejected materials with new materials at no additional cost to OWNER.

3.26 MANHOLE REHAB MATERIAL (cont)

3.26.6 WARRANTY

A. Warrant manhole liner against failure for a period of 10 years. "Failure" will be deemed to have occurred if the protective lining fails to (a) prevent the internal deterioration or corrosion of the structure (b) protect the substrate and environment from contamination by effluent or (c) prevent groundwater infiltration. If any such failure occurs within 10 years of initial completion of work on a structure, the damage will be repaired to restore the lining at no cost to the Owner within 60 days after written notification of the failure . "Failure" does not include damage resulting from mechanical or chemical abuse or act of God. Mechanical or chemical abuse means exposing the lined surfaces of the structure to any mechanical force or chemical substance not customarily present or used in connection with structures of the type involved.

3.26.7 MAINSTAY COMPOSITE LINER SYSTEM

A. Manufacturer:
   1. Madewell Products Corporation, 7561 Industrial Court, Alpharetta, Georgia 30004. Phone (770) 475-8199.

B. Hydraulic Cement Mortar: Mainstay ML-10. Fast-setting mortar used to stop leaks through cracks and holes.
   1. Composition: Blend of hydraulic cements and fillers.
   2. Compressive Strength, ASTM C109:
   a. 1 Day: 3,500 psi.
   b. 7 Days: 4,900 psi.
   c. 28 Days: 5,500 psi.
   3. Tensile Strength, ASTM C190:
   a. 7 Days: 290 psi.
   b. 28 Days: 575 psi.
   4. Working Time: 45 to 90 seconds at 77 degrees F.
   5. Color: Dark gray.

C. Restoration Mortar: Mainstay ML-72 Sprayable Microsilica Cement Mortar. Low shrinkage, high strength, sprayable microsilica mortar.
   1. Composition: Blend of cements, microsilica, thermoplastic fibers, densifiers, and modifiers. Mortar shall not contain calcium aluminate cements or aggregates.
   2. Thickness: 1 inch minimum.
   3. Compressive Strength, ASTM C109:
      a. 1 Day: 3,000 psi.
      b. 28 Days: 10,000 psi.
   4. Flexural Strength, ASTM C293:
      a. 1 Day: 535 psi.
      b. 28 Days: 1,400 psi.
   5. Tensile Strength, ASTM C496:
      a. 1 Day: 330 psi.
      b. 28 Days: 790 psi.
   6. Shrinkage, ASTM C596:
      a. 28 Days @ 90%: 0.01 percent.

3.26.7 MAINSTAY COMPOSITE LINER SYSTEM (cont)

7. Uniaxial Tensile Bond Strength, ACI 503R, Appendix A:
   a. 28 Days: Greater than 500 psi over high strength concrete (5,000 psi compression strength concrete - bond strength governed by substrate tensile strength). Minimum acceptable bond = 145 psi.
8. Color: Dark gray.

D. Corrosion Barrier Coating: Mainstay DS-5 Ultra High Build Epoxy Coating.
1. Composition: 100 percent solids, modified epoxy coating.
2. Thickness: Minimum of 80 mils in 1 or 2 coats.
3. Number of Components: 2.
4. Finish: Gloss.
5. Color: White.

E. Manhole Frame Seal: Madewell 806 Flexible Epoxy
1. Composition: 100% solids, flexible epoxy trowel-grade mastic.
2. Thickness: Minimum of 1/4 inch.
3. Number of Components: 2.
4. Finish: Semigloss.
5. Color: Light gray.

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 call 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 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.

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. Sheeting will be required where necessary to restrict the trench width to acceptable limits above the top of pipe.

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.

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. 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 6-inch above top of pipe. Placement shall be in accordance with TDOT Standards for Road and Bridge Construction.

4.10 **BACKFILL FOR TRENCHES**

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.

4.10 **BACKFILL FOR TRENCHES**

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

PIPE SIZES	CLASS	TRENCH WIDTH*	MAX. COVER OVER TOP OF PIPE
24"	4	3'-8"	23'
18"	3	2'-9"	9'
	3	3'-0"	7'
18"	4	2'-9"	19'
	4	3'-0"	15'
		3'-6"	11'
18"	5	3'-6"	22'
15"	3	2'-6"	13'
		2'-9"	10'
15"	4	2'-6"	18'
	4	2'-9"	14'
		3'-0"	11'
15"	5	3'-0"	26'
12"	3	2'-3"	7'
		2'-6"	6'
12"	4	2'-3"	15'
		2'-6"	11'
12"	5	2'-9"	20'

*** 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.

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.

Ductile Iron Pipe shall be required in situations where the proposed cover for the pipe is 15’ or greater OR where proposed cover is to be less than 3’. These are special laying conditions which must have prior approval from the **OWNER**.

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. These connections shall be made using either an electrofusion coupling or via a ductile iron bodied rigid coupling, similar to a HyMax coupling or approved equal.

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.

At stream crossing locations, a compacted clay or concrete check dam shall be installed within the pipe trench to prevent stream drainage or sinkage from following the pipe trench..

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:

MANHOLE DEPTH	BASE DEPTH
0' to 8' manhole	8"
8' to 12' manhole	10"
12' & deeper manhole	12"

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^{o}) 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.

Sewer Service Replacement connections shall be made by fusing a service tee onto the sewer main. The new service line should then be connected to the tee using a method approved in section 5.07. Inserta-Tees shall **NOT** be used unless directed by **ENGINEER.**

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 and 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^{o}F, nor longer than 20 minutes below 70^{o}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.

5.12 **CONCRETE** (continued)

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.

5.13 INTERNAL INSPECTION EQUIPMENT

The television camera and monitoring equipment shall be specifically designed and constructed to perform the work as specified. Camera shall be small enough to pass through a six-inch (6") diameter sewer and shall be waterproof with a self-contained lighting system capable of producing enough light to produce clear, bright, sharp color pictures or the monitor.

The lighting and camera quality shall be suitable to allow a clear, in-focus picture of a minimum of six (6) linear feet of the entire periphery of the sewer pipe. Picture quality and definition shall be to the satisfaction of the **ENGINEER**; otherwise, the equipment shall be removed from the line without pay.

The color monitor shall be located within a temperature-controlled television unit that will accommodate three (3) people to watch the sewer line inspection. The color monitor shall have a fourteen-inch (14") minimum-viewing screen. The **ENGINEER** and the **OWNER** shall have access to view the television monitor all times.

The **CONTRACTOR** shall furnish a typewritten log of all line segments TV'ed to the **ENGINEER**. The log shall be of a form acceptable to the **ENGINEER** and include identification of the line segment, direction of travel., line size, line condition with any deficiencies noted, etc.

5.14 MANHOLE REPAIRS

The **CONTRACTOR** shall repair manholes at the various locations and in a manner indicated on the Drawings. These manhole repairs shall involved one (1) or more of the following operations.

5.15 SEWER LINE POINT REPAIR

The locations shown on the Drawings or based on information provided by a second party. It is expected to be reasonably correct. However, the **CONTRACTOR** shall be solely responsible for exact location of defects.

After the defective pipe has been exposed, as much additional pipe shall be uncovered as is necessary to allow space for workmen and the installation of the new pipe. The defective pipe shall be cut out in such a way that the ends are straight and smooth and free of chips and cracks. After the defective pipe has been removed from the trench, the trench shall be excavated six inches (6") below the pipe diameter invert elevation. If rock is excavated, it shall be removed by non-explosive means to a point six inches (6") below the pipe or couplings. Rock so removed is a pay item only if it can not be removed by a normal backhoe bucket. No. 57 crushed stone shall be placed a minimum of six inches (6") deep underneath the exposed end of the existing pipe, compression couplings, and new pipe. Pipe trench shall be filled with No. 57 crushed stone to a point twelve inches (12") above the top of the pipe. The remainder of the trench shall be filled as per Section 4.10.

5.15 SEWER LINE POINT REPAIR (cont…)

After the trench bottom has been prepared as specified, the pipe shall be cut to a length one inch (1") less than the overall length of the section being replaced. The pipe shall then be placed in the trench and Feraco Series 106, or equal compression couples shall be installed. After installation, the work shall be checked to ensure that the replacement pipe is vertically and horizontally aligned with the existing pipe and that the compression couplings are tight and evenly fitted.

Repairs to lines eighteen inches (18") in diameter or less shall be made using short sections of PVC, ASTM-F675, pipe stuffers, 46 or HDPE, OR-32.

Reasonable care shall be exercised during the initial excavation of the defective pipe so as not to disturb existing pipe that is still acceptable.

5.16 SERVICE CONNECTION REPAIRS

After the defective service tee or wye has been exposed as much additional pipe shall be exposed as necessary to allow space for workmen and the installation of new tee or wye. The defective tee or wye shall be removed in such a way that the ends of the remaining pipe are straight and smooth and free of chip or cracks. The new tee or wye shall be installed by the use of one or more compression couplings and pipe as necessary. The replaced tee or wye shall be budded and lockfilled as specified in Section 4 for PVC pipe. The service lines shall be reconnected there to using fillings, pipe, and compression couplings as necessary.

At each location indicated on the drawings or observed by the **ENGINEER** during TV operations, the **CONTRACTOR** shall repair and/or replace certain tees or wyes.

Reasonable care shall be exercised during repair operations to not disturb the existing pipe.

5.17 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.**

5.18 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, and plug and seal all leaks.

5.19 RECONDITION MANHOLES

Contractor 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.

5.20 MANHOLE REHABILITATION

All surfaces to be treated must be free from all foreign material such as scale, form oil, dirt, latency, curing compounds, paints, or coatings. Surface preparation method shall be based upon the conditions of the substrate and the requirements of the coating to be applied. Proper surface preparation procedures must be followed to ensure adequate bond strength to any surface to be coated. Applicator must adhere to manufacturer's recommendations with regard to proper surface preparation.

New cement must cure at least 28 days prior to coating.

Active water infiltration shall be stopped by using a hydroactive urethane grout that is compatible and suitable for topcoating with the specified coating system.

All manhole invert surfaces shall be sufficiently smooth and even as to ensure adequate flow handling characteristics when coated.

Application procedures shall conform to the recommendations of the manufacturer, including material handling, mixing, safety and environmental controls during the application.

The coating shall be applied only with the equipment specifically designed for the application of the coating by the manufacturer. The application equipment shall be maintained and in proper working order.

The coating shall be applied only by an approved applicator. Certification by the manufacturer, in writing, shall be provided to **ENGINEER** prior to start of work.

No VOC/solvents shall be used on the job site for thinning, mixing, cleaning or maintenance of the coating or application equipment, or to flush out or purge the lines or equipment used to apply the coating.

The finished coating shall provide a minimum average thickness of 250 mils on brick manholes and 125 mils on precast concrete and cast in place manholes. The cured coating shall be monolithic with proper sealing to all internal connections and shall be placed in one (1) application, in conformance with the recommendations of the manufacturer.

5.21 AIR AND VACUUM RELIEF VALVES

Properly sized Air and vacuum relief valves shall be provided and installed as required along all force mains. Air relief valve shall be installed within a pre-cast concrete manhole. See standard detail SD-AV.

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.

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.

The test shall be considered acceptable when the vacuum remains at 10" of Mercury (Hg), or drops no lower than to 9" Hg within the time period specified below.

Manholes 4-foot in diameter shall be required to sustain a vacuum with no more than 1" Hg drop according to the following Schedule.

Manhole Depth	Time to Drop 1" Hg
4-10 ft	75 seconds
10-15 ft	90 seconds
15-25 ft	105 seconds

If the manhole fails the test, necessary repairs shall be made and the vacuum test repeated until the manhole passes the test. If the manhole joint mastic or gasket is displaced during the vacuum test, the manhole shall be disassembled, the seal replaced, and the manhole retested.

Before testing, all pipes and other openings into the manhole shall be suitably plugged in such a manner as to prevent displacement of the plugs while a vacuum is pulled. Installation and operation of the vacuum equipment shall be in accordance with the equipment specifications and instructions provided by the manufacturer. The test head shall be placed in the cone section of the manhole.

Before final acceptance, GPU will televise the interior of the sanitary sewer main to help assure compliance with the design, material, workmanship and record drawings. Any defects noted in this inspection shall be corrected by the contractor.

7.03 **MANHOLES** (continued)

All manholes that are tested must be tested after castings are installed even if tested previously without castings. 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. No pipe should exceed a deflection of 5%. PVC sewer lines failing mandrel test must be relayed.

(2) **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.

7.04 **GRAVITY SEWER LINES & SEWER LINE REPLACEMENT** (continued)

(3) **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.

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.

7.04 **GRAVITY SEWER LINES & SEWER LINE REPLACEMENT** (continued)

(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

Pipe Size Inches	Time, T (sec/100 ft.)	Allowable Air Loss, Q (ft^3/min)
6	42	2.0
8	72	2.0
10	90	2.5
12	108	3.0
15	126	4.0
18	144	5.0
21	180	5.5
24	216	6.0
27	252	6.5
30	288	7.0

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#)[gauge] 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.

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.

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.

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 **FLOW CONTROL**

When Sewer line flows are above the minimum requirements (generally not more than ¼ of the pipe diameter) or inspection of the complete periphery of the pipe is necessary to effectively conduct the inspection, installation, or sealing operations, one or more of the following methods of flow control shall be used at no extra cost to the **OWNER**

A. Plugging or Blocking

A sewer line plug shall be inserted into the line at a manhole upstream from the section to be inspected, repaired, tested, and/or sealed. During dig ups and/or replacement operations, flows shall be shut off.

9.09 FLOW CONTROL (CONT...)

During television inspection operations, flows shall be shut off or substantially reduced in order to properly inspect the pipe at the invert. After the inspection is complete, flows shall be restored to normal or not more than ½ of the pipe diameter during the joint testing and sealing operation.

B. Pumping and Bypassing

When bypass pumping is required to insure the completion of the work, inspection, testing, and sealing work, the **CONTRACTOR** shall furnish the pumping equipment, conduits, etc.. The pumping operations shall be conducted from manhole to manhole, and no flow shall be discharged to the surface or into natural water ways.

C. Liability

The **CONTRACTOR** shall be held responsible for damages to private or public property which may result from sewer flow control operations.

9.10 DISPOSAL OF WASTE MATERIAL

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

9.11 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.

9.11 SLOPE PROTECTION AND EROSION CONTROL (cont..)

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**.

9.11 **SLOPE PROTECTION AND EROSION CONTROL** (continued)

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^{o}) 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.

9.11 **SLOPE PROTECTION AND EROSION CONTROL** (continued)

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.

9.11 **SLOPE PROTECTION AND EROSION CONTROL** (continued)

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**.

9.11 **SLOPE PROTECTION AND EROSION CONTROL** (continued)

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.

9.12 **VIDEO**

Prior to construction, **CONTRACTOR** shall color video tape the entire project are 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.

9.13 **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.

9.13 **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 (FOR BID CONTRACT WORK ONLY)

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.

Pavement replacement is covered in section 10.09

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, crushed stone backfill in all areas subject to traffic, 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".

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. Pavement replacement and flowable fill are covered in Sections 10.09.

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:

PAY QUANTITIES FOR THRUST BLOCKS - CF CLASS B CONCRETE

PIPE DIA.	TEE	90º	45º	22-1/2º	DEAD END
6"	3.0	4.0	2.3	2.3	11.3
8"	5.4	8.1	4.3	3.3	12.5
10"	9.7	14.0	7.0	3.5	13.7
12"	15.0	20.0	11.2	6.3	15.0
16"	28.6	41.3	22.9	11.8	17.7

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. Around services, measurement of pavement replacement for payment shall be limited to an area 6' x 6', 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 and manhole 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 each respective item.

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 **FLOWABLE FILL**

a. **Measurement** – Measurement of flowable fill will be based on the actual number of cubic yards installed. Cubic yards installed shall be calculated based on the length times depth as shown on the accepted cut sheet times the actual trench width with a maximum of 5.0 feet.

Around manholes, measurement of flowable fill for payment shall be limited to an area 8' x 8', with appropriate deduction for pavement measured over trenches. Around services, measurement of flowable fill for payment shall be limited to an area 6' x 6', with appropriate deduction for pavement measured over trenches.

b. **Payment** – Payment for flowable fill shall be made at the bid unit price per cubic yard and shall constitute payment in full for flowable fill material, protection during placement, tools, labor, equipment, and miscellaneous items as necessary.

10.12 **EXTRA DEPTH TRENCH EXCAVATION (not this contract)**

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.

10.13 SEWER LINE TV INSPECTION (No additional compensation this contract)

a. **Measurement** - Measurement shall be made on the basis of actual linear feet of sewer line TVed for inspection (**NONE THIS CONTRACT**)

b. **Payment** - Payment of sewer line TVed for inspection shall be made at the unit price bid per linear foot and shall include full compensation for flow control, all equipment, including color monitor, color video tape or digital recordings, logging, and all labor and material to complete items as specified.

10.14 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.

10.15 MANHOLE REHABILITATION

a. **Measurement** – Manhole Rehabilitation shall be measured by vertical foot installed. Manhole depth shall be measured vertically from the invert at the center of the manhole to the top of the casting or cover.

Measurement for new castings, standard or watertight shall be by actual count of such covers actually installed.

b. **Payment** - Payment for manhole rehabilitation shall be made on the basis of the unit prices bid per vertical foor and shall constitute payment in full for furnishing all materials, including any excavation, concrete, brick, repair material, coating system, crushed stone backfill in all areas subject to traffic, clean up and waste removal, bypass pumping or plugs and any other incidentals, with all manholes being considered as standard manholes.

Payment for new standard or 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 the manhole rehabilitation. Pavement replacement and flowable fill are covered in Sections 10.09.

10.16 PUMP STATION REMOVAL

a. **Measurement** – Removal of the existing abandon pump station shall be measured as an agreed percentage of work complete.

b. **Payment** - Payment for removal of the existing abandoned pump station shall be made on the basis of the lump sum price bid and shall constitute payment in full for the removal and haul away of the existing concrete structure to a depth of 3 feet below grade, graded fill dirt, seed, straw, stabilization, erosion control and any other incidental items needed to fully remove structure and restore the site.

10.17 **TRAFFIC CONTROL**

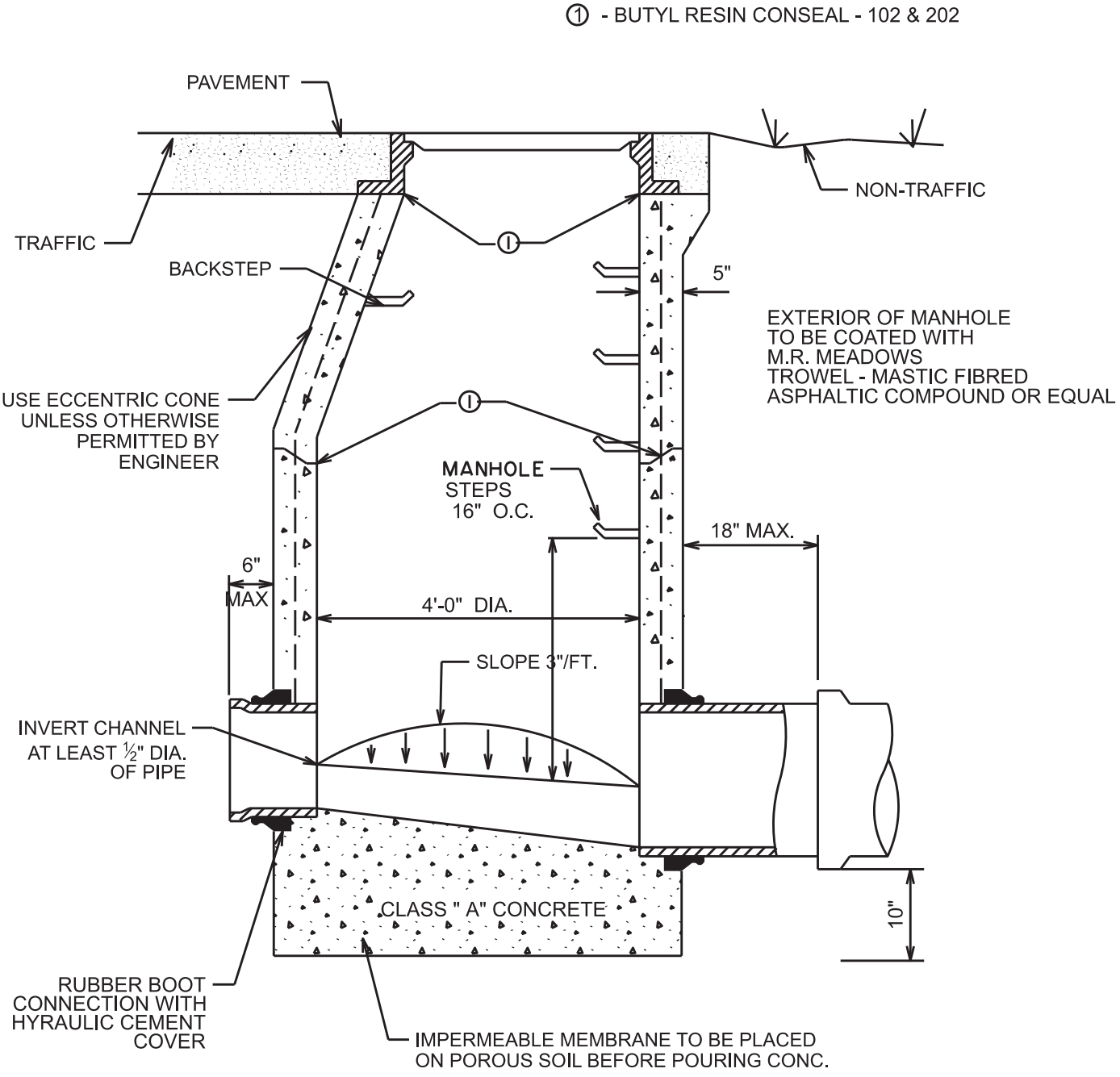
a. **Measurement** – Traffic Control shall be measured as an agreed percentage of work complete.

b. **Payment** - Payment for Traffic Control shall be made on a percentage basis of the lump sum price bid and shall constitute payment in full for all signage, flagging, detour layout, city coordination, personnel and any other incidental items necessary for safe and proper traffic control throughout the duration of the project.

STANDARD DETAILS

STANDARD PRECAST MANHOLE

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



CASTING SHALL BE:

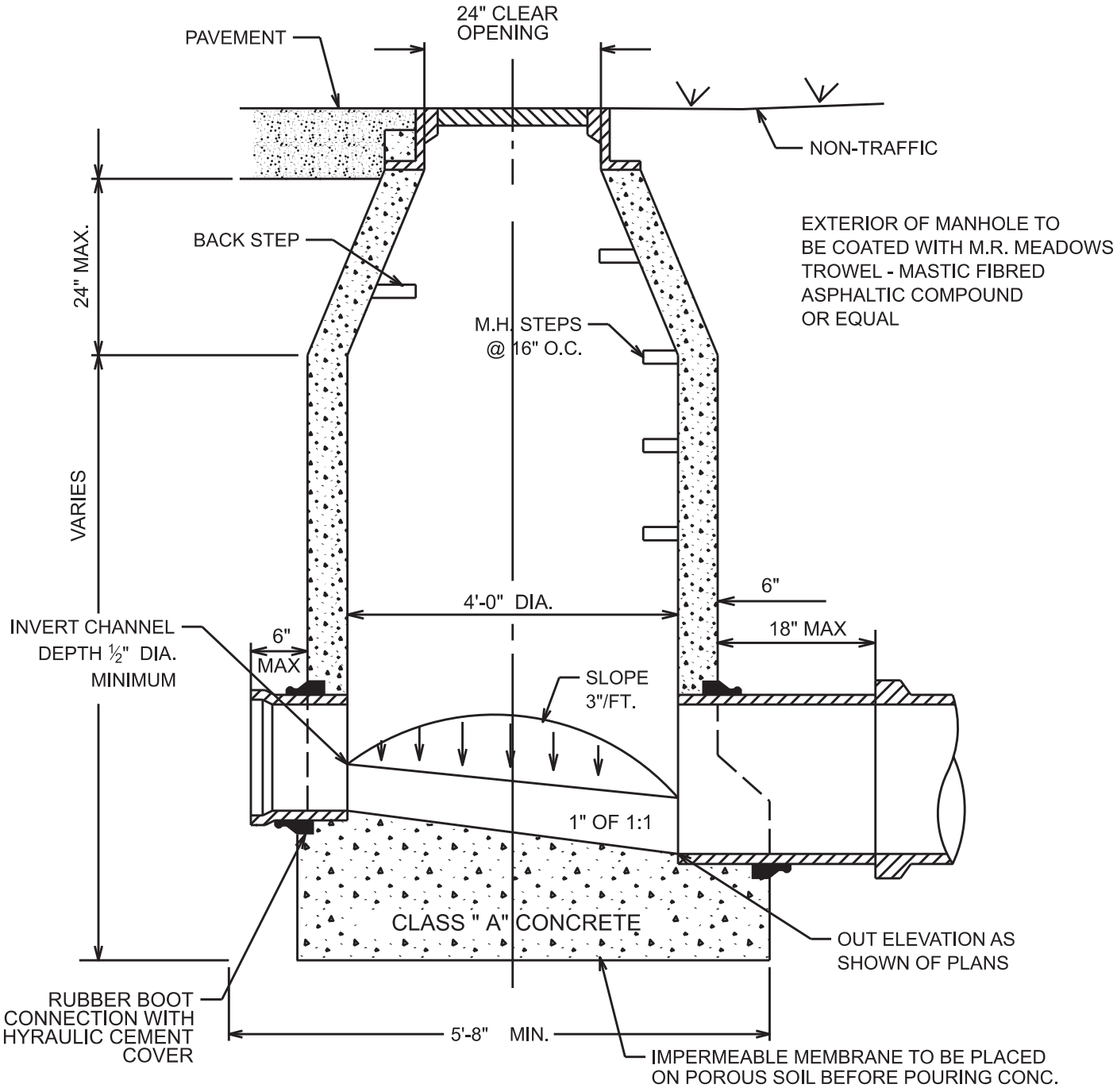
TRAFFIC -	JOHN BOUCHARD & SONS, CO. NO. 1150 OR EQUAL
FIELD -	JOHN BOUCHARD & SONS, CO. NO. 1155 OR EQUAL
WATER TIGHT -	JOHN BOUCHARD & SONS, CO. NO. 1123 OR EQUAL

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



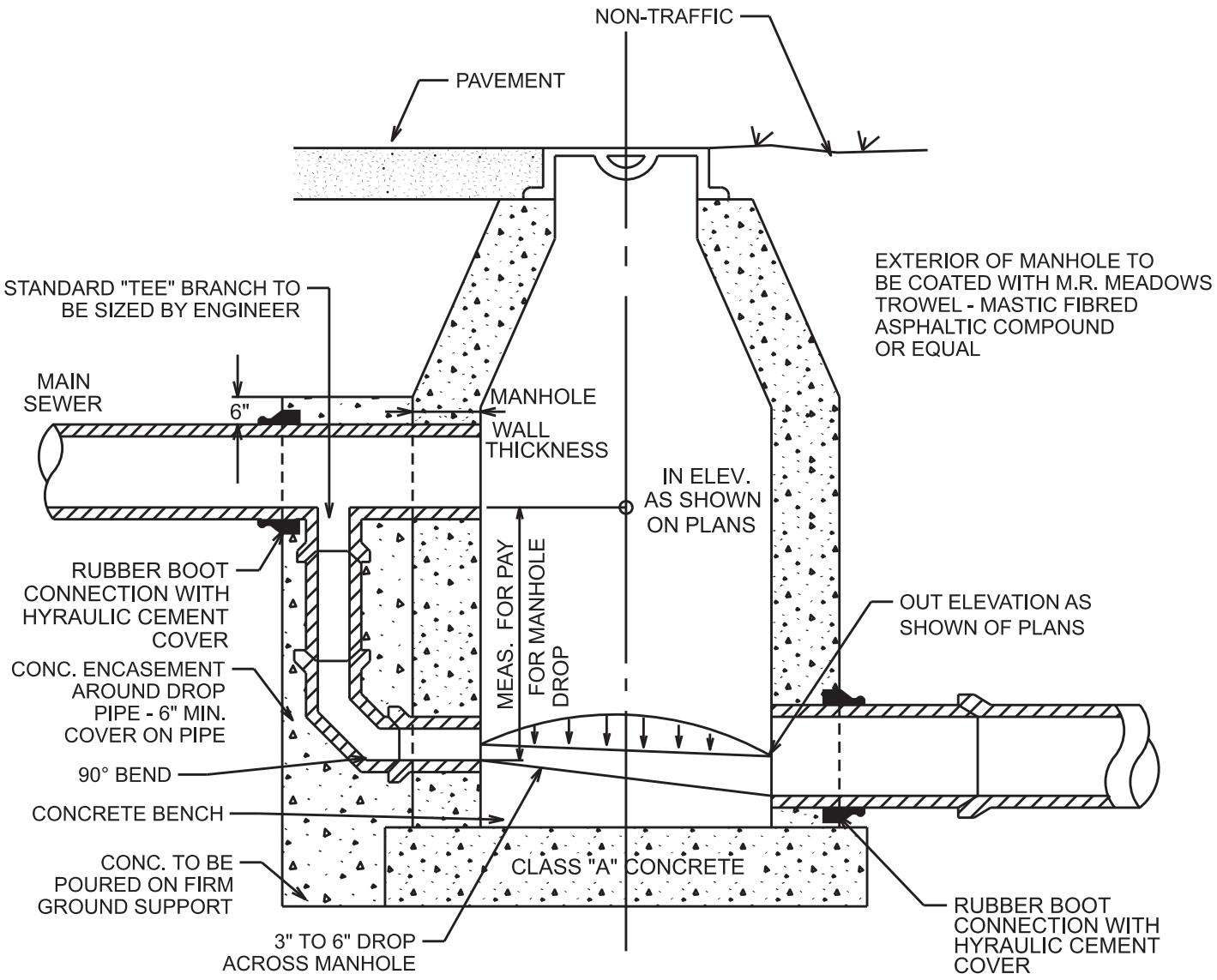
CASTING SHALL BE:

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-2

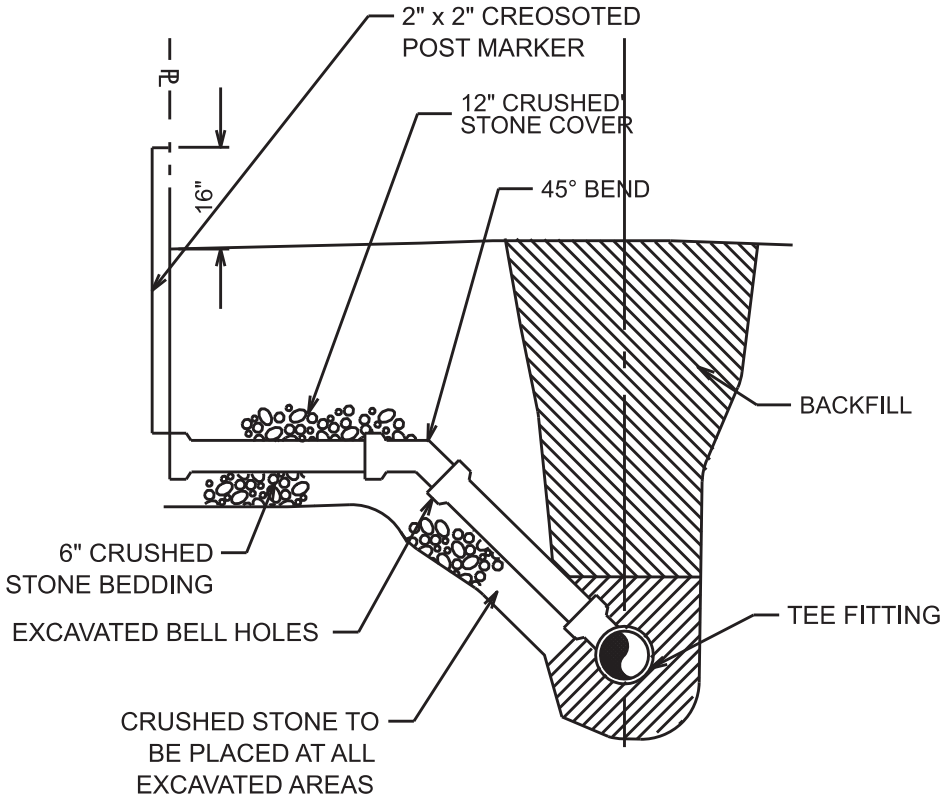
DROP MANHOLE CONSTRUCTION



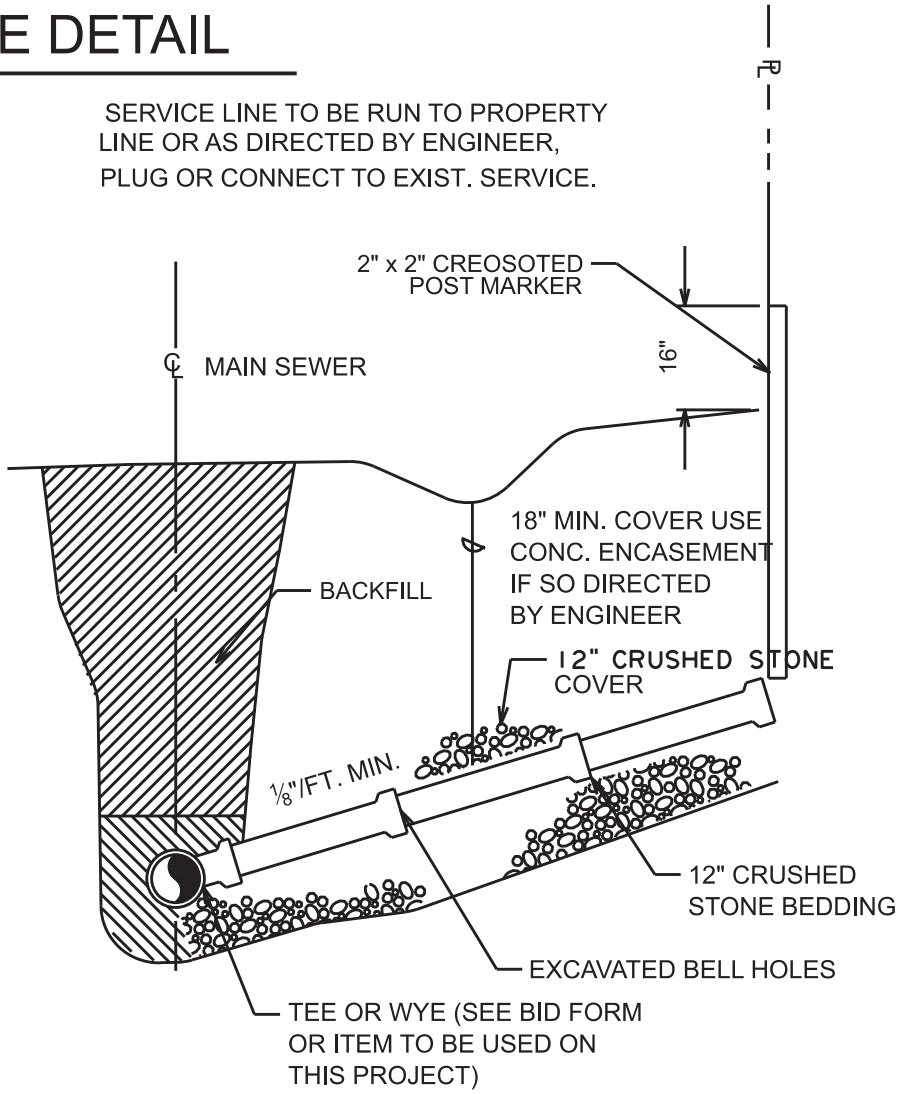
NOTE:
USE DROP MANHOLE CONSTRUCTION WHENEVER "IN ELEV. - OUT ELEV." EXCEED 30" OR WHEN INDICATED ON PLANS OR DIRECTED BY ENGINEER.

SD-3

SEWER SERVICE DETAIL



ELEVATED SERVICE LINE DETAIL

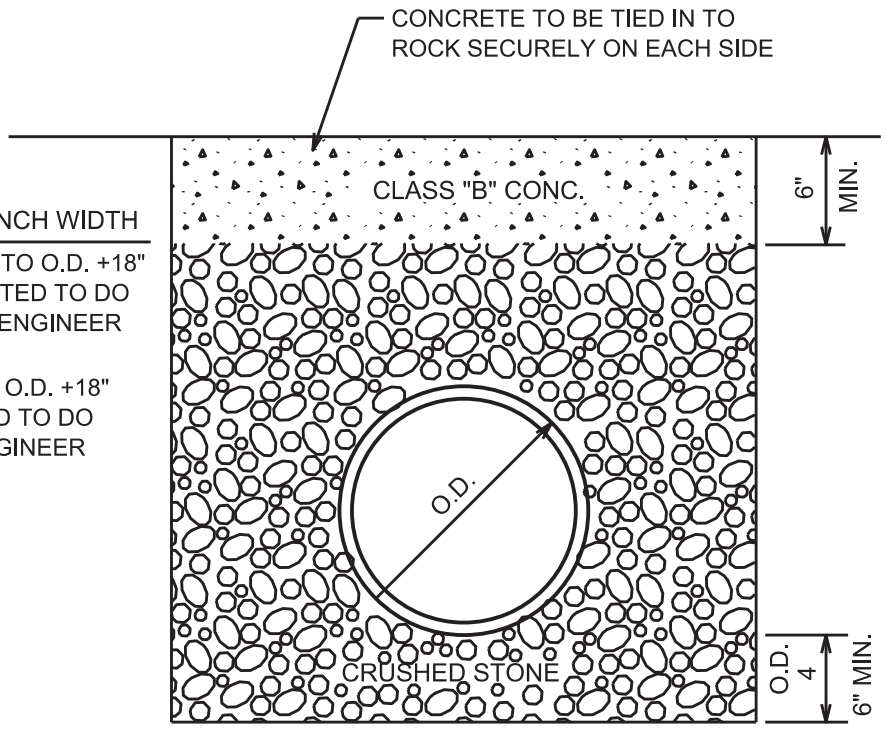


SERVICE LINE DETAIL

SD-4

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 AND ONLY WITH PRIOR APPROVAL FROM THE CITY OF GALLATIN
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.



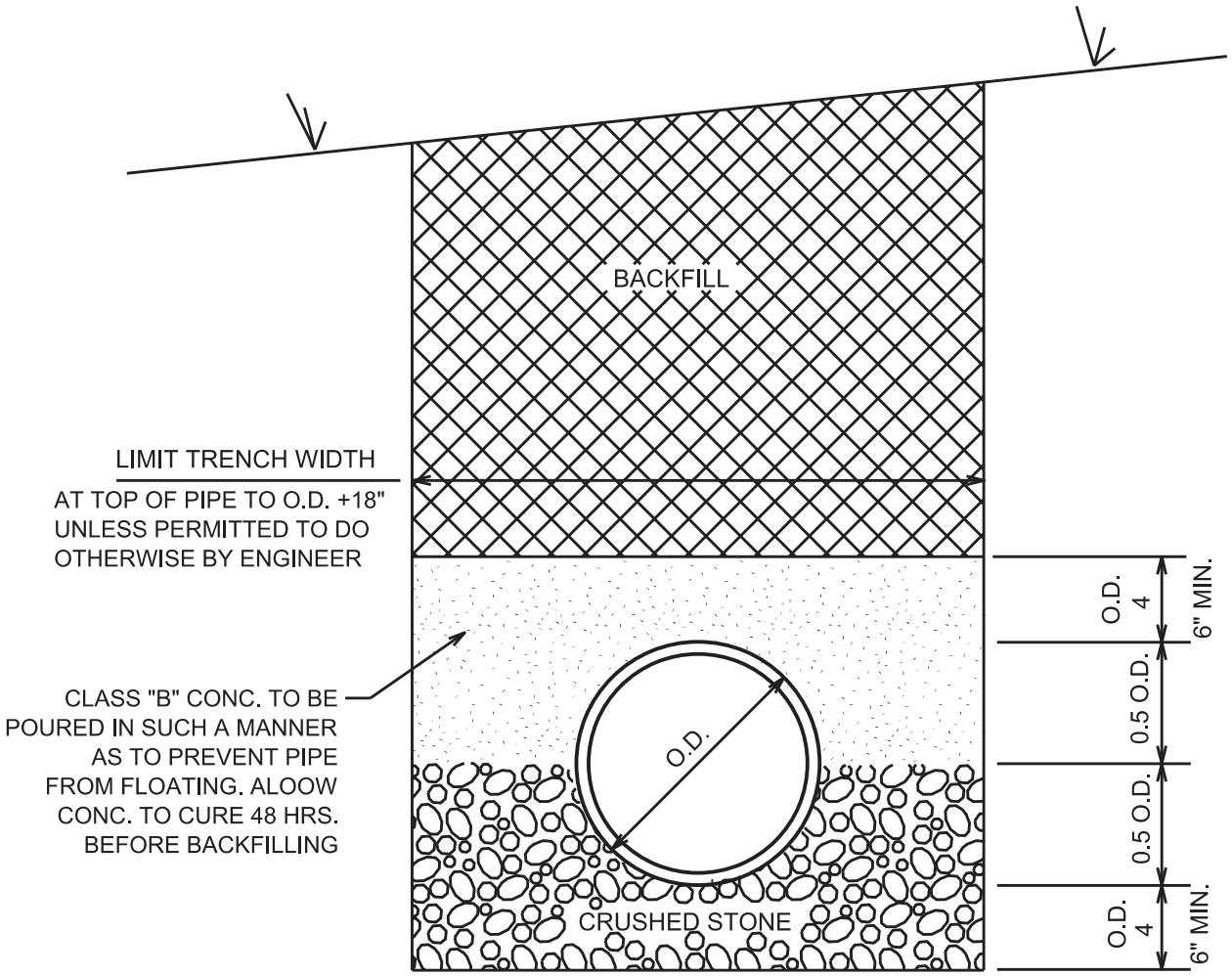
LIMIT TRENCH WIDTH

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

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

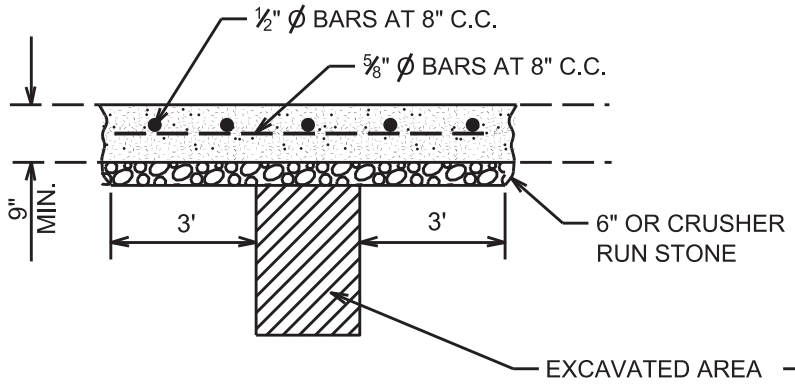


INSTALL ENCASEMENT WHERE DIRECTED BY ENGINEER OR AS SHOWN IN PLANS. GENERALLY, CONC. ENCASEMENT SHALL BE USED ON ALL BUT CAST IRON SEWERS WHERE DEPTH OF COVER IS LESS THAN 2' IN AREAS NOT SUBJECT TO TRAFFIC AND WHERE DEPTH OF COVER IS LESS THAN 3' IN AREAS SUBJECT TO VEHICULAR TRAFFIC LOADS

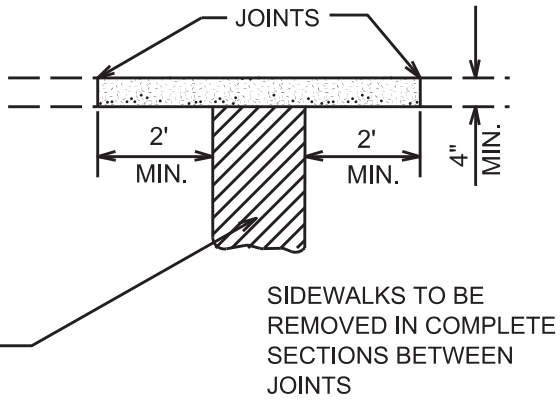
CONCRETE ENCASEMENT

SD-6

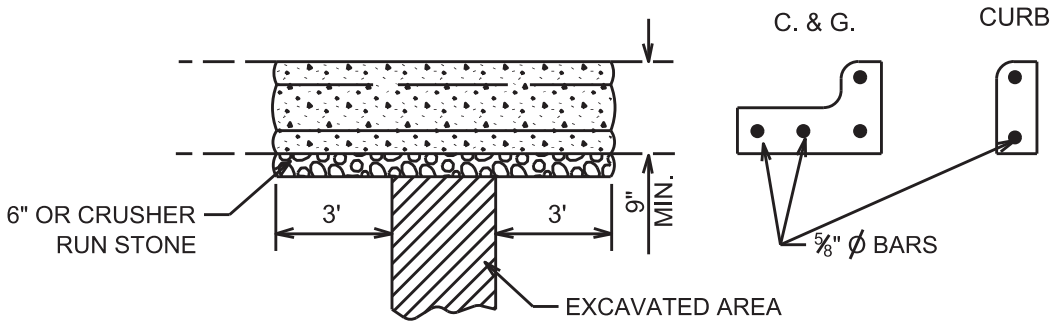
CONCRETE PAVEMENT



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 TAMPED, THE PAVEMENT SHALL AGAIN BE CUT 3" BACK OF EXCAVATION LINE BEFORE REPLACING.

2. CONCRETE BASES, WITH BITUMINOUS SURFACE SHALL BE CUT SAME AS A PAVEMENT AND SURFACING MATERIAL REMOVED ½" FOOT BACK OF FINAL CUT.

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

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

5. BACKFILL FOR TRANCES 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 GRAVE BASE.

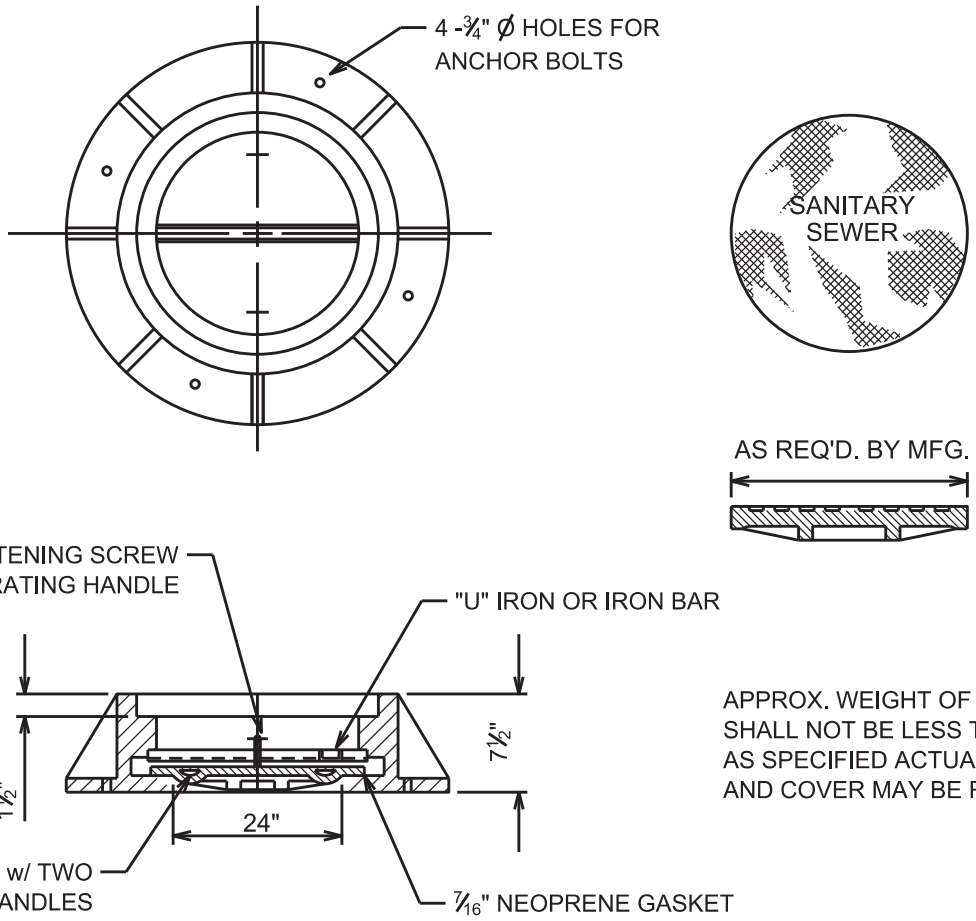
7. EXPANSION JOINTS REMOVED SHALL BE REPLACED.

8. ALL CONCRETE TO BE CLASS "A".

STANDARD METHOD

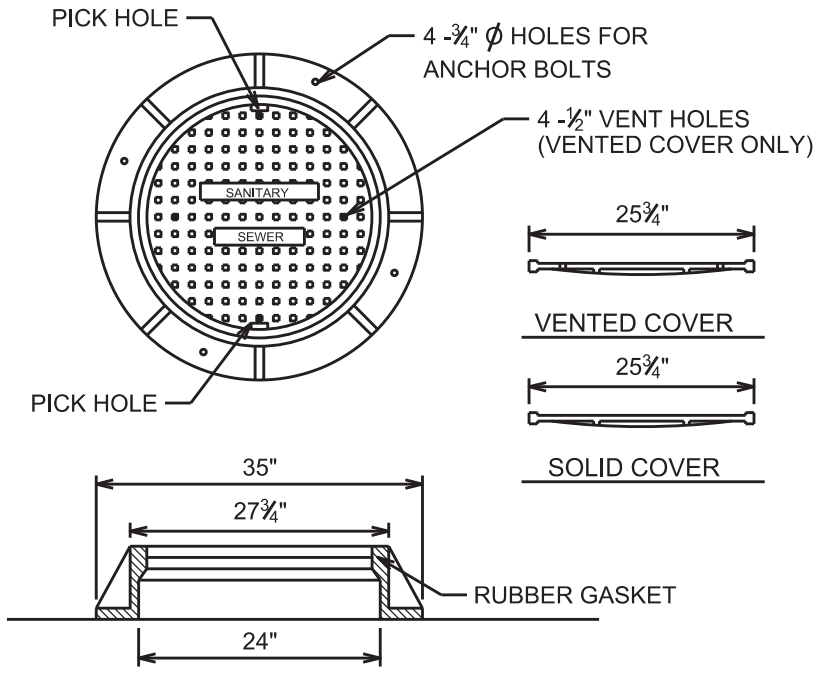
OPENING TRENCHES THROUGH HIGHWAYS
AND REPLACING PAVEMENT, ETC.
(TENNESSEE HIGHWAY DEPARTMENT STANDARD)

SD-7



APPROX. WEIGHT OF FRAME & COVER SHALL NOT BE LESS THAN 525 LBS. AS SPECIFIED ACTUAL SAMPLE FRAME AND COVER MAY BE REQUIRED

WATERTIGHT MANHOLE FRAME & COVER

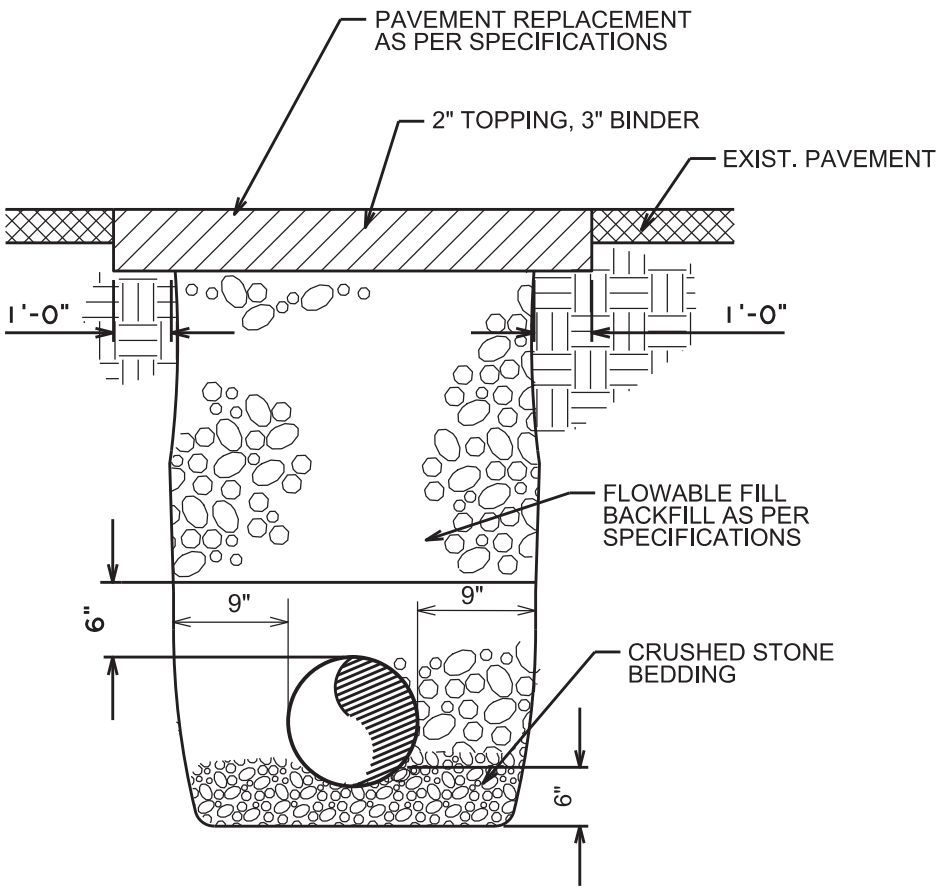


APPROX. WEIGHT OF FRAME AND COVER SHALL NO BE LESS THAN 415 LBS. AS SPECIFIED

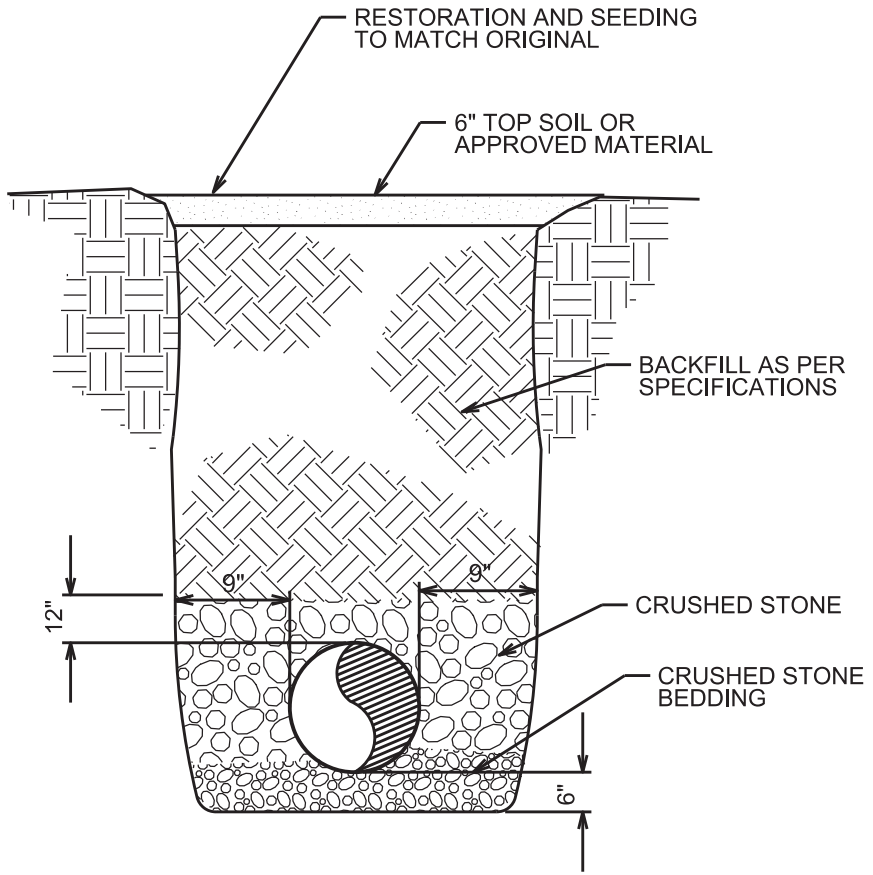
STANDARD MANHOLE FRAME & COVER

(SELF SEALING)

SD-8



TRAFFIC AREAS



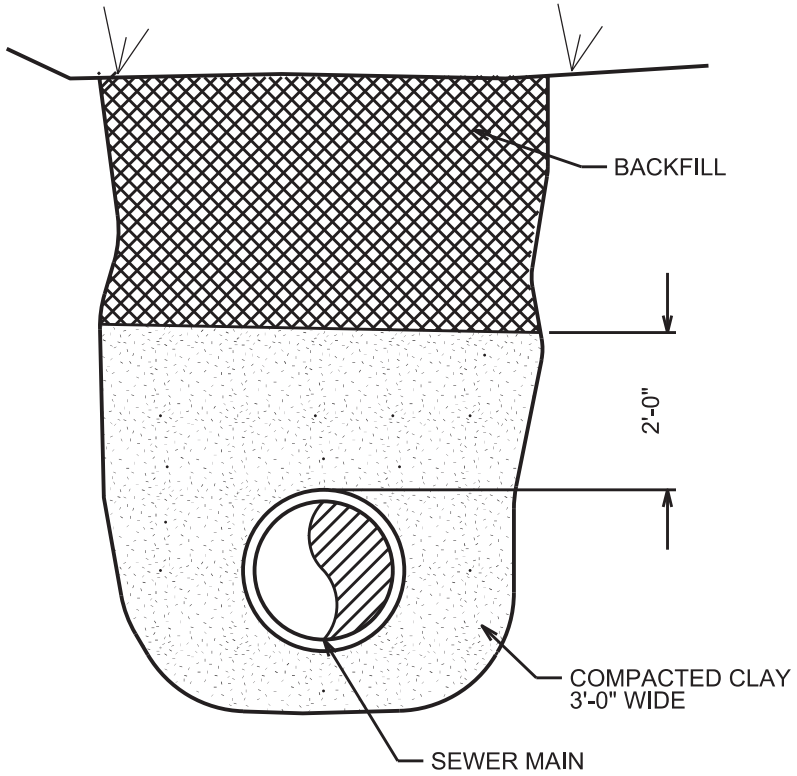
NON-TRAFFIC AREAS

TYPICAL SEWER LINE DETAIL

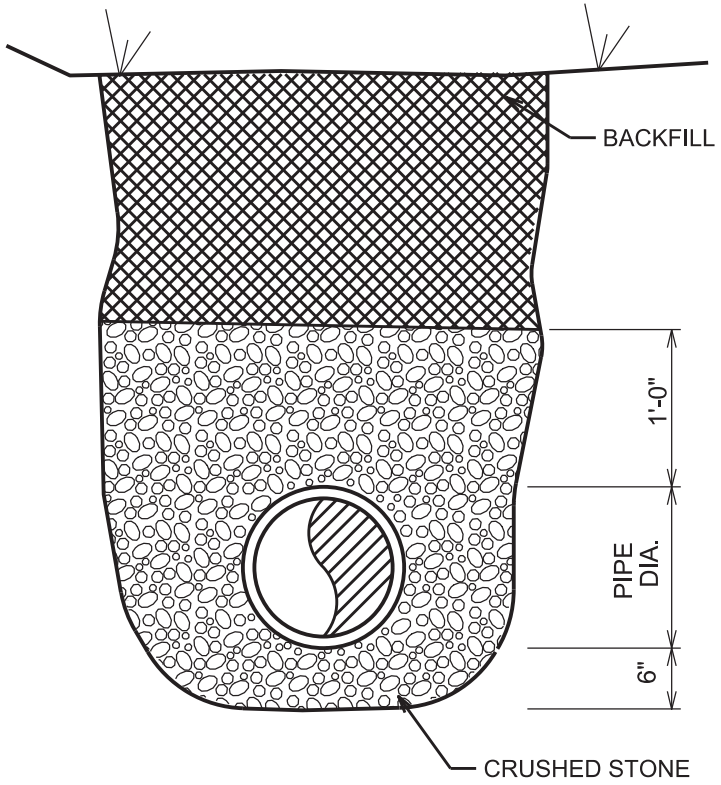
SD-9

CLAY STOP-GRAVITY SEWERS

PLACE EVERY 500 FEET OR AS DIRECTED



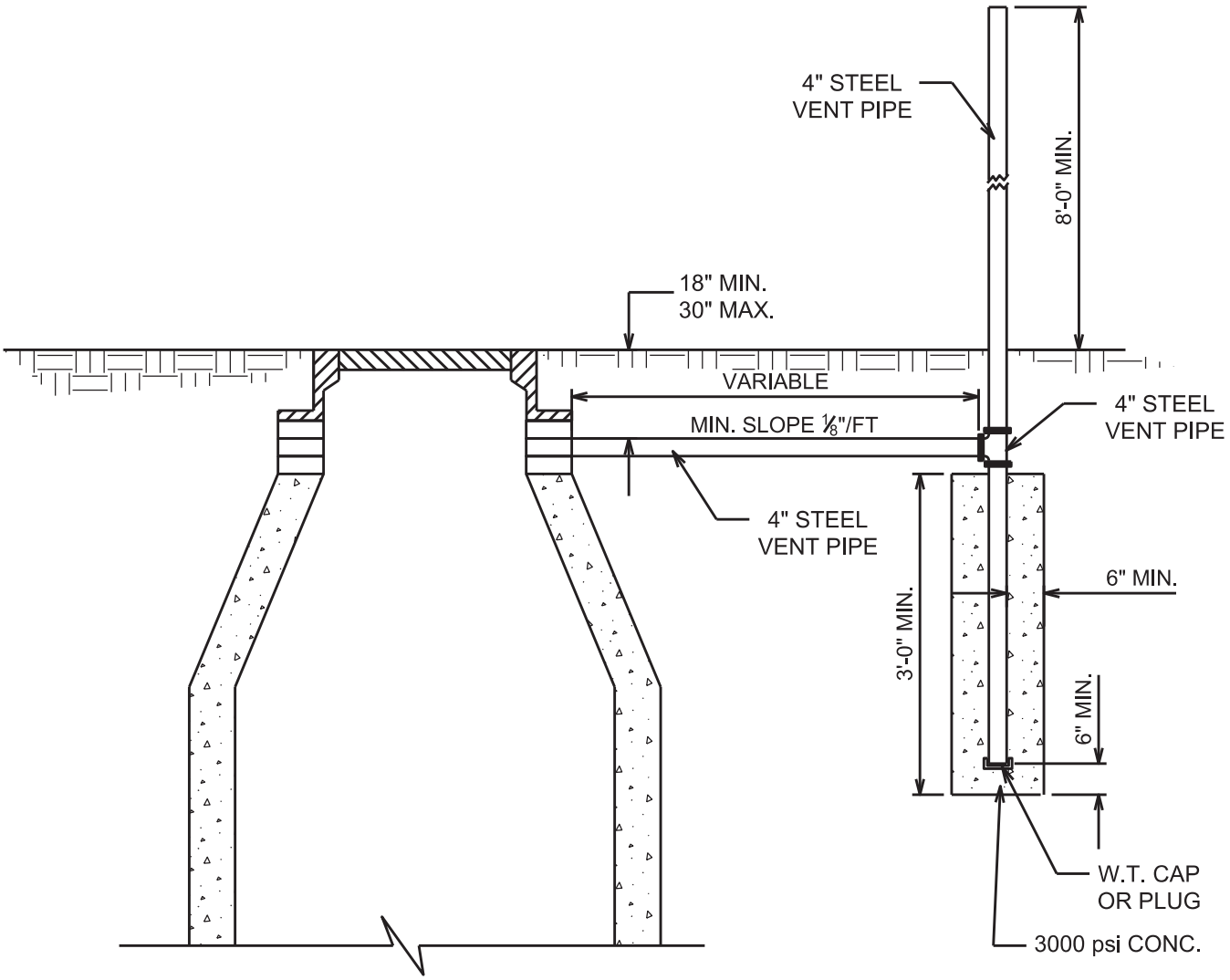
TRENCH @ CLAY STOP



NORMAL TRENCH

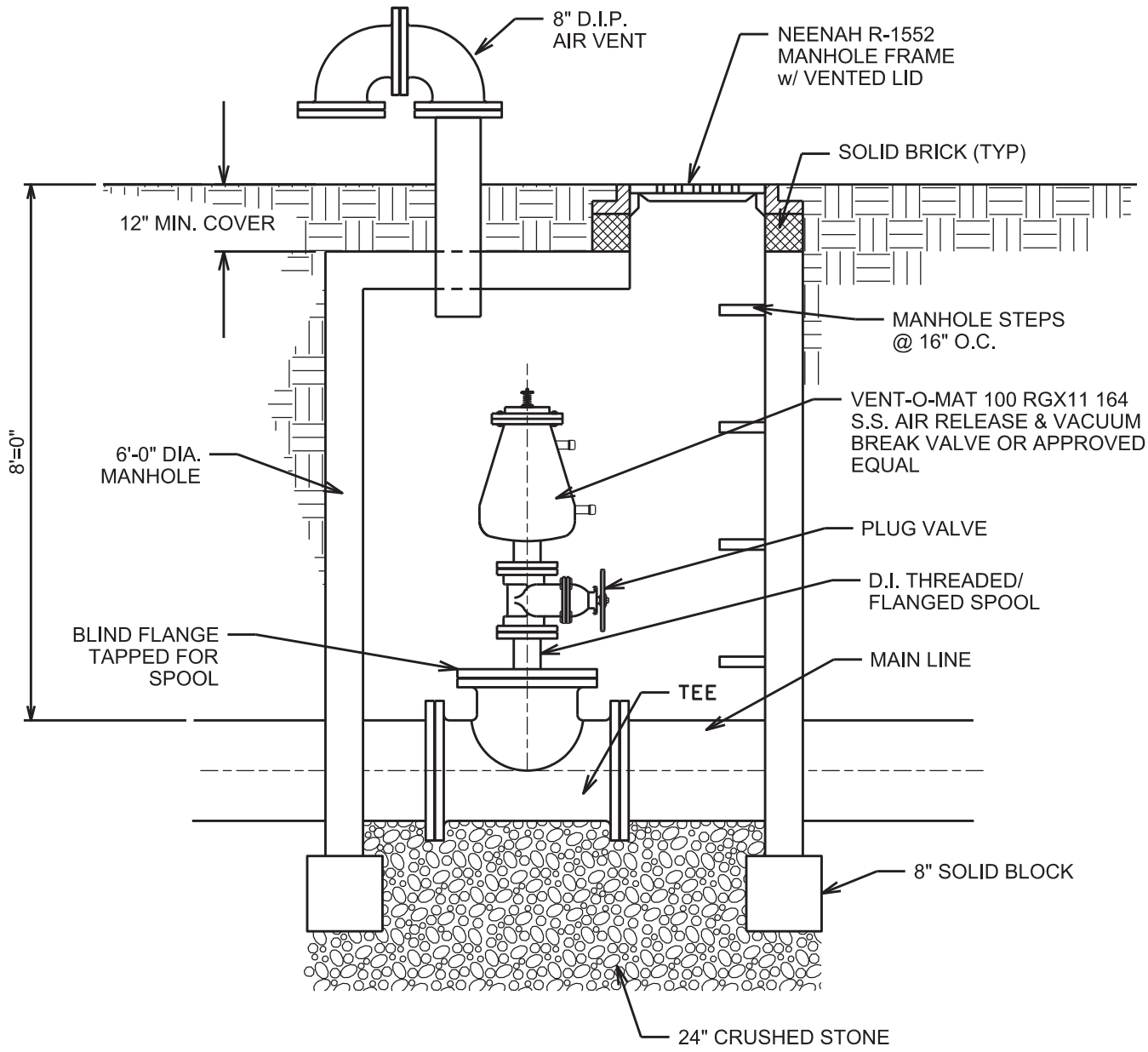
SD-10

STANDARD MANHOLE VENT



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 OF PLANS.



COMBINATION AIR VALVE

N.T.S.

SD-AV