TOWN OF SMYRNA
(RUTHERFORD COUNTY, TENNESSEE)

WPN 25.0654
Town of Smyrna General Conditions and Technical Specifications for Construction of Sewer Line Additions

APPROVED

THE DOCUMENT BEARING THIS STAMP HAS BEEN RECEIVED AND REVIEWED BY THE

TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER RESOURCES

AND IS HEREBY APPROVED BY THE COMMISSIONER

Matthew Taylor

November 20, 2025

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

GENERAL CONDITIONS AND TECHNICAL SPECIFICATIONS FOR CONSTRUCTION OF SEWER LINE ADDITIONS

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TITLE: DIRECTOR OF UTILITIES DATE: 10-7-2025

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GENERAL CONDITIONS

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, which includes 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**.

ADDITIONAL INSTRUCTIONS AND DETAIL DRAWING GC-2.01 Thru 2.02

GC-2 **ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS**

GC-2.01 The **CONTRACTOR** may furnish additional instructions and detailed 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 detailed drawings and instructions.

SCHEDULES, REPORTS AND RECORDS GC-3.01 Thru 3.03

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:

3.02.1 the dates at which special detail drawings will be required; and

3.02.2 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**.

DRAWINGS AND SPECIFICATIONS GC-4.01 Thru 4.03

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.

SHOP DRAWINGS GC-5.01 Thru 5.03

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**.

MATERIALS, SERVICES, AND FACILITIES GC-6.01 Thru 6.05

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 be allowed an increase in the **CONTRACT PRICE** or an extension of the **CONTRACT TIME**, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate **CHANGE ORDER** shall be issued.

SUBSTITUTIONS **GC-8.01 Thru 8.01**

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 catalog 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 catalog 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 adjusted to 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**.

PATENTS **GC-9.01 Thru 9.01**

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**.

SURVEYS, PERMITS, REGULATIONS **GC-10.01 Thru 10.03**

GC-10 **SURVEYS, PERMITS, REGULATIONS**

GC-10.01 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 benchmarks, 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**.

PROTECTION OF WORK, PROPERTY AND PERSONS GC-11.01 Thru 11.03

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.

SUPERVISION BY CONTRACTOR GC-12.01 Thru 13.01

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**.

CHANGES IN THE WORK GC-13.01 Thru 13.02

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.**

CHANGES IN CONTRACT PRICE GC-14.01 Thru 14.01

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.

TIME FOR COMPLETION AND LIQUIDATED DAMAGES GC-15.01 Thru 15.4.

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 and 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**.

15.04.1 To any preference, priority or allocation order duly issued by the **OWNER**.

15.04.2 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, abnormal and unforeseeable weather, and for 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:

17.01.1 Subsurface or latent physical conditions at the site differing materially from those indicated in the **CONTRACT DOCUMENTS**; or

17.01.2 Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inheriting 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) day 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**.

PAYMENT TO CONTRACTOR GC-19.01 Thru 19.01

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 non-completion, 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, material men, 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**.

ACCEPTANCE OF FINAL PAYMENT AS RELEASE GC-20.01 Thru 20.01

GC-20 **ACCEPTANCE OF FINAL PAYMENT AS RELEASE**

GC-20.01 The acceptance by the **CONTRACTOR** of final payment shall be and shall operate as a release to the **OWNER** of all claims and all liability to the **CONTRACTOR** other than claims in stated amounts as may be specifically excepted by the **CONTRACTOR** for all things done or furnished in connection with this **WORK** and for every act and neglect of the **OWNER** and others relating to or arising out of this **WORK**. Any payment, however, final or otherwise, shall not release the **CONTRACTOR** or his sureties from any obligations under the **CONTRACT DOCUMENTS** or the Performance Bond and Payment Bonds.

INSURANCE GC-21.01 Thru 21.03

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.

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

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

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

21.01.4 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

21.01.5 Claims for damages because of injury to or destruction of tangible property, including loss of use resulting there from.

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 coverage(s) afforded under the policies will not be canceled 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;

21.03.1 **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

21.03.2 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 Workman'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 statute, 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**.

CONTRACT SECURITY **GC-22.01 Thru 22.01**

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**.

ASSIGNMENTS **GC-23.01 Thru 23.01**

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 hereunder, without written consent of the other party.

INDEMNIFICATION **GC-24.01 Thru 24.03**

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 there from; 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**.

SEPARATE CONTRACTS **GC-25.01 Thru 25.03**

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.

SUBCONTRACTING **GC-26.01 Thru 26.05**

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**.

ENGINEERING AUTHORITY GC-27.01 Thru 27.04

GC-27 **ENGINEERS AUTHORITY**

GC-27.01 The **ENGINEER** shall act as the **OWNER'S** representative during the construction period. He shall decide questions, which may arise as to quality and acceptability of materials furnished and **WORK** performed. He shall interpret the intent of the **CONTRACT DOCUMENTS** in a fair and unbiased manner. The **ENGINEER** will make visits to the site and determine if the **WORK** is proceeding in accordance with the **CONTRACT DOCUMENTS**.

GC-27.02 The **CONTRACTOR** will be held strictly to the intent of the **CONTRACT DOCUMENTS** in regard to the quality of materials, workmanship and execution of the **WORK**. Inspections may be made at the factory or fabrication plant of the source of material supply.

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

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

LAND AND RIGHTS-OF-WAY GC-28.01 Thru 28.03

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.

GUARANTY GC-29.01 Thru 19.01

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.

TAXES GC-30.01 Thru 30.01

GC-30 **TAXES**

GC-30.01 The **CONTRACTOR** will pay all sales, consumer, use and other similar taxes required by the law of the place where the **WORK** is performed

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. **CONTRACTORS' AND SUBCONTRACTORS' 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.

7. Once the **CONTRACTOR** has passed all sewer main testing, it is the **OWNER's** responsibility to re-camera the gravity sewer main after 75% subdivision/commercial lots are built. The sewer video shall be inspected by the Town's Utilities Department staff, and if deem as such, the **OWNER** will be responsible for the cleaning and/or repairs of the mention gravity sewer main. This will be reflected in the utilities' bond amount for the **OWNER.**

TECHNICAL SPECIFICATIONS

TOWN OF SMYRNA

SEWER LINE ADDITIONS

SECTION 1 - SCOPE OF PROJECT

1.0 GENERAL SANITARY SEWER STANDARDS, SPECIFICATIONS & REQUIREMENTS

1.0.1 GENERAL

The purpose of the requirements and guidelines is to provide guidance to the developers, engineers, and contractors in order to achieve an acceptable installation for furnishing of sewer system components to subdivisions and other developments. Summarized below are requirements and conditions that apply to the granting of sewer service by the Town of Smyrna.

1.0.2 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.

1.0.3 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 Meeting. 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.

1.0.4 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.

1.0.5 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.

1.0.6 Traffic Control

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

1.0.7 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.

1.0.8 Increase or Reduction of Work

The project has a limited budget. In order to ensure 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.

1.1 SANITARY SEWER STANDARDS

1.1.1 Design of Sewer Lines

Prior to the design of any sewer line extension, component, or expansion, the design engineer should first confer with the Town's Planning Department with regard to growth potential and density that may be expected in the general area of the extension being planned. A conference with the Director of Utilities shall follow to discuss system standards and requirements, as well as any issues related to the sewer system components being proposed.

1.) Construction of sewer system components and sewer lines (including individual service connections) may not begin until approval by the Town of Smyrna and the Tennessee Department of Environment and Conservation, Department of Water Pollution Control has been received.

2.) No connection to an existing sewer line shall be made until all new lines have been completely tested, video recorded, and the tie-in has been approved by the Director of Utilities.

3.) The Town of Smyrna will not accept utility lines that were not approved in accordance with these specifications.

4.) Sewer lines, sewer system components, service connection, and service line construction to property line or right-of-way (only) is covered herein. Service line constructed from property line or right-of-way to structure is covered in the latest edition of the International Plumbing Code.

5.) Sewer service may be denied to structures currently connected to the Town's Water System which is deemed to be outside of the Town's Sewer Service District.

6.) All sewer lines and services (to easement boundary or right-of-way only) constructed utilizing these specifications become the property of the Town of Smyrna upon acceptance by the Director of Utilities. Utility lines and services (to property line or right-of-way only) will not be accepted by the Town unless and until they are in strict conformance with these specifications.

7.) One (1) set of plans, specifications and hydraulic calculations, including a vicinity map, shall be submitted for the initial review. If the plans are in order, with no major changes, the Developer or his Engineer will submit the number of additional sets of plans needed to Town's Utility Department for approval.

8.) Submittals shall be presented based on the Town's Planning and Utility Departments submittal schedules. Developers and their engineers are asked to submit drawings as far in advance as possible in order to conserve time at planning and utility meetings. For final Town's Utility Department approval, the following shall be submitted to the Director of Utilities.

A. The original marked-up copy.

B. One (1) full size set drawings including the vicinity map shall be submitted for approval.

C. One (1) electronic set (CD, USB flash drive/thumb drive, etc.) with drawings as a single PDF generated as 24X36 inch sheets, legible when printed on 11X17 inch paper.

D. One (1) set of hydraulic calculations for sewer as a single searchable PDF with Professional Engineer's stamp.

E. Appropriate Tennessee Department of Environment and Conservation (TDEC) fee for sewer review

F. TDEC fee schedule form for sewer review (CN-1457)

Approval of the plans and specifications by the Tennessee Department of Environment and Conservation, Tennessee Department of Transportation, Railroads, Corps of Engineers, Tennessee Valley Authority, and any other agency having jurisdiction is required before beginning construction. Prior to acceptance of the sewer system components by the Town, two sets of paper "Record Drawings" along with digital drawings (compatible with the Town of Smyrna's Utilities Department software) showing all work, changes, elevations, line locations, service locations, manhole locations, manhole invert elevations, easements, and other data required for complete "Record Drawings" shall be submitted to the Director of Utilities after each project or phase of a

project is completed. The “Record Drawings” shall be reviewed by the Utilities Department and may require additional information prior to acceptance of the sewer system components.

9.) Detailed drawings and specifications shall be submitted by the Engineer employed by the Developer for any special condition or structures such as lift stations, creek crossings, etc., and approved by the Director of Utilities before beginning any construction.

10.) All applicable Federal and State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply throughout the design, approval, and construction process.

11.) Sizes and locations of all water lines, components, appurtenances, and construction methods shall be in accordance with these Standard Specifications and plans approved by the Town. If plans are approved by the Town and they are later found not to be in compliance with these standard specifications or other requirements (as deemed necessary by the Director of Utilities) then they shall be revised to such standards required and shall be constructed accordingly prior to acceptance by the Town.

12.) Permits for pavement cuts or crossing of public roads, including any special backfill and pavement repair as required by the agency having jurisdiction, are the responsibility of the Developer. A bond is required from the Developer to cover all costs of repair and maintenance for a period of one (1) year from the date of acceptance of the project for all work performed in existing rights-of-way of all roads. Open road cuts will not be allowed unless approval has been granted by both the Director of Utilities and the Department of Public Works.

13.) If construction has not started within one (1) year from the date of approval then that approval will no longer be valid. Utility plans shall be resubmitted to renew approval. Renewal will not be automatically guaranteed, but will be based on current review and existing conditions.

14.) The Contractor's name, project name, project location, and estimated working time for each project shall be submitted to the Director of Utilities prior with the plans submitted for review and approval.

15.) Test reports and pump certifications shall be provided by the developer on all lift stations to assure that it meets the requirements of the Town’s specifications.

16.) Shop drawings for utility materials shall be submitted to the Director of Utilities for review after being thoroughly checked by the Contractor and stamped with his approval.

17.) The Town reserves the right to require relocation of sewer lines on the construction plans to facilitate maintenance.

18.) All utility construction shall be in accordance with specifications of the Town of Smyrna.

19.) All grading work shall be completed and all roads constructed to subgrade and lot corners are to be marked prior to the installation of utility lines.

20.) The contractor shall be responsible for locating and verifying the elevations of existing utilities prior to construction.

21.) A one-(1) year warranty period will begin upon the date of acceptance of the project by the Town.

22.) Any special requirements shall be transmitted as a part of the approval.

23.) All plans shall be stamped by a Tennessee Licensed Professional Engineer.

1.1.2 Initial Plan Submittals:

The plans must be submitted at least twenty-one (21) days prior to the date on which action is desired. The initial submittal should include, but not be limited to the following:

1.) Three (3) copies of the proposed sewer system improvements with complete construction plans in addition to all sets required by the Planning Department.

2.) Complete project specifications in accordance with these Standard Specifications.

3.) Engineering reports including design criteria and calculations used in sizing of sewer lines, lift stations, and other components.

1.1.3 Easements

1.) When utility lines are constructed outside a public right-of-way, easements must be a minimum of 20 feet in width. Wider easements may be required after further review by the Director of Utilities. Easements required across private property or in roads are to be acquired by the Developer in the name of the Town.

2.) Easements for utility line extensions may be provided in either of two (2) ways.

3.) Easement document must be on a form approved by the Town, and must include legal description of the easement(s), legal owner's name and Book & Page where deed is recorded, must be signed by the Owner, and notarized.

4.) Record with Subdivision Plat - If this method of recording easements is chosen, a preliminary plat of the subdivision must be provided at the time of plans submittal, which clearly defines the easements to be recorded, along with a letter of intent from the Licensed Engineer or Licensed Surveyor who will stamp the final subdivision plat, assuring that easements will be recorded as shown on the preliminary plat.

5.) All easements must be obtained and recorded in developed areas before construction can begin. In new subdivisions the letter of intent and preliminary plat showing the easements will be sufficient to start construction. However, the Final Plat must be recorded prior to final acceptance of the new facilities.

6.) Special easements such as Railroad Crossings, Corp of Engineers, Tennessee Valley Authority, and State Highway crossings must be prepared by the Developer's Engineer as described above prior to commencement of construction.

1.1.4 Pre-Construction Conference

1.) Before beginning any construction, the Developer shall contact the Town and schedule a preconstruction conference and shall pay all tap fees and impact fees as required prior to issuance of building permits. The Developer, Engineer, and the Town's Utility Representative shall attend the meeting to discuss procedures for construction, inspection, connections to existing facilities, acceptance procedure by the Town, and any other special issues that are warranted for discussion. At this meeting, the Contractor will be informed of the Town's policies and any special requirements. Listed below is a CHECKLIST of items relating to the project:

2.) BEFORE Pre-Construction Conference:
- Developer is to coordinate the conference.
- Developer, or his Engineer, is to have project plans approved by all agencies.
- Developer is to have a contract with the utility contractor prior to the preconstruction meeting.

3.) Contractor is to have shop drawings approved by the Town.

4.) When submitting plans and shop drawings to the Town's Director of Utilities they will retain one (1) copy and the Town will retain two (2) copies. Shop drawings will not be reviewed unless they have been checked by the Contractor and stamped by him to indicate that they meet the Town's Standard Specifications.

5.) Developer is to have at conference:
- Approved plans by the Town's Utilities Department Staff.
- Copy of Contractor's contract (both off-site and on-site).

6.) To Attend Conference:
- Developer.
- Developer's Engineer.
- Developer's Contractor.
- Representative from the Town's Utilities Department and/or the Town's project engineer.

1.2 SANITARY SEWER STANDARD PROJECT REQUIREMENTS

The below referenced specifications shall serve as a minimum guideline requirement for Sanitary Sewer System designs and installations within the Town of Smyrna. These guidelines should not be construed as being the total requirements. More specific technical specifications are contained in this manual for more detailed requirements for individual components of the proposed sewer system construction.

The Town of Smyrna may at its option require additions to be made to the plans and installations where circumstances warrant. The following requirements shall be included on all plans submitted to the Town of Smyrna for review and approval:

1.) Plans shall be drawn on a standard 24" x 36" or 30" x 42" sheets.

2.) A cover sheet shall be made a part of all plans, and shall incorporate a location map on an approximate scale not less than 1" = 1,000', the name of the project and, the names, addresses and telephone numbers of the Developer and the Design Engineer.

3.) Include a key map indicating sheet numbers for each sewer line.

4.) Sewer plans must be on plan and profile sheets, with contour lines shown in the plan portion and the lowest elevation of the sewer line beginning on the left side of the sheet in the profile.

5.) Construction plans shall show all existing and proposed utilities, including but not limited to, gas lines, underground telephone cables, power and telephone lines, water mains, sanitary sewer lines, storm sewers, etc.

6.) The scale of the plan/profile sheet will be: Plan 1" = 50' horizontal, Profile 1" = 5' or 1" = 10' vertical.

7.) All sewer plans shall include at least one (1) benchmark based on U.S.G.S. Datum. Additional bench marks shall be shown at approximately 1,500 feet intervals. The use of a manhole invert elevation or an assumed elevation will not be acceptable.

8.) Show all topographic features, such as driveways, pavement, rights-of-way, property lines, storm drainage structures, fencing, etc.

9.) The direction of the North should be clearly shown on all plans.

10.) All property lines are to be shown on the plans and each parcel is to be shown with the map and parcel number, lot number and/or street address.

11.) A connection must be provided for each parcel or proposed lot. The connection will be shown as a SDR 26 PVC tee or wye (or same material as the main line; HDPE, ductile iron, etc.) and a six (6) inch SDR 26 PVC service line extension where applicable. **Handmade tee and wye connections are not acceptable.** When laying the mains in private property a tee or wye and ten (10) feet of 6-inch service line shall be provided for each existing parcel.

12.) A maximum of three (3) six (6) inch service lines will be allowed into permanent end manholes, and a minimum 45 degree alignment differential must be maintained between them. At no time will an angle less than 90 degrees be permitted between the upstream sewer main or service line connections to the manhole and the out or downstream sewer main. The service lines shall enter into the manhole through a rubber Kor-N-Seal boot connector or an approved equal. The service lines should enter the manhole at grade of the base of the manhole and the invert must be properly shaped to convey flow from the service connection to the manhole invert bench. Should the service line be connected to the manhole above the manhole bench then an outside drop connection shall be constructed for the service line with stainless steel straps. The maximum length of a service line from the sewer main to property line shall be seventy-five (75) feet between 6” clean outs.

1.3 SPECIAL PIPE CONSIDERATIONS:

1.) In areas which have been filled and the proposed pipe will be within the fill, a minimum of Class 350, ductile iron pipe must be specified.

2.) If ductile iron pipe is specified for any part of a sewer, then it must be specified from manhole to manhole; jointing of two different type pipes between manholes will not be permitted.

3.) Due to maintenance considerations, it will be The Town's policy to require that all lateral sewers proposed at depths less than 4 feet and greater than 15 feet be constructed of ductile iron pipe and any service line risers from this depth also be ductile iron pipe. This condition should be avoided whenever possible and first consideration given to other routes.

4.) All sanitary sewers shall have a minimum of 30 inches cover in private property and 48 inches in paved areas subject to vehicular traffic. Across drains and areas where cover is less than as indicated above, ductile iron pipe and/or concrete encasement will be required.

1.4 MANHOLES:

1.) Manholes shall be installed at the upper end of each line; at all changes in grades, size, or alignment; at all intersections; and at distances not greater than 350 feet for sewer lines 15 inches in diameter or less, the manhole shall be 4 feet in diameter; 400 feet for sewer lines 16 to 21 inches in diameter, the manhole shall be 5 feet in diameter; and 500 feet for sewer lines over 22 inches in diameter, the manhole shall be 6 feet in diameter.

2.) When sewers are proposed along drains and lie within a potential flood plain or lie adjacent to a drainage ditch or drainage structure in which there is a potential of storm water entering the sanitary sewer, the Town will require approved watertight frames and covers (JBS 1123 casting) to be installed on the manholes.

3.) A vent stack assembly will be required on watertight manholes at intervals no greater than 1,000-feet.

1.5 SEWER EXTENSIONS AND CONNECTIONS

1.) When sewers are proposed to serve new subdivisions, contour elevations must be shown on the sewer plans. Subdivision grading, drainage, water system, and road plans must be submitted with the sewer plans for review, and must contain a typical section of the proposed roadway. Plans should designate which roads are to be public and which are to be private, as well as designating which sewer lines are to be private. All proposed developments shall extend the public sewer main to the far property line for future sanitary sewer extensions as directed by the Director of Utilities.

2.) If no other means are available and a smaller line is to be connected to a larger line, concrete collars are not allowed. Only an approved compression coupling or rubber O-ring style coupling such as "Fernco" will be acceptable. The practice of "hammer tapping" a sewer line is not allowed with the International Plumbing Code and is not an acceptable method of connecting a service line to a new or existing sewer line. In all cases, a tee, wye, or tapping saddle shall be used.

3.) Any time sewer lines are proposed to serve property where the "serviceability" of a lot or structure is questionable, the lot or structure must be identified with the following note: The service tee is to be placed at the lowest possible elevation on the main line and the service line is to be laid on a minimum slope. The home builder is responsible for locating the elevation of the end of the service line and setting building finished floor elevations such that gravity service is available. This note is also to be put on the recorded plat identifying critical lots and critical finished floor elevations.

1.6 WASTEWATER LIFT STATION REQUIREMENTS:

1.) Wastewater lift station design criteria shall be in accordance with the Tennessee Department of Environment and Conservation (TDEC), Division of Water Resources (DWR) “Design Criteria for Review of Sewage Works Construction Plans and Documents”.

2.) Lift stations shall be of the submersible type configuration utilizing pumps as manufactured by Flygt or an approved equal. For each pump in service, it shall have a 3-phase power supply, operate on 460/480 volts at 60 hertz, and be equipped with appropriate horsepower.

3.) The finished elevation of the lift station shown on the plan view shall be a minimum of six (6) inches above finished grade. The finished floor elevation or top-of-slab shall be located at a minimum elevation of 2-feet above the 100-year flood elevation where located within a floodable area. Provide a potable water tap with a frost proof hydrant and reduced pressure backflow preventer.

4.) Construction of the lift station shall include a paved (asphalt or concrete) driveway, minimum 6-feet high chain-link fence (or decorative fencing where required) enclosing the site, minimum 12-feet wide gates for access, odor control system (as determined by the Town’s Director of Utilities), and a SCADA Monitoring and Control System (as determined by the Town’s Director of Utilities) compatible with the Town’s existing SCADA System. The Town will evaluate separately the materials and criteria proposed for use in the design of wastewater lift stations. Plans and specifications must be submitted to the Town for review and approval. Once approval has been given by the Town, plans and specifications must be submitted to the TDEC, DWPC for approval.

5.) Design criteria for the proposed pumping station shall include, but not limited to, the following:

a. Topographic map with the drainage area clearly defined and the acreage shown.

b. Complete information concerning the proposed area of service, including the number and type of proposed units.

c. Complete anticipated flow data based on Tennessee Department of Environment and Conservation design criteria and utilizing a peak factor of 2.5.

d. Complete details of possible alternate gravity sewers to serve the same area, including cost estimates of both type systems.

e. Designed for the estimated ultimate tributary population.

1.7 FORCE MAIN REQUIREMENTS:

1.) The following design considerations are required for all force mains:

a. Velocity: At design flow, velocity in excess of two (2) feet per second (fps) shall be maintained. The force main shall be sized as not to allow velocities greater than 8 fps. A range of velocities shall be presented for current and future flows.

b. Air Release/Vacuum Valve: An automatic air release/vacuum valve (with rider pipe isolation gate valve) shall be placed at high points in the force main to prevent air-locking and creation of vacuums within the force main. The air release/vacuum valve shall be as manufactured by Val-Matic or an approved equal.

c. Termination: Force mains shall terminate in the invert of a manhole or utilize an inside drop with a 45-degree fitting to transition the flow to the invert of the manhole. The inside drop connection shall be secured to the manhole wall with stainless steel straps and anchor bolts.

d. Pipe Diameter: Force mains are to be a minimum of two (2) inches in diameter.

e. A maximum Hazen and Williams "C" factor used should not be greater than 130 regardless of that actually determined for the pipe.

f. Force mains using minimum two (2) inch ductile iron, Protecto 401 ceramic epoxy lining, Class 350, slip-on type joint meeting the latest requirements of AWWA Standard C151 or Class 200 PVC with a minimum of three (3) feet of cover will be acceptable to the Town of Smyrna.

g. For detection purposes, a 12 gauge solid strand copper tracing wire (shielded) and an approved metallic tape shall be identified as "sewer" and be installed as per the manufacturer's instructions. The 12 gage detection wire shall be duct taped to the force main during installation. Bury the metallic tape 12 inches below the subgrade. Connections between the detection wires shall be soldered or connected with wire nut fasteners and wrapped.

1.8 SEWER SYSTEM DESIGN CRITERIA:

1.8.1 Sewer Capacity

In determining the required capacities of sanitary sewers, the following factors must be considered:

a. Maximum peak hour and diurnal flows to be received by the sewer system.

b. Maximum wastewater from industrial plants.

c. Groundwater infiltration.

1.8.2 Design Flows

The following flow considerations are to be utilized when sizing sewer systems:

a. Per capita flow: Sewer systems serving residential development should be designed on the basis of an average daily per capita flow of wastewater of not less than 80 gallons per day. This amount of flow is assumed to cover nominal infiltration, but an additional allowance should be made where conditions are unfavorable. Additional flows contributing to the system should also be accounted for such as industrial, commercial, and manufacturing.

b. The sewers should be designed to carry, when running full, not less than the following daily per capita contributions of wastewater, exclusive of wastewater from industrial plants:

- Laterals and sub-main sewers; 400% of average design flow
- Main, trunk & outfall sewers: 250% of average design flow.

1.8.3 Minimum Size

No sewer collection line shall be less than eight (8) inches in diameter.

1.8.4 Depth

In general, sewers should be deep enough to drain basements and to prevent freezing. Where practical, a minimum depth of five (5) feet should be maintained.

1.8.5 Slope

All sewers shall be so designed and constructed to give mean velocities, when flowing half full, of not less than 2.0 feet per second and no more than 10.0 feet per second. The minimum required slopes for 8 inch through 12 inch sewer mains are shown below. However, these slopes should be used only when required. All sewers shall be laid with uniform slope between manholes.

SEWER SIZE (inches)	MINIMUM SLOPES (ft. per 100 ft.; %)	MAXIMUM SLOPES (ft. per 100 ft.; %)
8	0.40	8.0
10	0.28	6.0
12	0.22	5.0
15	0.15	3.75
16	0.15	3.75
18	0.12	3.0
21	0.10	2.4
24	0.080	2.0
27	0.070	1.6
30	0.060	1.4
36	0.050	1.1
42	0.042	0.85
48	0.040	0.75

The slope for a sewer service shall be a minimum of 1.0% and a maximum of 8.0 % (foot per 100-ft) for a 6-inch sewer service.

1.8.6 Alignment

Sewers shall be designed with straight alignment between manholes.

1.8.7 Increased Size

When a smaller sewer line joins a larger sewer line (at a manhole), the inverts of pipes of the two sewer lines should be placed to maintain the same energy gradient. The crown of each pipe shall match.

1.8.8 High Velocity Protection

Ductile iron pipe shall be used when slopes are greater than:

SEWER SIZE (INCHES)	SLOPE (FT/100 FT)
8	18
10	13
12	9

1.9 PROTECTION OF WATER SUPPLIES:

1.9.1 Water Supply Interconnections:

There shall be no physical connection between a potable water supply line and a sewer or appurtenance thereto which would permit the passage of any wastewater or polluted water into the potable supply.

1.9.2 Relation to Water Mains:

a. Horizontal Separation: Whenever possible, sewers should be laid at least ten (10) feet horizontally from any existing or proposed water line. Should local conditions prevent a lateral separation of ten (10) feet, the water main may be laid within a separate trench and within the referenced 10-feet horizontal separation (only with the approval of the Director of Utilities) and only if the elevation of the top of the sewer pipe is at least 18 inches below the bottom of the water line.

b. Vertical Separation: Whenever a sewer must cross under a water main, the sewer shall be laid at such elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide the separation or reconstructed with ductile iron pipe for a minimum distance of ten (10) feet on each side of the sewer. At least one (1) full length of water main should be centered over the sewer so that both joints shall be as far from the sewer as possible.

c. When it is impossible to obtain proper horizontal and vertical separation as stipulated above. The sewer main shall be installed in a solid wall steel casing. Casing openings shall be sealed and be no less than 10 feet from the nearest edge of the water line. Both the water main and the sewer shall be pressure-

tested to ensure water tightness in accordance with the Town of Smyrna's Water Line Standard Specifications.

1.10 SEPARATION OF WATER & SEWER MAINS:

1.10.1 The following factors should be considered in providing adequate separation:

a. Materials and type of joints for water and sewer pipes.

b. Soil conditions.

c. Service and branch connections into the water main and sewer line.

d. Compensating variations in the horizontal and vertical separations.

e. Space for repair and alterations of water and sewer pipes.

f. Off-setting of pipes around manholes.

g. Water mains and sanitary or storm sewers shall not be laid in the same trench.

h. Water and sewer services shall maintain the same separation as mains.

1.10.2 Parallel Installation:

a. Normal conditions-Water mains shall be laid at least ten (10) feet horizontally from any sanitary sewer, storm sewer or sewer manhole. Whenever possible; the distance shall be measured edge-to-edge.

b. Unusual conditions-When local conditions prevent a horizontal separation of ten (10) feet, 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 18 inches 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 water tightness prior to backfilling.

1.10.3 Water and Sewer Crossing:

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

b. Unusual conditions-When local conditions prevent a vertical separation as described hereinbefore, the following shall be used:

i. Sewers passing over or under water mains shall be installed in a solid wall steel casing. Casing openings shall be sealed and be no less than 10 feet from the nearest edge of the water line.

ii. Water mains passing under sewers shall, in addition: be protected by providing a vertical separation of at least 18 inches between the bottom of the sewer line and the top of the water main; have adequate structural support for the sewers to prevent excessive deflection, settling, or breaking of the water main joints; and have the length of water line centered (at the point of crossing) so that the joints will be equidistant and as far as possible from the sewer. Both the sewer and the water main shall be constructed of water pipe and tested in accordance with the Town of Smyrna's Standard Water Specification.

1.10.4 Crossings at Sewer Manholes:

No water pipe shall pass through or come into contact with any part of sewer line or sewer manhole.

1.10.5 Surface Water Crossings:

a. Surface water crossings, both under and over water, present special problems which should be discussed with the Town of Smyrna; the Tennessee Department of Environment and Conservation, Division of Water Supply and Division of Water Pollution Control; and the U.S. Army Corps of Engineers before plans are prepared.

b. All surface water crossings shall be in accordance with the requirements of an Aquatic Resource Alteration Permit or COE permit.

i. Above Water Crossings-The pipe shall be:

- Adequately supported and pier supports designed by a structural engineer licensed and registered in the State of Tennessee
- Protected from damage and freezing.
- Accessible for repairs and replacement.

1.11 ONE YEAR WARRANTY

For a period of one year, after completion of all items of work and after written notice of acceptance of completed work by the Town, the Developer shall warrant the fitness and soundness of all work done and materials and equipment put in place. The Developer shall remedy any defects in the work which shall appear within a period of one year from the date of final acceptance of the work by the Town. The Town will give notice of observed defects with reasonable promptness.

1.12 SPECIAL PROJECT PROCEDURES

1.12.1 Smoking and Fire Precautions

No smoking, fire, or use of any fire or explosion producing tools, or equipment will be

permitted on the properties of oil companies or other concerns prohibiting the same on their premises or at any locations where such may endanger said premises or the current operations thereon.

1.12.2 Manufacturer's Qualifications

The manufacturers of all materials and equipment used must be reputable and regularly engaged in the manufacture of the particular material or equipment for the use and service to which it will be subjected.

1.12.3 Developer Shall Pay for All Laboratory Inspection Service

All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Developer and approved by the Town of Smyrna Director of Utilities. The Developer shall pay for all laboratory inspection services as a part of the required work. Submit all material test reports to the Director of Utilities in triplicate.

1.12.4 Compliance with State and Local Laws

Comply with all applicable requirements of state and local laws and ordinances to the extent that such requirements do not conflict with federal laws or regulations.

1.12.5 Markers

Preserve all Corps of Engineers, USGS, TVA, State of Tennessee, and private markers; do not remove or disturb any such markers without prior approval from the Director of Utilities. Any removal and replacement of such markers shall be at the expense of the Developer.

1.12.6 Pavement Repair and/or Replacement

Whenever pipe trenches are cut across or along existing pavement or shoulders, backfill the same and restore traffic over the cuts as quickly as possible by constructing a temporary twelve-inch (12") surface of Class A, Grade D crushed stone. Add material and otherwise maintain such surface until the permanent pavement is restored or until the entire project is accepted.

1.12.7 Approved Chemicals

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. The use of all such chemicals and the disposal of residues shall be in strict conformance with all applicable instructions and federal, state and local regulations.

1.12.8 Department of Transportation Permits

The Developer will secure any permits and provide bonds as required by the Tennessee Department of Transportation for the installation of permanent facilities on State

Highway rights-of-way. The costs for such bonds and/or permits, if applicable, shall be paid by the Developer. All such work shall be coordinated with and be subject to the approval of the Tennessee Department of Transportation, in addition to the approval of the Town of Smyrna and the Director of Utilities.

The Developer will secure any permits as required by the local Public Works and the County Highway Department for the installation of sewer lines within the rights-of-way of local and county roads. The Developer shall be responsible for complying with the requirements of the local Public Works, County, and Traffic Department, and all such work shall be coordinated with and be subject to their approval.

1.12.9 Installation, Testing and Guarantee

The completely installed system shall be guaranteed against any and all defects of operations, manufacture, materials, workmanship, or installation for a period of one year from the date of written acceptance by the Town of Smyrna.

1.12.10 Drawings of Records

The Developer shall provide and keep up-to-date a complete record set of blue line prints, which shall be corrected daily to show every change that has occurred with the project. Keep this set of prints at the job site, and use only as a record set. This shall not be construed as authorization for the Developer to make changes in the approved layout without definite instructions and approval by the Director of Utilities in each case. These record drawings shall be converted to digital format by the developer's engineer and shall be submitted to the Town of Smyrna in a format compatible with the Town's Utilities Department software. Drawings and records shall be provided to the Town's Utilities Department before any building permits or certificate of occupancy (CO's) is issued.

1.12.11 Detection Wire

For detection and location purposes of force mains, a 12 AWG solid copper tracing wire (shielded) shall be installed as per the manufacturer's instructions. Connections between wires shall be connected with Dryconn Waterproof Connectors. Also, metallic tape marked "sewer" shall be provided 12" below grade directly above the force main.

1.12.12 Utilities

The Developer shall contact the owner of all underground utilities before beginning construction in the area. Carefully protect from damage all utilities in the vicinity or the work at all times. If it is necessary to repair, remove, and/or replace any such utility in order to complete the work properly, do so in compliance with the rules and regulations of the particular utility involved. Any such work shall be considered incidental to the construction of the project. A Tennessee-One-Call shall be performed by the developer's contractor prior to commencement of any work in the area of existing utilities.

1.12.13 Insurance

The Contractor shall procure, maintain, and furnish, and provide an Owner's protective

policy with the Town of Smyrna named insured and as hereinafter specified:

Owner's General Public Liability and Property Damage Insurance including vehicle coverage issued to the Owner and protecting the Owner from all claims for personal injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with any operations under the Contract Documents, whether such operations be by the Contractor or by any Subcontractor employed by the Contractor or anyone directly or indirectly employed by the Contractor or by a Subcontractor employed by the Contractor. Insurance shall be written with a limit of liability of not less than $1,000,000 for all damages arising out of bodily injury, including death, at any time resulting therefrom, sustained by any one person in any one accident; and a limit of liability of not less than $1,000,000 aggregate for any such damages sustained by two or more persons in any one accident. Insurance shall be written with a limit of liability of not less than $500,000 for all property damage sustained by any one person in any one accident; and a limit of liability of not less than $500,000 aggregate for any such damage sustained by two or more persons in any one accident.

This requirement for an Owner's protective policy shall be in addition to any and all other insurance requirements as set forth in the Contract Documents, if applicable.

1.12.14 National Pollution Discharge Elimination System (NPDES) General Permit for Municipal Separate Storm Sewer System (MS4) Phase II Program

All work shall be in accordance with the Town of Smyrna's National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Phase II Program. Prior to any excavation activities commencing, the developer, developer's engineer, and/or contractor shall apply for and receive an approved permit from the Town of Smyrna for such excavation activities. The application for permit will be reviewed by the Program Director and an approved permit shall be obtained prior to excavation activities. All erosion and sediment runoff control measures shall be installed in accordance with the approved permit and shall be maintained throughout the project cycle and until adequate and approved vegetative cover has been established.

1.12.15 Sign Installation

The Town shall direct the contractor in the installation of utilities signs and post locations. This is to be done at the contractor's cost.

1.12.16 Thrust Blocks & Restraints for Sanitary Sewer Pipes & Re-claimed Water Pipes under Pressure

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

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

1. Poured concrete under a pipe of sufficient volume to counteract unbalanced force with steel clamp and anchor bolts to hold fitting to concrete as per standard drawings.

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

When using all thread rods for restraint purposes, the number of rods used shall be a minimum of half the pipe's size (Ex. 8" water main will have four (4) all thread rods.) The all thread rods shall be used in conjunction with mega-lug joint restraints that are the same size as the pipe size that is being restrained. The all thread rods shall be stainless steel and/or have a coating to protect the rods from rusting.

AMOUNT OF ALL THREAD RODS PER PIPE SIZE

Pipe Size(s)	Number of Rods Needed
4"	2
6"	4
8"	4
10"	6
12"	6
14"	8
16"	8
18"	10
20"	10
24"	12
30"	16
36"	18
42"	22
48"	24

1.12.17 Oil-water Separators and Grease Traps

Each facility that deals with oil and/or chemicals to be discharge into the sanitary sewer system shall have an oil-water separator/grease trap installed within its sanitary sewer service. The facility owner/developer/renter/contractor shall complete an oil-water separator/grease trap data sheet, which shall be turned into the Utilities Department engineer(s) for review. The minimum size of an oil-water separator/grease trap shall be 1500-gallon unless specified by the Town's engineer(s) in the Utilities Department. Details and/or information on the grease trap/oil-water separator that is to be used shall be given to the Utilities Department engineer for review.

A. 1500-gallon Grease Trap/ Oil-water Separator

When installing the grease trap/oil-water separator, it shall be installed 8 to 15-ft. away from the building. It is to have a cleanout on the upstream and downstream side surrounding the grease trap itself. The concrete grease trap/oil-water separator shall be traffic rated. There shall not be over 25-in. of risers used on the grease trap/oil-water separator. During inspection, a minimum of 10-ft. of pipe on the downstream side and 5-ft. of pipe on the upstream side needs to be uncover for the grease trap inspection.

B. 50gpm /100lbs. Grease Trap

If the capacity of the grease trap is calculated below 500-gallons, then a 50gpm/ 100lbs. grease trap shall be used. These grease traps are to be installed under the sink in question, and they are not to be installed outside of the establishment that is using the grease trap. The grease trap shall be pumped/cleaned quarterly.

1. During Construction Inspection

Before the floor is installed to where the grease trap is to be located, there is to be a minimum of 2-ft of pipe exposed from the sink to the sewer service. There is to be minimum of 1-ft of inlet and outlet pipe coming out of the grease trap. The grease trap shall be a Watts WD-L series grease trap and/or approved equal. The grease trap shall be metal and/or or approved equal material.

2. After Construction Inspection

The grease trap will be inspected quarterly. If deem so by the Town's Wastewater Treatment Plant inspector that the inspected grease trap is not adequate in size and/or is used to maximum capacity, then it is the **OWNER's** responsibility to upgrade the size of the grease trap itself. The **OWNER** is given a time frame of 90-days to make the proper improvements on the grease trap.

If any changes are added to the area that are needing a grease trap and/or oil receptacle apparatus (cooking fixture, drains, sinks etc.) are needed, then the **OWNER** is to contact the Utilities Department. A grease trap data sheet shall be filled out and submitted to the Utilities Department for calculations of capacity. Any changes request made by the **OWNER** shall be approved by the Wastewater Treatment Plant in the Utilities Department.

SECTION 2 - PRELIMINARY WORK

2.0 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.

2.1 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.

2.2 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(s) 48 hours prior to construction on property.

2.3 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.

2.4 BLASTING POLICY

The **CONTRACTOR** shall have existing water, sewer, and gas mains located before blasting the construction site. The **minimum** distance that can be blasted from existing natural gas, water or wastewater lines is **25 feet** with an allowable weight in explosive pounds of ¾ pound. For increased weight in pounds of explosives, see the chart below from the Tennessee Blasting Standards Act (Tennessee Code 68-105-104) for the distance in feet from existing utilities:

ALLOWABLE MAX POUNDS OF EXPLOSIVES PER DAILY CALCULATIONS

For Distances Up to 300 Feet

Distance (ft.)	Weight (lbs.)	Distance (ft.)	Weight (lbs.)	Distance (ft.)	Weight (lbs.)
0-10	1/8	70	6.00	190	21.00
11-15	1/4	80	7.25	210	23.50
16-20	1/2	90	8.50	230	26.00
21-25	3/4	100	9.75	250	28.50
26-30	1.00	110	11.00	270	31.00
40	2.25	130	13.50	290	33.50
50	3.50	150	16.00	300	34.75
60	4.75	170	18.50		

For Distances 301-ft. to 5000-ft.

$W(lbs.) = (d(ft)/55)^2$

For Distances 5001-ft. and Up

$W(lbs.) = (d(ft)/65)^2$

The developer/contractor will need to submit a blasting plan to Smyrna Utilities showing their pounds of explosives per hole.

SECTION 3 – MATERIALS

3.0 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 manufacturers, 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.

3.1 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, and latest revision. Cement shall be furnished in undamaged 94 pound, one (1) cubic foot sacks, and shall show no evidence of lumping.

3.2 CONCRETE FINE AGGREGATE

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

3.3 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.

3.4 WATER

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

3.5 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 ENGINEER's approval of such proportions.

3.6 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.

3.7 CLASS "B" CONCRETE

Class "B" concrete shall have a minimum compressive strength of 3000 pounds per square inch in 28 days and shall contain not less than 4-1/2 sacks of concrete per cubic yard.

3.8 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.

3.9 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.

3.10 PEA GRAVEL

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

3.11 MANHOLE FRAMES & COVERS

3.11.1 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 a 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.

3.11.2. Standard Manhole Frames and Covers:

Manhole frames shall be furnished and set in a bed of mastic and the outside grouted 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 so as to constitute a watertight seal between the barrel and the frame.

3.11.3 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 bent handle 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.

3.12 MANHOLE STEPS

Manhole steps shall be made of copolymer polypropylene plastic meeting the latest revision of ASTM 2146-68, Type II, and 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.

3.13 MORTAR MATERIALS

Mortar for manholes shall consist of one part of Portland cement to two parts of sand. Sand shall be 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.

3.14 PRECAST CONCRETE MANHOLES

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

3.15 CONCRETE SEWER PIPE - REINFORCED

Reinforced concrete sewer pipe shall not be allowed as an acceptable material.

3.16 CAST IRON PIPE

Cast iron pipe shall not be allowed as an acceptable material.

3.17 DUCTILE IRON PIPE

3.17.1 Material

Ductile iron sewer pipe shall conform to ANSI/AWWA Specification C151/A21.51, latest revisions, for ductile iron pipe centrifugally cast in metal or sand lined molds. Lining for the ductile iron pipe (DIP) shall be PROTECTO 401 Ceramic Epoxy or Ceramapure PL90 Ceramic Epoxy. Pipe shall be made with 60-42-10 grade ductile iron, or stronger, and pressure Class 350 shall be used unless noted otherwise on the Plans.

A JOINTS
Joints shall be push-on type compression joints unless otherwise indicated and shall conform to ANSI/AWWA/C111/A21.11, latest revisions. Gaskets and lubricant shall be furnished with the pipe.

B. TESTING
Testing of ductile iron pipe and joints shall be performed in accordance with ANSI/AWWA/C151/A21.51 and ANSI/AWWA/C111/A21.11, latest revisions.

C. MARKING
The weight, pressure, class, manufacturer's mark, year of manufacture and letters "DI" or "DUCTILE" shall be cast or stamped on the pipe.

D. CERTIFICATIONS
Manufacturer shall furnish certifications as follows:

1. That the pipe and joints have been manufactured in accordance with ANSI/AWWA/C151/A21.51 and ANSI/AWWA/C111/A21.11, latest revisions.

2. The pipe and joints have been tested in accordance with the procedures and outlined in ANSI/AWWA/C151/A21.51 and ANSI/AWWA/C111/A21.11, latest revisions.

E. Pipe shall be furnished in lengths of eighteen (18') feet or twenty (20') feet (except for special construction conditions).

F. Interior coating for ductile iron pipe

3.17.2 Standard Specification for Lining Ductile Iron Pipe for Sewer Service

1. Condition of Ductile Iron prior to Surface Preparation

All ductile pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that

the entire interior of the ductile iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends.

2. Lining Material

The standard of quality is Protecto 401 Ceramic Epoxy or Ceramapure PL90 Ceramic Epoxy lining. The material shall be an amine cured novolac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.

A. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with test duration of 30 days.

B. The following test must be run on coupons from factory lined ductile iron pipe:

I. ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.

II. ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.

III. Immersion testing rated using ASTM D-714-87.

- 20% Sulfuric acid—No effect after two years.
- 140°F 25% Sodium Hydroxide—No effect after two years.
- 160°F Distilled Water—No effect after two years.
- 120°F Tap Water (scribed panel)—0.0 undercutting after two years with no effect.

IV. ASTM G-22 90 Standard practice for determining resistance of Synthetic Polymeric materials to bacteria. The test should determine the resistance to growth of Acidithiobacillus Bacteria and should be conducted at 30 degrees centigrade for a period of 7 days on a minimum of 4 panels. The growth must be limited only to trace amounts of bacteria.

C. An abrasion resistance of no more than 3 mils (.075 mm) loss after one million cycles using European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.

3. Application

A. Applicator:
The lining shall be applied by a certified firm with a successful history of applying linings to the interior of ductile iron pipe and fittings. All applicators must be independently inspected at least two times per year to insure compliance with the requirements of this specification. This

inspection must be coordinated and reviewed by the manufacturer of the lining material and any deviation from the application and/or quality requirements shall be corrected by the applicator. All inspections shall be in writing and a permanent record maintained.

B. Surface Preparation:
Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas with oil, grease, or any substance that can be removed by solvent, shall be solvent cleaned to remove those substances. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasively blasted using sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering oxide may be left on the surface. Any area where rust reappears before lining must be re-blasted.

C. Lining:
After surface preparation and within 12 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness. No lining shall take place when the substrate or ambient temperature is below 40°F. The surface also must be dry and dust free. If flange pipe or fittings are included in the project, the lining shall not be used on the face of the flange.

D. Coating of Bell Sockets and Spigot Ends:
Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum using Protecto 401 Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

E. Number of Coats:
The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. To prevent delamination between coats, no material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.

F. Touch-Up and Repair:
Protector 401 Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

4. Inspection and Certification

A. Inspection:

All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC PA-2 Film Thickness Rating.

The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2,500 volt test. Any defects found shall be repaired prior to shipment.

Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

B. Certification

The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

5. Handling

Lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling.

Care should be taken not to let the pipe strike sharp objects while swinging or being off loaded. Ductile iron pipe should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers.

6. Manufactures

Pipe shall be manufactured by U.S. Pipe/Griffin Pipe & Foundry Co., American Cast Iron Pipe Co., McWane Pipe/James B. Clow & Sons, or approved equal.

3.18 CAST IRON FITTINGS

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

3.19 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. For depths 0-3 feet PVC pipe is not allowed. For depths 4 ft. – 15 ft. PVC pipe shall be SDR-26 for gravity lines. For depths over 15 ft. PVC will not be allowed.

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

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

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

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

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

3.21 POLYVINYL CHLORIDE (PVC) SEWER FORCE MAIN

All sewer pipes shall be made from clean, virgin, NSF-approved, Type I, Grade I polyvinyl chloride (PVC), conforming to ASTM resin specification D-1784. All pipes 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 class 200 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 pipes shall have a metallic tape and 12 AWG gauge solid copper tracer wire. The metallic device shall be Terra Tape or equal and shall be compatible with City location equipment.

Manufacturer shall have the pipe tested in accordance with provisions of the 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 pipes used on this project.

All pipes 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 slip liner pipe shall be stainless steel conforming to ASTM C-425. Each coupling shall bear the manufacturer's name and an indication of its size.

3.23 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 Spirolite or equal.

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

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

The integral bell and spigot gasket joint is designed so that when assembled, the elastomeric gasket, contained in a machined groove on the pipe spigot, is compressed radially in the pipe bell to form a positive seal.

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

The selection and conditioning of pipe samples for testing shall be as established by the ENGINEER. Three (3) specimens of pipe, a minimum of twelve (12) inches long, shall be flattened between parallel plates in a suitable press until the distance between the plates is forty percent (40%) of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within two (2) to five (5) minutes.
Remove the load and examine the specimens for splitting, cracking or breaking. There shall be no evidence of splitting, cracking or breaking.

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

All pipes 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)

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

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

SECTION 4 - EXCAVATION & BACKFILL

4.0 GENERAL

The work called for by this section shall consist of clearing and grubbing, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work; the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping of trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the Director of Utilities, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below.

Products only approved within the standard specifications and/or as approved by the Director of Utilities.

4.1 PREPARATION OF THE SITE

4.1.1 Before starting construction, remove from the work site all vegetative growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the drawings and/or the PROJECT ENGINEER specifically indicate are to be removed. Dispose of this refuse material in a manner acceptable to the Town of Smyrna.

4.1.2 In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be shown on the drawings, specifically listed in the specifications, marked on the site, or identified by the Town of Smyrna Director of Utilities. In no case damage or remove such growth without written permission from the Owner.

4.1.3. If the area to be excavated is occupied by trees, brush, or other vegetative growth, clear such growth, grub the excavated area, and remove all large roots to a depth of not less than 2 feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the Town of Smyrna. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material, and compact to the same density as the surrounding material.

4.1.4 Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the Town of Smyrna. Take special precautions to protect and preserve such growth throughout all stages of the construction.

4.1.5 Preparation of the site shall be considered an integral part of the excavation and one for which no separate payment shall be allowed.

4.2 UNSUITABLE MATERIALS

4.2.1 Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, sub grade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1 inch to 2 inch lifts of crushed stone up to the level of the lines, grades, and/or cross sections shown on the drawings. The top 6 inches of this refill shall be No. 67 (TDOT) crushed stone for bedding.

4.3 ROCKS AND BOULDERS

4.3.1 Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as unclassified excavation, and no separate payment will be made therefore.

4.3.2 Should rock be encountered in the excavation, remove it by blasting or otherwise. Where blasts are made, cover the excavated area with enough excavated material and/or timber, steel, or rubber. Blast matting shall be used to prevent danger and damage to life and property. The Contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. The contractor shall be licensed for such operations and shall observe all applicable laws and ordinances pertaining to blasting operations.

4.3.3 Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the bottom of pipe up to 24 inches in diameter, not less than 8 inches below the bottom for 24 inch to 36 inch diameter pipes, and not less than 12 inches below the bottom for pipes larger than 36 inches in diameter, if rock extends to such depth. Then backfill the space below grade with No. 67 (TDOT) crushed stone or other approved material, tamp to the proper grade, and make it ready for construction. For monolithic concrete sewers and for structures, excavate rock to the outside bottom of the structure or sewer. Where pipelines are constructed on concrete cradles, rock shall be excavated to the bottom of the cradle.

4.4 DISPOSAL OF MATERIALS

4.4.1 Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the Town of Smyrna shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of by the Contractor at no additional cost as specified below.

4.4.2 Waste materials may be deposited in spoil areas at locations approved by the Town of Smyrna. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain. Seed as specified in Section 02485, Seeding.

4.4.3 Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat and workmanlike condition, as described below.

4.4.4 The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

4.5 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

4.5.1 Unclassified excavation for pipelines shall consist of the excavation necessary for the construction of water, sewer, and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials, all of which shall conform to the applicable provisions set forth elsewhere in these specifications.

4.5.2 The Contractor may, if he chooses, use a motor powered trenching machine. If he does, however, he shall be fully responsible for the preservation or repair of existing utility service connections.

4.5.3. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically required by the Director of Utilities, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the design engineer on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: 4/3d + 15 inches, where "d" represents the internal diameter of the pipe in inches. When approved in writing by the design engineer and the Director of Utilities, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to non-vertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula 4/3d + 15 inches shall be at the expense of the Contractor and may cause the Town of Smyrna to require that stronger pipe and/or a higher class of bedding be used at no cost.

4.5.4 For rigid pipe, shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel. For plastic sewer lines, provide a minimum of 6 inches of No. 67 (TDOT) crushed stone for bedding.

4.5.5 Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than two (2) joints ahead of pipe laying.

4.5.6 Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than that required to allow a 2-foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures. Should the Contractor excavate below the elevations shown or specified, he shall, at his own expense, fill the void with either concrete or granular material approved by the Town of Smyrna.

4.5.7 Do not excavate pipe trenches more than 200-feet ahead of the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the Director of Utilities deems necessary to maintain vehicular or pedestrian traffic.

4.5.8 In all cases where materials are deposited along open trenches, place them so that in the event of rain no damage will result to the work and/or to adjacent property.

4.5.9 Excavation for other structures may be performed with non-vertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2- foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings.

4.6 SHEETING, SHORING, AND BRACING

4.6.1 Take special care to avoid damage wherever excavation is being done. Sufficiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have enough strength and rigidity to withstand the pressures exerted, to keep the walls of the excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring, and bracing, which are considered an incidental part of the excavation work.

4.6.2 Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5-feet high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less than 5-feet deep when examination of the ground indicates hazardous ground movement may be expected. Guard the walls and faces of all excavations in which employees are exposed to danger from moving ground by a shoring system, sloping of the ground, or some equivalent protection.

4.6.3 The contractor shall comply with all OSHA standards in determining where and in what manner sheeting, shoring, and bracing are to be done. The sheeting, shoring, and bracing system shall be designed by a professional engineer licensed in the State of Tennessee and shall be subject to approval by the design engineer for the project. However, such approval does not relieve the Contractor of the sole responsibility for the safety of all employees, damage to any property, the effectiveness of the system, and any damages or injuries resulting from the lack and/or inadequacy of sheeting, shoring, and bracing.

4.6.4 Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary, with the approval of the PROJECT ENGINEER.

4.6.5 Do not leave sheeting, shoring, or bracing materials in place unless this is called for by

the drawings, ordered by the design engineer, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.

4.6.6 Fill and compact all holes and voids left in the work by the removal of sheeting, shoring, or bracing as specified herein.

4.6.7 The Contractor may use a trench box, which is a prefabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.

4.7 DEWATERING OF EXCAVATION

4.7.1 Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the Town of Smyrna. Give special attention to excavations for those structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift.

4.8 BORROW EXCAVATION

4.8.1 Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the Town of Smyrna. All federal, state, and local regulations concerning borrow pits, drainage and erosion control shall be strictly followed.

4.8.2 Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the Town of Smyrna.

4.8.3 Properly clear and grub borrow pits, and remove all objectionable matter from the borrow pit material before placing it in the backfill.

4.8.4 The taking of materials from borrowed pits for use in the construction of backfill, fills, or embankments shall be considered an incidental part of the work; no separate payment shall be made for this.

4.9 BACKFILLING

4.9.1. Before backfilling, give the Town's inspector ample notice and time for inspecting backfilling. Begin backfilling after the line construction is completed and then inspected

and approved by the Town of Smyrna. Trenches shall contain 6-inches of stone under the pipe and on each side with 12-inches of stone placed above the pipe.

4.9.2 Backfill material above the pipe envelopes shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clod, vegetable matter, debris, stone, and/or objectionable materials and that has a size of no more than 2-inches. Place this backfill simultaneously on either side of the trench in even layers that before compaction are no more than 6 inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. When shown on the drawings, this backfill shall, at locations beneath or closely adjacent to pavement, consist of No. 67 (TDOT) crushed stone. Compaction of backfill material layers shall be at 98% by standard proctor test. Where adjacent to and within paved areas the top 12-inches of the trench at subgrade shall consist of crusher-run stone compacted at 98% by standard proctor test. Compaction testing shall be at intervals directed by the site inspector.

4.9.3 In areas approved by the Town of Smyrna, from 1 foot above the pipe upward, the backfill material may contain broken stones that make up approximately 3/4 of the backfills total volume. However, if this type of backfill is used, there must be enough spoils and earth materials to fill all voids completely. The maximum dimension of individual stones in such a backfill shall not exceed 6 inches, and the backfill material shall be placed and spread in even layers not more than 12 inches deep. At the direction of the Director of Utilities, at locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are at least 6 inches deep. Compaction tests shall be required for the 12-inch lifts to meet 98% standard proctor density. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

4.9.4 If earth material for backfill is, in the opinion of the Town of Smyrna, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the Town considers too wet or otherwise unsuitable.

4.9.5 Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clod, vegetative matter, debris, stone, and/or other objectionable materials.

4.9.6 Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D, and crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner. On heavily traveled roadways and as required by the Town of Smyrna, cold mix or leveling course binder minimum of 4-inches thick shall be installed and maintained until permanent pavement is installed.

4.9.7 Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.

4.9.8 Wherever pipes have diameters of 15 inches or less, do not use power operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.

4.9.9 Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the Town of Smyrna.

4.9.10 Acceptable Backfill Material: Where crushed stone backfill is required the crushed stone shall be No. 67 size as designated by Tennessee Department of Transportation Specifications and shall meet all requirements of the TDOT Specifications for crushed stone used in road surfacing.

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

Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the Town of Smyrna requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

4.9.11 Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the Town of Smyrna requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

4.9.12 Compaction Requirements: Unless specified otherwise elsewhere, under buildings and 2 times the depth of pipe beyond, and under roads and 2 times the depth beyond the shoulder, compact to 98% maximum density in accordance with ASTM D698. In all other locations, compact soil to 90%.

4.10 MAINTENANCE

4.10.1 Seed and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the Town of Smyrna.

4.10.2 Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the Town of Smyrna. Continue such maintenance until final acceptance of the project or until the Town of Smyrna issues a written release.

4.11 SLOPES

4.11.1 Neatly trim all open cut slopes, and finish to conform to either the same as the slope lines shown on the drawings or the directions of the Town of Smyrna. Leave the finished surfaces of bottom and sides in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the Contractor will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical

equipment. Conduct grading operations so that material is not removed or loosened beyond the required slope.

SECTION 5 - EROSION CONTROL

5.0 GENERAL

This work shall consist of erosion control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. The protection of these sites shall continue throughout the construction period. During flood seasons, protect the sites by sandbagging, the pumping of water, and any other means appropriate to restrain flooding of plants and equipment. During dry weather, sprinkle the sites with water or use other means as necessary to provide dust control. In case of abnormally cold weather, any construction such as excavation work may be delayed until warmer weather or covered to prevent freezing.

All work shall be in accordance with the Town of Smyrna's National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Phase II Program. Prior to any excavation activities commencing, the developer, developer's engineer, and/or contractor shall apply for and receive an approved permit from the Town of Smyrna for such excavation activities. The application for permit will be reviewed by the Program Director and an approved permit shall be obtained prior to excavation activities. All erosion and sediment runoff control measures shall be installed in accordance with the approved permit and shall be maintained throughout the project cycle and until adequate and approved vegetative cover has been established. Erosion control measures such as straw bale berms (See Standard Drawing EC-1 "Temporary Straw Bales Detail"), silt fencing, check dams, or other applicable measures.

5.1 EROSION CONTROL ON CONSTRUCTION SITE

Temporarily stabilize areas from which topsoil has been removed and topsoil stockpiles by seeding fast growing annuals such as rye and annual ryegrass that provide quick protection. These annual grasses are to be seed certified by the State Department of Agriculture and can be worked into the soil when the site is prepared for final seeding of more permanent species. Use commercial lime and fertilizer on exposed areas, subject to severe erosion.

5.1.1 Conduct construction so as to provide the site with maximum protection from erosion at all times.

5.1.2 Conduct excavation activities to provide erosion and sediment control as follows:

1. Do not start clearing and excavation until a firm construction schedule is submitted to and approved by the Town of Smyrna. Continuously coordinate the schedule with the clearing and excavation activity.

2. In streets and other paved areas, remove excavated material from the site as construction progresses to prevent any erosion of this material.

3. In other areas, place the excavated material so as not to block any drainage area. Replace this excavated material in the trench immediately after repairs have been completed and are approved by the Town of Smyrna.

4. Retain natural vegetation whenever feasible. Install sediment control measures where needed and maintained throughout the project.

5. Restore and cover exposed areas subject to erosion as quickly as possible by means of seeding and mulching. Use diversion ditches or other methods as appropriate to prevent storm water from running over the exposed area until seeding is established as specified.

6. Take particular care along streams and drainage ditches so that fallen trees, debris, and excavated material will not adversely affect the stream flow. Exercise care to minimize the destruction of stream banks. Wherever the stream banks are affected by construction, reduce the slope of the stream banks to provide a suitable condition for vegetation protection. Minimize land exposure in terms of area and time.

7. Cover exposed excavated areas with mulch or vegetation.

8. Mechanically retard the rate of runoff water.

9. Trap the sediment contained in the runoff water utilizing approved sediment control measures.

10. Divert water from erosive areas.

11. Take care during the pouring of concrete, hauling of materials, etc., to keep vehicles from creating a severe erosion problem. Proper scheduling of operations and prompt repair of ruts created during this operation is necessary from this source.

12. Control dust by sprinkling or other means as necessary to keep it to a minimum.

13. Pave or otherwise stabilize roadways and driveways as soon as feasible.

14. Regrade and reseed surfaces eroded or otherwise damaged during any and all construction operations as necessary.

SECTION 6 – GRADING

6.0 GENERAL

6.01 The work called for by this section shall include, but not necessarily be limited to, finish grading and the spreading of any shaping of topsoil to the finished contour elevations indicated by the drawings and/or as existed prior to commencement of construction.

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

6.1 TOPSOIL

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

6.2 SITE GRADING

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

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

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

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

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

2. Hand grade steep slopes and areas that are inaccessible for machine work.

3. Protect graded areas from undue erosion, and repair and re-grade areas where erosion does occur.

4. Refill areas where noticeable settlement has occurred.

5. Finish grade areas that are to receive topsoil up to four (4) inches below the finished contour elevations called for by the drawings or, over rock, to 12 inches below these elevations.

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

1. Obtain approval of the finish grading from the project engineer and the Town of Smyrna before starting to place topsoil.

2. Scarify subgrade to a depth of three (3) inches.

3. Place the topsoil to a depth of four (4) inches when lightly rolled or, on rock, to a depth of 12 inches.

4. Level the topsoil so that it slopes uniformly and has no water pockets.

5. Carefully rake the topsoil by hand to remove all clods, roots, sticks, stones over one (1) inch in diameter, and other foreign materials from the surface.

6.2.6 Dispose of excess excavated materials and debris away from the site at an approved location.

SECTION 7 – SEEDING

7.0 GENERAL

7.0.1 This work shall be performed in all disturbed areas not receiving such site improvements as buildings, roads, walks, sod, planting, etc., and shall include, but not necessarily be limited to, all seed bed preparation; the supplying and placing of soil additives, seed, and mulch wherever required by the drawings or directed by the Town of Smyrna; and maintenance.

7.0.2 Unless otherwise approved by the Town of Smyrna, seeding operations shall be limited to the following planting periods:

A. Spring - March 1 through May 30

B. Fall - August 15 through October 31

7.0.3 Refer to other sections for items affecting seeding. Coordinate this work specified by other sections for timely execution.

7.1 MATERIALS

7.1.1 Grass Seed:
Kentucky 31 Fescue (Festuca elatior) and/or annual rye meeting the requirements of the State Department of Agriculture and furnished in new bags or bags that are sound and not mended; no "below standard" seed will be accepted.

7.1.2 Fertilizer:
Commercially manufactured; Grade 10-10-10; furnished in standard containers that are clearly marked with the name, weight, and guaranteed analysis of the contents and that ensure proper protection in transportation and handling; and in compliance with all local, state, and federal fertilizer laws.

7.1.3 Agricultural Limestone:
Containing a minimum of 85% calcium carbonate and magnesium carbonate combined, 85% of which passes a No. 10 mesh sieve.

7.1.4 Mulch:
Stalks of rye, oats, wheat, or other approved grain crops properly cured prior to bailing, air dried, and reasonably free of noxious weeds and weed seeds or other material detrimental to plant growth.

7.2 SEEDING PROTICALS

7.2.1 Perform all seeding and related work as a continuous operation. Sow seed as soon as the seed bed has been prepared, and perform subsequent work in a continuous manner.

7.2.2 Before beginning seeding operations in any area, complete the placing of topsoil and final grading, and have the work approved by the A/E.

7.2.3 Scarify, disk, harrow, rake, or otherwise work each area to be seeded until the soil has

been loosened and pulverized to a depth of not less than 2 inches. Perform this work only when the soil is in a tillable and workable condition.

7.2.4 Apply fertilizer and agricultural limestone uniformly over the seed bed, and lightly harrow, rake, or otherwise incorporate them into the soil for a depth of approximately 1 inch at the following rates:

A. Fertilizer: 15 pounds per 1,000 square feet

B. Agricultural Limestone: 40 pounds per 1,000 square feet

7.2.5 Sow seed uniformly with a rotary seeder, wheelbarrow seeder, hydraulic equipment or by other satisfactory means.

7.2.6 The seeding rate shall be 5 pounds per 1,000 square feet for Kentucky 31 Fescue (Festuca elatior).

7.2.7 When seeding during March 1st through April 1st and October 1st through November 20th, add an additional 3 pounds per 1,000 square feet of annual rye grass.

7.2.8 Perform no seeding during windy weather or when the ground surface is frozen, wet, or otherwise not tillable.

7.2.9 Spread mulch material evenly over the seeded areas immediately following the seeding operation.

7.2.10 Mulch Rate:
Two (2) bales (100 pound minimum) per 1,000 square feet
The mulch rate may be varied by the Town of Smyrna, depending on the texture and condition of the mulch material and the characteristics of the area seeded. Cover all portions of the seeded areas with a uniform layer of mulch so that approximately 25% of the ground is visible.

7.2.11 No equipment, material storage, construction traffic, etc., will be permitted on newly seeded ground.

7.2.12 Dispose of all surplus materials.

7.3 INSPECTIONS

The Town of Smyrna shall inspect the seeding within 60 days after planting and determine if it is acceptable.

7.4 GUARANTEE; SEEDING GROWTH

7.4.1 Secure an acceptable growth of grass in all areas designated for seeding.

7.4.2 An area is considered acceptable if it is represented by a minimum of 100 seedlings per square foot of the permanent species of grass representative of the seed mixture. If an acceptable growth is not obtained on the first planting, reseeding and re-mulching will be required.

7.4.3 If the planting is less than 50% successful, rework the ground, re-fertilize, reseed, and re-mulch.

SECTION 8 – PAVEMENT REPAIR

8.0 GENERAL

8.0.1 The work specified by this section shall consist of repairing or replacing all damaged pavement, whether public or private. Dirt shoulders, roads, streets, drives, and walks are to be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall, and repave the entire area as specified below and as shown on the drawings or on the standard drawings.

8.0.2 Both these specifications and the drawings make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT). Even though the weather limitations, construction methods, and materials specifications contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the TDOT specifications shall not be considered applicable.

8.1 MATERIALS

8.1.1 Aggregate Base:
Class A, Grading D crushed stone (TDOT specifications, Section 303, subsection 903.05)

8.1.2 Bituminous Prime Coat:
Cutback asphalt, Grade RC-250, or emulsified asphalt, Grade AE-P (Section 402, Subsections 904.02 and 904.03)

8.1.3 Crushed Stone Chips:
Size 6 or Size 7 (Subsection 903.14)

8.1.4 Double Bituminous Surface:
For both courses, either cutback asphalt, Grade RC-800 or RC-3000, or emulsified asphalt, Grade RS-2 (Subsections 904.02 and 904.03)

8.1.5 Asphaltic Concrete Binder:
Grading B or C (Section 307), as directed by the Town of Smyrna.

8.1.6 Bituminous Tack Coat:
Cutback asphalt, Grade RC-250, or emulsified asphalt, Grade SS-1 (Section 403, Subsections 904.02 and 904.03).

8.1.7 Asphaltic Concrete Surface:
Grading “D” or “E” (Section 411) as approved by the Town of Smyrna.

8.1.8 Pavement Markings (White and Yellow):
Thermoplastic, Paint, Paint with Glass, Reflectors, Etc. Section 716.

8.2 SUBGRADE

8.2.1 Before any base material is installed, compacts the subgrade of the area to be paved to 98% of optimum density as determined by ASTM D698 (Standard Proctor).

8.2.2 The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.

8.2.3 When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

8.3 BASE

8.3.1 Install a mineral aggregate base of the type specified above in accordance with Section 303 of the TDOT specifications. The maximum compacted thickness of any one layer shall be 6 inches and the total thickness of the base shall be that indicated by the standard drawings or as shown on the plans.

8.4 BITUMINOUS PRIME COAT SURFACE

8.4.1 Uniformly apply a bituminous prime coat of either emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallon per square yard.

8.5 ASPHALTIC CONCRETE BINDER

8.5.1 Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.30 gallons per square yard. Take care to prevent the bituminous material from splashing on exposed faces of curbs and gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder layer to the thickness shown on the standard drawings or as specified by the Town of Smyrna.

8.5.2 Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

8.6 BITUMINOUS TACK COAT SURFACE

8.6.1 Uniformly apply a bituminous tack coat of either emulsified asphalt, Grade SS-1, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.1 gallon per square yard.

8.7 ASPHALTIC CONCRETE SURFACE

8.7.1 When the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under at a rate of 0.10 gallon per square yard. Take

care to prevent the bituminous material from splashing on exposed faces of curbs, gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the tack coat has been properly cured, apply the asphaltic concrete surface layer to the thickness shown of the drawings or as specified by the Town of Smyrna. Apply the surface course as described above for the binder course.

8.8 SMOOTHNESS

8.8.1 The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12 foot straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects in a manner approved by the Town of Smyrna.

8.9 SAMPLING AND TESTING

8.9.1 Submit to the Town of Smyrna test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain approval of these reports before starting paving operations.

8.9.2 Tests shall be made of the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness tests.

8.9.3 When making surface tests, furnish one man to mark all surface defects for corrections.

SECTION 9 – QUALITY CONTROL

9.0 GENERAL

9.0.1 REQUIREMENTS INCLUDED

A. General Quality Control.

B. Workmanship.

C. Manufacturers' Instructions.

D. Manufacturers' Certificates.

E. Mockups.

F. Manufacturers' Field Services.

G. Testing Laboratory Services.

9.1 RELATED REQUIREMENTS

A. Inspection and testing required by governing authorities.

B. Section 01300 - Submittals: Submittal of Manufacturers' Instructions.

C. Section 03303 - Concrete for Utility Lines: Tests required for concrete.

9.2 PROJECT QUALITY CONTROL

9.2.1 Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

9.3 WORKMANSHIP

9.3.1 Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

9.3.2 Perform work by utilizing only persons qualified to produce workmanship of specified quality.

9.3.3 Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

9.4 INSTRUCTIONS

9.4.1 Comply with manufacturers' instructions for all materials in full detail, including each step in sequence. Should instructions conflict with Standard Specifications, request clarification from the Director of Utilities before beginning work.

9.5 CERTIFICATES

9.5.1 When required by individual Specification Sections, submit manufacturers' certificate, in duplicate, that products meet or exceed specified requirements.

9.6 MOCKUPS

9.6.1 When required by the individual Specifications Section, erect complete, full-scale mockup of assembly at Project site. Tests will be performed in accordance with Section 01400, if applicable. Remove mockup at completion when approved by the Director of Utilities.

9.7 FIELD SERVICES

9.7.1 When specified in respective Specification Sections, require supplier or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship; start-up of equipment; test, adjust, and balance of equipment, as applicable; and, to make appropriate recommendations.

9.7.2 Representatives shall submit a written report to the Director of Utilities listing observations and recommendations.

9.8 LABORATORY TESTING SERVICES

9.8.1 Contractor shall employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services required by individual Specification Sections.

9.8.2 Services will be performed in accordance with requirements of governing authorities or agencies and with specified standards.

9.8.3 Reports will be submitted to the Director of Utilities in duplicate giving observations and results of tests, indicating compliance or non-compliance with specified standards, and with Standard Specification and Contract Documents.

9.8.4 Contractor shall cooperate with Testing Laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.

1. Notify the Director of Utilities and Testing Laboratory at least 48 hours prior to expected time for operations requiring testing services.

2. Make arrangements with the Testing Laboratory and pay for additional samples and tests for Contractors' convenience.

SECTION 10 - MANHOLES

10.0 GENERAL

10.0.1 Manholes shall be precast or monolithic concrete with eccentric or concentric cones unless otherwise approved by the Town of Smyrna. All manholes shall contain an exterior bituminous coating. An admixture of Xypex Admix C-500 NF Red (or an approved equal) may be substituted for the bituminous coating by approval of the Director of Utilities.

10.0.2 Refer to other sections for items affecting manholes. Coordinate manhole installation and/or work with that specified by other sections for timely execution.

10.0.3 Shop drawings are required for castings, plastic gaskets, manhole steps, and precast manholes specified in this section.

10.1 MATERIALS

10.1.1 Concrete Masonry:
Reinforced or plain, meeting the applicable industry standards and requirements of Section 03303 (Concrete for Utility Lines). Manholes shall be precast reinforced concrete pipe manhole sections with tongue and groove joints. Manholes shall conform to the requirements of ASTM Specification C 478, except as modified herein. Concrete used in the manufacturing shall have a 28 day compressive strength of not less than 5,000 psi and the absorption shall not exceed 6%. The minimum wall thickness of the manhole riser sections shall be 5” for 4 foot diameter manholes, 6” for 5 foot diameter manholes and 7” for 6 foot diameter manholes. Cone sections shall have a minimum wall thickness of 8” at their top. Base riser sections shall be made with bottoms cast monolithically. Bottoms cast into already made pipe sections are not acceptable. The minimum thickness of the bottom shall be 6” for manholes 4, 5 and 6 feet in diameter. Suitable openings for inlet and outlet sewer pipe shall be cast into the base sections and into riser sections for drop connections

10.1.2 The length of tongue and groove joints on manhole sections shall be not less than the wall thickness of the sections. The nominal clearance between tongue and groove pieces shall be 1/16”. The manhole sections shall be joined with a flexible plastic joint sealant. The sealant shall be a factory extruded formulation of 100% solids with top quality partially vulcanized butyl rubber which provides shape retention in combination with adhesion and cohesion. The sealant shall conform to the requirements Federal Specification SS S 210A. It shall be applied to clean, dry surfaces only.

10.1.3 Flexible manhole sleeves or flexible manhole entrance joints shall be installed on all pipe entering and leaving manholes. Flexible manhole sleeves shall be installed on all pipes 21” in size and smaller. Flexible manhole sleeves shall be Type I or Type II. Type I sleeves shall be of high quality synthetic rubber terminating in a substantial serrated flange of the same material. The flange shall be cast into the wall of the manhole base to form a tight water stop. Minimum thickness of the sleeve material shall be 3/8”. Sleeve material shall comply with the requirements of ASTM Specification C 923. Sleeves shall be secured to the sewer pipe to make a watertight union with stainless steel strap clamps, draw bolts and nuts. Type II sleeves shall be of high quality synthetic rubber having a minimum thickness of 3/8” which complies with the requirements of ASTM

Specification C 923. Manhole openings shall be accurately core drilled. The sleeve shall be secured to the manhole by a stainless steel band with self-locking toggle to make a watertight union. The sleeve shall be secured to the sewer pipe to make a watertight union with stainless steel strap clamps, draw bolts and nuts. Flexible manhole entrance joints shall be installed in all manhole pipe openings 24" to 42" in size. Joint material shall be cast into the wall of the manhole base to form a tight waterstop. Joint material shall be of high quality synthetic rubber which complies with the requirements of ASTM Specification C 923. Joints shall be water tight under a 30 foot head of water. Flexible manhole entrance joints shall be A Lok joints as manufactured by the A Lok Products Corporation, Press Wedge II as manufactured by the Press Seal Gasket Corporation, or equal. Flexible manhole sleeves and flexible manhole entrance joints shall be installed in accordance with instructions of their manufacturer. Kor-N-Seal boot connectors (or an approved equal) may be used based upon approval by the Town.

10.1.4 Casting Adjustment:
Only concrete grade rings will be allowed to adjust the casting elevation. Concrete grade rings are allowed up to 12 inches in height to elevate the casting. Anything over 12 inches in height, a different size barrel shall be used on the manhole to obtain the height desired to stack out the manhole to raise the casting.

i. If the manhole casting is located in a paved area and the casting needs to be adjusted by 1 or 1 ½ inches, then and only then a steel non-adjustable riser ring can be used.

10.1.5 Mortar:
Composed of one (1) part Portland cement and two (2) parts sand (volumetric measure) thoroughly mixed in a tight box, with water added gradually and mixed continually until mortar has attained the proper consistency for use in brick masonry; prepared only in such quantities as needed for immediate use; mortar mixed for more than 30 minutes, re-tempered, or previously set will not be allowed. <u>All mortar</u> used with in a manhole shall have Xypex Admix C-500 NF Red (or an approved equal) mixed in to it.

10.1.6 Gray Iron Castings:
Manhole frames and covers shall be made of cast iron conforming to the minimum requirements of ASTM Specification A48 76, Class 35 or ductile iron conforming to the requirements of ASTM Specification A536 80, Grade 65 45 12. All castings shall be made accurately to the required dimensions and shall be sound, smooth, clean, and free from blisters and other defects. Defective castings which have been plugged or otherwise treated shall be rejected. Frames and covers shall be as detailed on the plans. The contact surfaces between the cover and its corresponding supporting ring in the frame shall be machined so that the cover will rest on the ring for the full perimeter of the contact surfaces with no rocking. The frames and covers shall be thoroughly cleaned subsequent to machining and, before rusting begins, painted with a bituminous coating so as to present a smooth finish; tough and tenacious when cold, but not tacky and with no tendency to scale; and with the actual weight in pounds stenciled or printed by the manufacturer on each casting in white paint. There shall be no holes or perforations in the covers.

10.1.7 Plastic Gasket for Precast Manholes:
Preformed plastic gasket shall meet or exceed all requirements of FS SS-S-00210, "Sealing Compound, Preformed Plastic for Pipe Joints," Type I, rope form. The sealing

compound shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes, or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded rope form of suitable cross section and in such sizes as to seal the joint space when the pipes are laid. Use two (2) complete ropes at each joint. The sealing compound shall be protected by a suitable removable two (2) piece wrapper, which shall be designed so that half may be removed longitudinally without disturbing the other half in order to facilitate application of the sealing compound. The flexible plastic gasket shall also meet the requirements of the following table:

Composition	Test Method	Minimum	Maximum
Bitumen (Petroleum Plastic)	ASTM D4	50	70
Ash Inert Mineral Matter	AASHO T111	30	50
Volatile Matter	ASTM D6	--	2.0

Property	Test Method	Minimum	Maximum
S.G. at 77^0 F	ASTM D71	1.20 ºF	1.30
Ductility at 77^0 F	ASTM D113	5.0 ºF	---
Softening Point	ASTM D36	320ºF	---
Penetration at 77^0 F (150 gms) 5 sec.	ASTM D217	50 ºF	120

10.1.8 Ladder Bars:
Manhole steps shall be constructed of aluminum or steel covered with rubber or plastic. Aluminum steps shall be made of aluminum alloy conforming to the requirements of ASTM Specification B 221 having a minimum tensile strength of 38,000 psi. The minimum tread width shall be 10". The steps shall incorporate two non-skid grooves and shall be of the drop front design. Rubber or plastic covered steel steps shall consist of a l/2" diameter steel reinforcing rod covered by a corrosion resistant rubber or copolymer polypropylene plastic. The minimum tread width shall be 12". The steps shall incorporate traction cleats and foot guide lugs. All manhole steps shall comply with the requirements of OSHA.

10.1.9 Material Testing:
All precast reinforced concrete manhole risers and tops specified herein shall be tested and inspected by a commercial testing laboratory approved by the Town of Smyrna prior to delivery to the site, and all materials that fail to conform to these specifications shall be rejected. After delivery to the site, any materials that have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site. Supply certified copies in duplicate of the inspection and acceptance reports of the testing laboratory to the Town of Smyrna before using the materials. The commercial testing laboratory shall be engaged and paid for by the Contractor. Submit a certificate from the manufacturer of the castings indicating that they meet all applicable requirements of these specifications.

10.2 INSTALLATION

10.2.1 Dewater sufficiently to maintain the ground water level at or below the bottom of the

manhole foundation prior to and during placement of the foundation.

10.2.2 Obtain an adequate foundation for all manhole structures by removing and replacing unsuitable material with well graded granular material, by tightening with coarse rock, or by such other means as provided for foundation preparation of the connected sewers or as directed by the Town of Smyrna. Wherever at the site there is water encountered, place all cast-in-place bases or monolithic structures on a one-piece waterproof membrane to prevent any movement of water into the fresh concrete.

10.2.3 When the foundation subgrade has been prepared and is approved by the Town, carefully construct the concrete foundation for monolithic manholes to the line and grade required by the drawings. Construct the manholes after the concrete foundation has been allowed to set for a period of not less than 24 hours. Monolithic manholes shall only be installed when specifically approved by the Director of Utilities.

10.2.4 For precast manholes, carefully block the base section above the prepared surface so that it is fully and uniformly supported in true alignment. Make sure that all entering pipes can be inserted at proper grade. Then place the concrete foundation and invert under and upon this base section as shown in the standard drawings. A base section with monolithic foundation (bottom) may be used only when approved by the Director of Utilities.

10.2.5 Thoroughly wet and then completely fill all lift holes.

10.2.6 Construct monolithic concrete manholes and bases of 4,000 psi concrete in accordance with the provisions of this section, industry standards, and applicable provisions of Section 03303, Concrete for Utility Lines. The ladder bars shall be cast in place only. No coring and epoxying of ladder bars will be allowed unless approved by the Director of Utilities during special circumstances of installation.

10.2.7 Carefully set the cast iron frame for the cover at the required elevation, and properly bond it to the masonry with cement grout and mastic seal. Mastic seal tape shall be installed in the joints of each base, barrel, and cone of the manhole. Mastic wrap shall be wrapped around the outer surface of the manhole at joints of each base, barrel, and cone. The mastic wrap shall be a minimum of 10-in. in width. This shall be place on the outsides of the manhole with the joint in the middle of it. The required elevation is defined as the top of casting elevation on the approved construction plans. Whenever manholes are constructed in paved areas, tilt the top surface of the frame and cover so as to conform to the exact slope, crown, and grade of the existing adjacent pavement. When sewers are proposed along drains, lie within or adjacent to a potential area of flooding, lie within a designated floodplain, lie within or adjacent to an area that may cause the casting to be flooded, then the Town will require that a watertight frame and cover be installed (with brass bolts) on manholes. If the manhole casting and lid are not immediately placed on the installed manhole, then a covering shall be placed over the opening. The covering shall not allow any water or foreign material to enter the manhole.

10.2.8 Manhole inverts shall be constructed of concrete or Portland Cement, mortared masonry fill, and may, at the Contractor's option, be covered with cement mortar to the approximate cross section of the sewers connected to them. Make any necessary changes in cross sections gradually from side to side of the manhole; make changes in direction of flow of the sewers to a true curve of as large a radius as is permitted by the

size of the manhole. The angle between the influent and effluent pipe inverts shall not be less than 90-degrees.

10.2.9 All rigid unreinforced pipe entering or leaving the manhole shall be provided with flexible joints within 12 inches of the manhole structure, or encase the full joint in concrete. Place such pipe on firmly compacted bedding, particularly in the area of the manhole excavation, which is normally deeper than excavation for sewer trenches. Take special care to see that the openings through which pipes enter the structures are completely and firmly rammed full of shrink proof mortar or otherwise constructed to ensure water tightness.

10.2.10 Where the difference in the invert elevation is less than 48 inches, the inverts of the inlet line shall be installed at 0.1 inches above the invert above the outlet line invert elevation. Drop manholes shall be similar in construction to standard manholes except that a drop connection of pipe and fittings (upper tee connection and lower 90-degree bend connection) shall both be machined cored or preformed for installation at the factory with proper connectors as described above. The drop manhole connections shall be of the proper sizes and materials and shall be constructed outside the manhole and supported by 3,000 psi concrete as indicated by the standard drawings.

10.2.11 No mortar or hydraulic cement shall be used to alter the inside of the manhole in any way. Non-shrink grout is only to be used around the sewer pipe when it is placed into the invert of the manhole through the boot. <u>All non-shrink grount</u> used with in a manhole shall have Xypex Admix C-500 NF Red (or an approved equal) mixed in to it.

10.2.12 A maximum of three (3) six (6) inch service lines will be allowed into permanent end manholes, and a minimum 45^0 degree alignment differential must be maintained between them. At no time will an angle less than 90 degrees be permitted between the upstream sewer main or service line connections to the manhole and the out or downstream sewer main. The service lines shall enter into the manhole through a rubber Kor-N-Seal boot connector or an approved equal. The service lines should enter the manhole at grade of the base of the manhole and the invert must be properly shaped to convey flow from the service connection to the manhole invert bench. Should the service line be connected to the manhole above the manhole bench then an outside drop connection shall be constructed for the service line with stainless steel straps. The maximum length of a service line from the sewer main to property line shall be seventy-five (75) feet between 6” clean outs.

10.2.13 When installing a watertight casting on a manhole, no concrete riser rings are to be used. The water tight casting is to be bolted on the cone of the manhole. If the manhole is to be raised or lowered, then a different size cone and/or barrel shall be used to create the proper height for the manhole.

10.2.14 Place backfill by hand around the manhole and to a distance of at least one (1) pipe length into each trench, and tamp with selected material up to an elevation of 12 inches above the crown of all entering pipes. Continue backfilling in accordance with the requirements for trench backfilling.

<u>10.3 TESTING OF SEWER MANHOLES</u>

10.3.1 Vacuum Test

1. Each manhole shall be vacuum tested after the first proof roll of base stone or

binder section is installed.

2. No standing water shall be allowed in the manhole excavation, which may affect the accuracy of the test.

3. All pipes and other openings into the manhole shall be suitably plugged in such a manner as to prevent displacement of the plugs while the vacuum is drawn. Installation and operation of the vacuum equipment and indicating devices shall be in accordance with equipment specification and instructions provided by the manufacturer.

4. A vacuum of 10.0 inches shall be drawn. The time for the vacuum to drop to 9.0 inches for one minute shall be recorded.

Depth	Diameter	Time to Drop from 10 psi to 9 psi
4-feet to 10-feet	4-feet	75 seconds
10-fee to 15-feet	4-feet	90 seconds
15 feet to 25-feet	4-feet	105 seconds

5. Acceptance for four (4) feet diameter manholes shall be defined as when the time to drop one (1) inch is less than 1 minute and 15 seconds (75 seconds). For manholes five (5) feet in diameter, add an additional 15 seconds. For manholes six (6) feet in diameter, add an additional 30 seconds.

6. If the manhole fails the test, necessary repairs shall be made and the vacuum test repeated until the manhole passes the test. No hydraulic cement or mortar shall be used to alter the inside of the manhole in any way when conducting repairs. Mortar is only to be used around the sewer pipe when it is placed into the invert of the manhole through the boot. If the manhole joint mastic is displaced, the manhole shall be disassembled, the seal replaced, and the manhole retested.

SECTION 11 – SANITARY GRAVITY SEWER LINES

11.0 GENERAL

11.0.1 Pipe material for sewer lines less than 18 inches shall be SDR 26 PVC or ductile iron pipe Class 350 may be used when indicated on the drawings by the design engineer and/or when required by the Town of Smyrna.

11.0.2 Pipe material for sewer lines 18 inches, 21 inches, and 24 inches shall be SDR 26 PVC. Ductile iron pipe shall be used when indicated on the drawings by the design engineer and/or when required by the Town of Smyrna.

11.0.3 Pipe material for sewer lines larger than 24 inches shall be ductile iron. Other materials not specified herein, may be considered for use on large diameter applications (larger than 24 inches) only after reviewed and approved by the Town of Smyrna.

11.0.4 Shop drawings are required for all products specified in this section.

11.0.5 Refer to other sections for items affecting gravity sewers. Coordinate this work with that specified by others sections for timely execution.

11.1 MATERIALS

11.1.1 Pipes

A. Polyvinyl Chloride (PVC): to be installed at depths between 4 ft. -15 ft. and shall meet and/or exceed the requirements of ASTM D3034 and SDR-26; suitable for use as a gravity sewer conduit with provisions for contraction and expansion at each joint; with a rubber ring and standard length 12.5 feet plus or minus one (1) inch; designed to pass all tests at 73 degrees F (plus or minus 3 degrees F); six (6) inches long sections of pipe to be subjected to impact from a free falling type (20 pounds, Type A) in accordance with ASTM D2444 with no evident splitting or shattering (denting not considered a failure); and with a minimum envelope of four (4) inches of granular material around the pipe, but with all other bedding and backfilling requirements remaining the same as for other pipe material.

B. Ductile Iron Pipe (DIP): to be installed at depths between 0 ft.- 4 ft. and at locations greater than 15 ft. in depth. The pipe shall be Class 350 with Protecto 401 Ceramic Epoxy lining or Ceramapure PL90 Ceramic Epoxy lining. It shall contain push-on joints conforming to ASTM A746, ANSI/AWWA C151/A21.51 thicknesses unless otherwise approved by the Town.

C. Lateral Branches: to be wyes or tees of the same material as the main sewer and have a six (6) inch inside diameter unless otherwise specified by the Town or noted by the design engineer; and able to withstand all test pressures involved without leakage. Service riser pipe shall be six (6) inch diameter to the cleanout (located at the right-of-way/property line) and then may be four (4) inch diameter pipe from the cleanout to the building. If the sewer lateral is installed on a sewer main that is 5-ft or less below final grade, then that sewer lateral is required to have a back water valve installed on it.

i. Sewer service wyes and tees at the sewer main sweeps shall fall in the direction of flow of sewer main.

ii. If the wye is made of PVC, then the wye shall be 6" SDR-26 PVC gasketed joint wye with the 45^0 degree angle of the wye shall be at either 10 or 2 o'clock in position.

iii. If the sweeping tee is made of DIP, then the sweeping tee shall be 6" Class 350 ductile iron with Protecto 401 Ceramic Epoxy lining or Ceramapure PL90 Ceramic Epoxy lining. The Protecto 401 Ceramic Epoxy lining or Ceramapure PL90 Ceramic Epoxy lining can be applied to the sweeping tee, but must be inspected by the Town's utilities inspector and be approved by that inspector. The sweeping tee shall have a 45^0 angle with mechanical joint fittings

iv. If a sewer service is to be installed in an existing sewer main when a manhole is not available, then an inserta-tee is to be used. An inserta-tee is to be used on sewer mains that are constructed with the materials of PVC, ductile iron, and reinforced concrete. If the sewer main is made of clay pipe, then the main is to be cut, two (2) sleeves are to be inserted, and a wye is to be installed with a 5 ft. piece of pipe (PVC or DIP) on both sides of the wye. All material used in this sewer service assembly shall be made of the same material.

v. A sewer cleanout shall have a concrete box protecting the cleanout in both paved (JBS 8006) and unpaved (36-H concrete box) areas. It shall have a steel casting and lid that has the "sewer" printed on it. The cleanout box shall be set to final grade when installed.

vi. A maximum of three (3) six (6) inch service lines will be allowed into permanent end manholes, and a minimum 45 degree alignment differential must be maintained between them. At no time will an angle less than 90 degrees be permitted between the upstream sewer main or service line connections to the manhole and the out or downstream sewer main. The service lines shall enter into the manhole through a rubber Kor-N-Seal boot connector or an approved equal. The service lines should enter the manhole at grade of the base of the manhole and the invert must be properly shaped to convey flow from the service connection to the manhole invert bench. Should the service line be connected to the manhole above the manhole bench then an outside drop connection shall be constructed for the service line with stainless steel straps. The maximum length of a service line from the sewer main to property line shall be seventy-five (75) feet between 6" clean outs.

D. Special Pipe Material:

i. When permitted by the Town's engineer, DR-18 PVC C-900 pipe can be used. The pipe shall be green, and must be installed with green sewer tape laid above the gravel envelope. This pipe can be installed at depths 15 ft. to 23 ft.

11.1.2 Joints and Jointing Materials

A. All rubber end rings shall be extruded or molded and cured such that any cross section will be dense, homogenous and free of parasites, blisters, pitting, and other imperfections. The basic rubber material, EPDM, shall meet ASTM C443 with the exception of 40-60 duro hardness. The resilient interlocked end seals shall be duro A-40-70, plus or minus 2.

B. Polyvinyl Chloride (PVC) Pipe Joints: Joints for sewer plastic pipe shall meet all requirements of ASTM D3212 standard specifications. Joint design shall be tested and certified to result in no leakage under prescribed laboratory test conditions of joint alignment, load conditions, pressure and vacuum, and deflection. Pipe and fittings shall have an integral bell with elastomeric seal joint.

C. Ductile Iron Pipe Joints: gasket type joints for bell and spigot ductile iron pipe designed to meet the infiltration requirements of these specifications; jointing to comply with the applicable provisions of ANSI A21.11.

11.1.3 Compression Couplings

A. When dissimilar pipe materials like PVC are joined, use compression couplings that are resistant to the corrosive action of soils and sewage and that will provide a permanent watertight joint. The compression couplings shall be of natural or synthetic rubber or rubber-like material and shall comply with the requirements and test methods specified in Table 2 of ASTM C425. The coupling shall meet the leak requirements specified in ASTM C425, and the bands for attaching the couplings to the dissimilar pipes shall be of stainless steel meeting ASTM A167 or A240. Each coupling shall bear the manufacturer's identifying mark and an indication of its size.

11.2 INSTALLATION: PIPE LAYING

11.2.1 Lay no pipe except in the presence of an inspector representing the Town.

11.2.2 Before placing sewer pipe in position in the trench, carefully prepare the bottom and sides of the trench, and install any necessary bracing and sheeting as provided in Section 02221, Unclassified Excavation for Utilities.

11.2.3 Wherever necessary to provide satisfactory bearing surface, place concrete cradles as shown on the drawings or as directed by the Town. Cradles shall be of concrete and conform to the dimensions shown on the drawings. Concrete placed outside the dimensions shown shall be at the Contractor's expense.

11.2.4 When lasers are used, set reference points for both line and grade at each manhole. Where grades are 0.6% or less, check the elevation of the beam each 100 feet with an offset point or engineer's level. Lasers being utilized for installation of sewer lines shall have been calibrated within the last year (12-months). Certification of the calibration (by an authorized manufacturer’s representative) shall be submitted to the Town upon request.

11.2.5 Do not allow water to run or stand in the trench while pipe laying is in progress or before

the trench has been backfilled. Do not at any time open up more trench than the available pumping facilities are able to dewater.

11.2.6 Correct trench bottoms found to be unsuitable for foundations after pipe laying operations have started, bringing them to exact line and grade with compacted earth as necessary.

11.2.7 Carefully inspect each piece of pipe and special fitting before it is placed, and lay no defective pipe in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. When pipe laying is not in progress, keep the ends of the pipe tightly closed with an approved temporary plug.

11.2.8 Bell holes shall be large enough to allow ample room for the pipe joints to be properly made. Cut out bell holes no more than two (2) joints ahead of the pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel rests on a solid foundation for its entire length. Lay each pipe joint so as to form a close concentric joint with adjoining pipe and to avoid sudden offsets or inequalities in the flow line.

11.2.9 Before constructing or placing any joints, demonstrate to the Town, by completing at least one sample joint, that the methods to be used conform to the specifications and will provide a watertight joint and further that the workmen to be involved in this phase of work are thoroughly familiar and experienced with the type of joint proposed and type of pipe being installed.

11.2.10 No other type of joint may be used unless authorized in writing by the Town.

11.2.11 Install wye or tee branches in sewer lines to serve properly each lot facing or abutting on the street or alley in which sewer is being laid and at such other locations as may be designated by the Town. If wye and tee branches are not to be used immediately, close them with approved stoppers that are held in place to prevent infiltration and withstand all test requirements.

11.2.12 For all wyes and tees that are plugged and laid in rock, blast a minimum of six (6) linear feet of ditch line in the direction and to the approximate grade of the future lateral connection as directed by the Town, but do not excavate the material. This work will be considered incidental to the installation of the wye and tee. Furnish the Town with a record of the exact location, depth, and distance from the downstream manhole of each tee installed in an approved format acceptable to the Town.

11.2.13 If the work consists of constructing a new sewer to replace an existing one, connect existing service lines to the new line.

11.2.14 New sewer service laterals shall conform to the standard specifications and/or standard drawings.

11.2.15 The Contractor shall provide above-ground markers at the property line to indicate the termination of new service laterals. These markers shall be a green metal fence post or 2-inch PVC pipe with green markings.

11.2.16 As the work progresses, thoroughly clean the interior of the pipe in place. After each line of pipe has been laid, carefully inspect it, and remove all earth, trash, rags, and

other foreign matter from its interior.

11.2.17 After the joints have been completed, they shall be inspected, tested, and accepted by the Town of Smyrna before being covered. The pipe shall meet the test requirements for water tightness; immediately repair any leak or defect discovered at any time after completion of the work. Any pipe that has been disturbed after joints were formed shall be taken up, the joints cleaned and remade, and the pipe re-laid at the Contractor's expense. Carefully protect all pipes in place from damage until backfilling operations are completed.

11.2.18 Do not begin the backfilling of trenches until the pipe in place has been inspected and approved by a representative of the Town. Bedding of gravel (crushed stone No. 67) on the sewer main shall be as followed: 6 in. on bottom and sides and 12 in. on top. On top of the sewer line's gravel envelope, sewer excavation tape shall be laid upon it.

11.2.19 Lay sewers at least ten (10) feet horizontally from any existing or proposed water main. If this is not practical, the sewer may be laid closer than ten (10) feet to a water main provided it is laid in a separate trench and the elevation of the top of the sewer is at least 18 inches below the bottom of the water main.

11.2.20 Where a sewer crosses under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main. If the elevation of the sewer cannot be varied to meet the above requirements, relocate the water main to provide this separation, or else reconstruct it with mechanical joint ductile iron pipe for a distance of ten (10) feet on each side of the sewer with a full joint of the water main centered over the sewer.

11.2.21 If it is impossible to obtain proper horizontal and vertical separation as stipulated above, construct both the water main and the sewer of mechanical joint ductile iron pipe, and pressure test each.

11.2.22 Perform boring by means of auguring to the size, line, and grade shown on the drawings. Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide a watertight joint.

11.2.23 Make connections to all existing sewer lines as shown on the drawings or as directed by the Town. Make service connections either by removing a section of the sewer from the existing line and inserting a wye or tee branch of the proper size or by constructing a manhole (if approved by the Town), junction box, regulator chamber, or other structure as approved by the Town.

11.2.24 Make connections to existing manholes or inlets by machine coring a hole in the wall of the existing structure and installing a Kor-N-Seal boot connector (or an approved equal), and then inserting a length of sewer pipe into the connector. The connector shall be secured to the pipe with stainless steel tightening bands. The void area between the pipe and structure shall be filled with non-shrink grout, concrete, or mortar. Trowel the inside and outside surfaces of the joint to a neat finish. Shape or reshape the bottom of the manholes as necessary to fit the invert of the sewer pipe.

11.2.25 The joining together dissimilar pipes by using suitable compression couplings. If compression couplings are not available, then make jointing with a special fabricated

coupling approved by the Town.

11.2.26 Provide concrete protection or concrete cap as shown on the drawings for pipe sewers that, when completed, have less than two (2) feet of covering in non-traffic areas and three (3) feet of cover in traffic areas. All concrete shall be placed with constructed forms. No concrete pours will be allowed unless a standard concrete form has been properly constructed, no wild pours will be allowed.

11.2.27 Carefully protect from damage all existing sewers, water lines, gas lines, sidewalks, curbs, gutters, pavements, electrical lines, and other utilities or structures in the vicinity of the work at all times. If it is necessary to repair, remove, and/or replace any such utility or structure in order to complete the work properly, do so in compliance with the provisions set forth in other sections of these specifications. Any such work shall be considered incidental to the construction of sewers, and no additional payment will be allowed.

11.2.28 Water service connections will be repaired or replaced by the Contractor at his expense as an incidental part of the work.

11.2.29 Service or house connections to existing sewer mains that are damaged or removed shall be repaired or replaced by the Contractor at his own expense as an incidental part of the work. When removing an existing sewer service connection, the existing sewer service should be located and hard capped 5 ft-10 ft. from the sewer main.

11.2.30 For PVC and ductile iron pipe, furnish a certificate from the pipe manufacturer indicating that the pipe meets all applicable requirements of these specifications.

11.2.31 The minimum pipe stiffness for PVC pipe at 5% deflection shall be 46 for all sizes when tested in accordance with ASTM D2412; external loading properties of plastic pipe shall be by parallel plate loading.

11.2.32 A specimen of PVC pipe six (6) inches long shall be flattened between parallel plates in a suitable press until the distance between the plates is 40% of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is complete in two (2) to five (5) minutes.

11.2.33 After being immersed for two (2) hours in a sealed container of anhydrous acetone (99.5% pure), a sample ring of PVC pipe shall show no visible spalling or cracking when tested in accordance with ASTM D2152 (swelling or softening is not considered a failure).

11.2.34 The Contractor shall construct a concrete check dam in accordance with the Tennessee Department of Environment and Conservation (TDEC) Department of Water Resources (DWR) in the trench for the gravity sewer lines. The wall shall be constructed as to key into the trench wall and extend high enough in the trench to dam water from flowing freely through the trench gravel and along the exterior of the sewer pipe and applying hydrostatic pressure on the manhole connection. The cutoff wall shall be provided for all gravity sewer lines. Check dams shall be placed 10 ft. upstream of the downstream manhole after the sewer line crosses under the storm drain and drain area. Check dams are, also, required where the sewer is laid parallel to a stream, creek, and/or drainage conveyances.

11.3 TESTING OF GRAVITY SEWERS LINES

11.3.1 Visual Tests

1. Upon completion of the construction or earlier if the Town deems advisable, the Town will make a visual inspection of the sewer and construction site. Immediately repair all leaks and defects found by such inspection.

2. In addition to general cleanup and leakage, the following standards shall be used to determine failure or defects of this project.

3. Sewers shall be built so as to remain true to line and grade. The inclining grade of the bottom of the sewer after completion shall be such that, after flooding, the flood water drains off so that no remaining puddle of water is deeper than 1/2 inch on pipe 36 inches internal diameter or smaller and 3/4 inch on pipe larger than 36 inches internal diameter. Any section of pipe that does not comply with the specifications at any time previous to final acceptance of the work shall be replaced or re-laid at the Contractor's expense.

4. The Contractor will be held strictly responsible that all parts of the work bear the load of the backfill. If any cracks develop in the pipe within one (1) year from the date of final acceptance of the work, the Contractor will be required to replace, at his expense, all such cracked pipe. To this end, the Contractor is advised to purchase pipe under a guarantee from the manufacturer, guaranteeing proper service of sewer pipe under conditions established by the drawings, specifications, and local conditioning at the site of the work.

11.3.2 Air Testing for Sewers 24 Inches and Smaller

1. Perform low pressure air testing as follows:

   a. Furnish all equipment, facilities, and personnel necessary to conduct the test. The test shall be observed by a representative of the A/E.

   b. Make the air test after all services have been installed and backfilling has been completed and compacted.

   c. Perform the first series of air tests after 2,000 linear feet but before 4,000 linear feet of sewer has been laid. The purpose of this first series of tests is to assure both the Contractor and the Town that the materials and methods of installation meet the intent of these specifications. Conduct the remainder of the tests after approximately each 10,000 linear feet has been laid.

   d. Plug all tees and ends of sewer services with flexible joint plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

   e. Prior to testing, check the pipe to see that it is clean. If not, clean it by

passing a full-gauge squeegee through the pipe. It shall be the Contractor's responsibility to have the pipe cleaned prior to testing.

f. Immediately following this check or cleaning, test the pipe installation with low pressure air. Supply the air slowly to the plugged pipe installation until the internal air pressure reaches 5.0 psi more than the average back pressure of any groundwater that may submerge the pipe. Back pressure on the pipe due to groundwater is considered to be 1 psi per 2.31 feet of ground water depth (measured from the invert of the pipe). Allow at least two (2) minutes for temperature stabilization.

g. The pipeline shall be considered acceptable when tested at an average pressure of 3.5 psi. Air pressure cannot drop from a stabilized pressure of 5 to 4 psi in less than the below specified time. If the pressure decreases below 4 psi or less, then the pipe shall be presumed defective.

h. The requirements of this specification shall be considered satisfied if the time required in seconds and/or minutes for the pressure to decrease from 5.0 to 4.0 psi is not less than that shown in the following table:

ALLOWABLE AIR LOSS VALUES PER 100 LF

Time (minutes & seconds)	Pipe Size (inches)
45 sec	6
3 min	8
3 min & 45 sec	10
4 min & 45 sec	12
6 min	15
7 min & 30 sec	18
9 min & 30 sec	21
12 min	24
15 min	30

i. If the pipe installation fails to meet these requirements, the Contractor shall determine (at his own expense) the source or sources of leakage and repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of this test before being considered acceptable.

2. The recommended procedures for conducting acceptance tests are as follows:

a. Clean pipe that is to be tested.

b. Plug all pipe outlets with suitable test plugs, and brace each plug securely.

c. Increase gauge pressure in the test by the amount of ground water pressure from the invert of the pipe.

d. Add air slowly to the portion of the pipe installation being tested until the internal air pressure is raised to 4.0 psi more 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 two (2) minutes, disconnect the air supply.

g. When pressure decreases to 4.0 psi either by leaking down or by bleeding down with a release valve, start the stopwatch, and determine the time in seconds that is required for the internal air pressure to reach 3.0 psi. Compare this time interval as calculated above. If the time shown above is more than that calculated, the test shall be assumed to be acceptable.

3. Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug, which can become a dangerous high velocity projectile. Locate gauges, air piping manifolds, and valves at the top of the ground. No one shall be permitted to enter a manhole where a plugged pipe is under pressure. Four pounds air pressure (gauge) develops a force against the plug in a 12 inch pipe of approximately 450 pounds. Pipes larger than 24 inches in diameter shall not be air tested because of the difficulty of adequately blocking the plugs. Provide a safety release device set to release at ten (10) psi between the air supply and the sewer under test.

4. Regardless of the outcome of the tests, repair any noticeable leak.

11.3.3 Testing for Sewers Larger than 24 Inches

Sewer lines larger than 24 Inches in diameter may be tested by one of the three methods listed below as directed by the Director of Utilities.

1. Using Existing High Ground Water

a. Where the natural ground water is 24 inches or more above the top of a section of pipe, measure the flow of water in the pipe and the rates of seepage and infiltration. Measure the flow rate by using a calibrated weir. Leave the weir in the line until the flow rate has stabilized. The Contractor is responsible for verifying the groundwater level by providing sight gauges in manholes or digging test holes at suitable locations.

b. The total seepage and infiltration of ground water as determined by the test shall in no case exceed 25 gallons per 24 hours per inch-mile of pipe. Make infiltration tests on all sewer construction before placing the lines in service and before making any connections to other sewers. If the amount of infiltration into the sewer(s) is in excess of the maximum quantity specified above, then re-caulk or remake the joints, relay the sewer (if necessary), or perform other remedial construction, at the Contractor's expense, in order to reduce groundwater infiltration to within the specified limits.

c. In making infiltration tests, furnish the required equipment and labor and do the necessary pumping under the direction of the A/E. Tests must be repeated until each sewer individually meets the specifications for infiltration amounts as set out above.

2. Exfiltration Test

a. Where the groundwater is not 24 inches or more above the top of the pipe section being tested, then perform an exfiltration test. Bulkhead the pipe below the lower manhole by the section being tested with a pneumatic plug or other device. Insert a vent pipe 48 inches long in the stopper of the upper end of that section. Then fill the lower manhole with water, or add water until there is a minimum of four (4) feet over the upper end; make certain that all air is forced out through the vent tube. Measure the drop in the level of the water in the manhole due to exfiltration over a specific time, and calculate the water loss due to exfiltration. The total exfiltration shall not exceed that specified above for infiltration. Conditions encountered in construction may vary this procedure slightly, but essentially this is the method to be used.

3. Using Pipe Joint Test Equipment

a. Sewer pipes larger than 24 inches in diameter shall be tested by means of an internal testing machine such as Cherney (or an approved equal). The testing equipment shall be mounted on rolling skids sized for the internal diameter of the pipe. The equipment shall consist of a dual rubber bladder which straddles the joint and shall inflate on each side of the joint. The dual bladder will be inflated to a pressure sufficient not to move or allow internal test air to exit. The void area between the bladders shall then be pressurized to at least 4.0 psig. The internal air pressure over the joint shall be allowed to stabilize for approximately 2 minutes due to temperature. Add more air/internal pressure if required until stabilization is reached. The internal air pressure shall maintain the 4.0 psig pressure for a minimum of one minute. Should the pressure fall below 3.0 psig within one minute then the joint is considered to have failed. The pipe joint will then be required to be removed and repaired with an acceptable method as approved by the Town. The test shall be conducted as described above or by a recommended method of the testing equipment manufacturer as reviewed and approved by the Town.

4. Repairs

a. Regardless of the outcome of any tests, repair any noticeable leak.

11.3.4 Sewer Test Plug and Strainer Policy

Prior to any sanitary sewer main testing or internal inspection beginning, the Town of Smyrna Inspector shall provide the Contractor with the appropriate size and number of strainers to perform the proposed sanitary sewer work. The Contractor shall provide all test plugs to be used for the proposed work. The Inspector shall receive and approve all test plugs prior to use. Once approved, the Inspector shall physically attach a serialized ID tag to each strainer and test

plug for the proposed work. Each ID tag shall be logged by the Town of Smyrna Inspector and signed for by an authorized representative of the Contractor. After all testing and inspection has been completed, each ID tag shall be returned to the Inspector while still attached to the associated test plug or strainer. The Inspector shall physically remove each ID tag from the returned test plugs and strainers. The Inspector shall log and sign all ID tags that have been returned.

11.4 INSPECTION OF MATERIALS

11.4.1 All material used on this project will be visually inspected by the Town's representative at the site for conformance to the required specifications. When reasonable doubt exists that said material meets the specifications, the Town may require certified mill tests, samples, and/or tests by an independent laboratory or other suitable form of verification that the material meets the required specifications.

11.5 DEFLECTION TESTING FOR PVC PIPE

11.5.1 At the CONTRACTOR'S expense and before the road is paved, test deflection of the pipe by passing a 9-arm pin go/no-go mandrel sized to 95% of the pipe diameter of the actual pipe used with the pipe in place and covered. Make this acceptance test after backfill consolidation has occurred.

11.6 RECORDING OF SEWER LINES

11.6.1 Pre-recording of sewer lines:

At the CONTRACTOR'S expense and before any road paving or issuance of building permits, all sections of the sewer line shall be CCTV drone camera inspected and given to the Town by way of CD and/or USB memory drive. The sewer main shall be clean of any soil and/or debris. This is to be done before any recording occurs. All sewer services (if there are any) must be recorded during the recording of the sewer main. If any possible leaky areas (gaps in the line), damages of the pipe, and/or sagging that is over 5% that is recognized by the Town's utilities engineer (by the engineer's discretion), the section of the sewer line in question shall be repaired or replaced. After the repairs or replacement of the piping**, the new section shall be CCTV drone camera inspected and re-submitted** to the Town's utilities engineer for review.

11.6.2 Post-recording of sewer lines:

At the CONTRACTOR'S expense and prior to the first bond review, all sections of the sewer line shall be CCTV drone camera inspected and given to the Town by way of CD and/or USB memory drive.

Once the **CONTRACTOR** has passed all sewer main testing, it is the **OWNER's** responsibility to re-camera the gravity sewer main after 75% subdivision/commercial lots are built. The sewer video shall be inspected by the Town's Utilities Department staff, and if deem as such, the **OWNER** will be responsible for the cleaning and/or repairs of the mention gravity sewer main. This will be reflected in the utilities' bond amount for the **OWNER.**

11.7 CLEANUP OF CONSTRUCTION SITE

11.7.1 After completing each section of the sewer line, remove all debris, construction materials, and equipment from the site of the work, grade and smooth over the surface on both sides of the line, and leave the entire area in a clean, neat, and serviceable condition.

SECTION 12 – FORCE MAIN SEWER LINES

12.0 GENERAL

12.0.1 Furnish all material, equipment, tools, and labor in connection with the sewage force main, complete and in accordance with the drawings and these specifications.

12.0.2 It shall be the Contractor's responsibility to ensure that all necessary materials are furnished to him and that those found to be defective in manufacture are replaced at no extra cost to the Owner. Materials damaged in handling after being delivered by the manufacturer shall be replaced at the Contractor's own expense. If installed material is found to be defective before the final acceptance of the work, the cost of both the material and labor needed to replace it shall not be passed on to the Owner.

12.0.3 The Contractor shall be responsible for safely storing materials needed for the work that have been accepted by him until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

12.0.4 Refer to other sections for work related to that specified by this section. Coordinate this work with that is required by other sections for timely execution.

12.0.5 Minimum force main size shall be two (2) inches in diameter.

12.0.6 All force main lines shall have a 12 AWG gauge solid copper tracer wire (shielded) attached with metallic tape marked “sewer” to the crown (the top) of pipe installed in accordance with manufacturer’s recommendation. Every 500-ft. there shall be a pull box that the tracer wire will be housed in. A minimum of 24-in. of 12 AWG gauge solid copper tracer wire shall be in the box. This box shall be placed starting outside of the fenced area of the lift station and every 500-ft. until discharging in to a manhole and/or Wastewater Treatment Plant.

12.0.7 Force main material shall be ANSI/AWWA HDPE SDR-9 PVC pipe that are two (2) inches in diameter and less and C-200 SDR-21 PVC pipe that are three (3) inches in diameter and greater with push on type joints unless otherwise required by the Town of Smyrna. ANSI/AWWA C151/A21.51 ductile iron pipe line with PROTECTO 401 Ceramic Epoxy lining or Ceramapure PL90 Ceramic Epoxy lining with push-on type joints shall be required at areas of fill material, special installations, and as required by the Town.

12.0.8 Inline insertion valve shall be installed with a hot tapping machine in conjunction with a temporary gate valve. The outer diameter of the water main that is to be tapped shall be measured with pipe outer diameter measuring tape before any installation is to begin. When tapping the water main, a coupon shall be retained to not leave any material(s) in the water main. The installation valve saddle attached to the water main shall be hydrostatically tested 200 psi for two (2) hours.

12.0.9 When an air release valve is needed for the force main, it shall be a Aquestia A.R.I. D-025 combination vacuum-air release valve or approved equal for wastewater. The combination vacuum-air release valve shall be housed within a manhole that is precast or monolithic concrete with eccentric or concentric cones unless otherwise approved by the Town of Smyrna. All manholes shall contain an exterior bituminous coating. An

admixture of Xypex Admix C-500 NF Red (or an approved equal) may be substituted for the bituminous coating by approval of the Director of Utilities.

12.1 MATERIALS

12.1.1 Ductile Iron Pipe and Fittings

A. Ductile iron pipe shall be made of good quality ductile cast iron that meets the requirements of ASTM E8-61T. The pipe shall be centrifugally cast in metal or sand-lined molds. It shall be made and tested in accordance with ASTM A536 and be subjected to and able to withstand a hydrostatic pressure of 500 psi.

B. The pipe shall be a plain end ductile iron pipe with a push-on single gasket joint and shall conform to ANSI A21.51/AWWA C151. The design thickness shall be Class 350 for pipe as defined by ASTM A21.50/AWWA C150.

C. The length of each individual piece of ductile iron pipe shipped must be plainly marked on that piece of pipe.

D. The push-on single gasket joints shall be UL approved and able to withstand an operating pressure of 200 psi.

E. The bell of each pipe shall have a tapered annular opening and a cast or machined retaining groove for the gasket. The gasket groove shall have a flared design so that maximum deflection will be provided. The plain spigot end of the pipe shall be beveled in order to simplify its entry into and centering within the bell and the compression of the gasket.

F. The gasket shall be of high quality vulcanized rubber made in the form of a solid ring to exact dimensions. The design of the gasket groove in the bell of the pipe and the design, hardness, and other properties of the gasket itself shall be such that the joint is liquid tight for all pressures from a vacuum to the maximum internal liquid pressure of 350 psi.

G. Enough lubricant shall be furnished with each order to provide a thin coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell, and have no harmful effect on the rubber gasket. It shall have a consistency that will allow it to be easily applied to the pipe in either hot or cold weather and that will enable it to adhere to either wet or dry pipe.

H. Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings unless otherwise shown on the drawings. All fittings shall conform to ANSI A21. 10/AWWA C110.

I. Pipe and pipe fittings shall have PROTECTO 401 ceramic epoxy lining as specified in ANSI A21. 4/AWWA C104. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 millimeter thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

12.1.2 PVC Pipe

A. All plastic pipes shall be made from Class 12454-B polyvinyl chloride plastic (PVC 1120) as defined by ASTM D1784.

B. All Class 200 SDR-21 pipes shall have NSF approval and be manufactured in accordance with ASTM D2241. The following tests shall be run for each machine on each size and type of pipe being produced, as specified below:

1. Flattening Test: once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.

2. Acetone Test (Extrusion Quality Test): once per shift in accordance with ASTM D2152. There shall be no flaking, peeling, cracking, or visible deterioration on the inside or outside surface after completion of the tests.

3. Quick Burst Test: once per 24 hours in accordance with ASTM 5199.

SDR	Minimum Bursting Pressure Rating	Pressure (psi)
13.5	315	1,200
17	250	1,000
21	200	800

4. Impact Tests: for 6" and larger, once per shift in accordance with ASTM D2444; for 4" and smaller, once each 2 hours in accordance with ASTM D2444.

5. Wall Thickness and Outside Dimensions Tests: once per hour in accordance with ASTM D2122.

6. Bell Dimensions Test: once per hour in accordance with ASTM D3139.

C. If any specimen fails to meet any of the above-mentioned tests, all pipes of that size and type manufactured between the test periods must be scrapped and a full set of tests rerun.

D. Furnish a certificate from the pipe manufacturer stating that he is fully competent to manufacture PVC pipe of uniform texture and strength and in full compliance with these specifications and further stating that he has manufactured such pipe and done so in sufficient quantities to be certain that it will meet all normal field conditions. In addition, the manufacturer's equipment and quality control facilities must be adequate to ensure that each extrusion of pipe is uniform in texture, dimensions, and strength. Also furnish a certificate from the manufacturer certifying that the pipe furnished for this project meets the requirements of these specifications.

E. All pipes shall be manufactured in the United States of America. All pipes for any one project shall be made by the same manufacturer.

F. Pipe 8" and larger shall be furnished in 20 feet lengths. The Contractor's methods of storing and handling the pipe shall be approved by the Town. All pipes shall be supported within five (5) feet of each end; in between the end

supports, there shall be additional supports at least every 15 feet. The pipe shall be stored away from heat or direct sunlight. The practice of stringing pipes out along the proposed force main routes will not be allowed.

G. Certain information shall be applied to each piece of pipe. At the least, this shall consist of:

1. Nominal size
2. Type of material
3. SDR or class
4. Manufacturer
5. NSF Seal of Approval

H. Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.

I. The pipe shall have push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber will be allowed. The gaskets shall be of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal.

J. The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be able to accommodate the thermal expansions and contractions experienced with a temperature shift of at least 75^0F.

K. Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell, have no harmful effect on the gasket or pipe material, and support no bacterial growth. The lubricant containers shall be labeled with the manufacturer's name.

L. Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, as a minimum, equal to that of the barrel. Joints shall be either integral bell and ring joints with rubber compression gaskets as manufactured by the Clow Corporation, Johns-Manville, or Vulcan Plastic Corporation; twin gasket couplings as manufactured by the Certain-Teed Products Corporation; or an approved equal. However, the pipe and bell must be made by the same manufacturer.

M. Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.10/AWWA C110. The gaskets shall be ducked tipped transition gaskets for use with PVC pipe.

N. Fittings shall be lined with a thin cement lining as specified in ANSI A21. 4/AWWA C104; this lining is to be furnished at no extra cost. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mm thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

O. Fitting laying lengths shall conform to ANSI A21.10/AWWA C110.

P. Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

12.2 INSTALLATION OF FORCE MAIN

12.2.1 Lay the force main to and keep it at the lines and grades required by the drawings. All fittings shall be at the required locations, and the spigots shall be well centered in the bells. Where the grades are 0.2% or less, there shall be used an optic level or a laser to maintain the required slopes for the line.

12.2.2 Unless otherwise indicated by the drawings, all force mains shall have at least 36 inches of cover. The pipe shall slope continuously between high and low points and have a minimum of 60" cover at the high points. No departure from this policy shall be made except at the approval of the Town.

12.2.3 Provide and use tools and facilities that are satisfactory to the Town and that will allow the work to be done in a safe and convenient manner. Use a derrick, ropes, or other suitable equipment to lower all pipe and fittings into the trench one piece at a time. Carefully lower each piece so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances, drop or dump force main materials into the trench.

12.2.4 Lower no pipes and fittings into the trench until they have been swabbed to remove any mud, debris, etc., that may have accumulated within them. After the pipe has been lowered, remove all unnecessary materials from it. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell and ensure that the pipe is dry and oil-free.

12.2.5 Take every precaution to keep foreign material from getting into the pipe while it is being placed in the trench. If the crew laying the pipe cannot put it into the trench and in place without allowing earth to get inside it, then place a heavy, tightly woven canvas bag of suitable size over each end of the pipe and leave it until time to connect that pipe to the one adjacent to it.

12.2.6 Place no debris, tools, clothing, or other materials in the pipe during laying operations.

12.2.7 After a length of pipe has been placed in the trench, center the spigot end in the bell of the adjacent pipe, and then insert to the depth specified by the manufacturer and bring to the correct line and grade. Secure the pipe in place by tamping an approved backfill material around it after enclosing the pipe in its gravel envelope. Sewer warning tape shall be placed above the gravel envelope.

12.2.8 Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so that each pipe barrel will rest on a solid foundation for its entire length.

12.2.9 Whenever pipe installation is not in progress, close the open ends of pipe in the trench with a water tight plug or by other means approved by the Town. Cap the joints of any pipe in the trench that cannot be completed until a later time with packing in order to make them as watertight as possible; this shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, this seal shall remain in place until the trench has been pumped completely dry.

12.2.10 The cutting of pipe so that fittings or closure pieces can be inserted shall be done in a neat and workmanlike manner and without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.

12.2.11 The flame cutting of pipe by means of an oxyacetylene torch will not be allowed.

12.2.12 Unless otherwise directed by the Town, the installation of pipe with the bell ends shall be facing in the direction of laying.

12.2.13 Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer, and shall be approved by the Town.

12.2.14 Lay no pipe in water or when it is the Town's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, this shall be considered incidental to the project, and no separate payment will be made for its use.

12.2.15 Install thrust blocks wherever the force main changes direction (e.g., at tees and bends), at dead ends, or at any other point where the manufacturer recommends and/or the Town indicates that they are to be used.

12.2.16 Make all joints, whether standard mechanical or push-on joints, in conformance with the recommendations of the joint manufacturer as approved by the Town.

12.2.17 For detection purposes, a 12 gauge solid strand copper tracing wire (shielded) and an approved metallic tape identified as "sewer" shall be installed. The wire shall be duct taped to the top of the pipe and the metallic sewer tape shall be installed approximately 12 inches below the finished ground elevation in the trench of the pipe. Connections between the 12 gauge detection wires shall be soldered or connected with wire nut fasteners and wrapped.

12.2.18 Every 500 ft. of a force main, there shall be a tracer wire box/pull box installed for the 12 AWG gauge solid copper tracer wire, which is to be tapped to top of the force main pipe with metallic tape. The tracer wire shall be extended to each air release valve. The 12 AWG gauge solid copper tracer is not to be wrapped around the air release valve in any

way. The tracer wire shall be placed to the top of each box. The long side of the frame of the box shall run parallel with the force main.

12.3 SERVICE INSTALLATIONS

The service assembly shall include two inch (2") PEX SDR-9, C-200 SDR-21 PVC or approved equivalent material service pipe is required. The pipe shall be green in color.

PEX pipe shall be manufactured using high-pressure peroxide extrusion method for cross-linked polyethylene (PEXa). PEX pipe shall have a co-extruded PE shield that protects the pipe against ultraviolet light (sunlight) for an extended time. PEX pipe shall meet or exceed the requirements of ASTM F876, CSA B137.5 and PPI TR-3, and is certified to NSF Standards 14/61 and AWWA C904.

PEX pipe shall be produced in SDR-9 copper tube sizes (CTS) so that it is compatible with AWWA C800 valves and fittings when used with manufacturer's recommended insert which is required to stiffen the pipe. Pipe shall be compatible with fittings certified to ASTM F2080 and CSA B137.5.

The maximum temperature and pressure ratings shall be in accordance with ASTM F876, CSA B137.5 and PPI TR-3. The temperature and pressure ratings apply to the application of PEX pipe conveying hot and cold water at the 2.0 safety factor on allowable working pressure according to ASTM and CSA. The pipe shall withstand a maximum 200 psi (1380 kPa) operating pressure rating at 73.4°F (23°C) when using a 1.5 safety factor.

Each sewer service that is a privately owned force main (e.i. grinder pump) shall have a metro box (see detail PS-1.1 &1.2). The metro box shall be installed every 500-ft. and/or half the distance to the discharged manhole or force main service cleanout (see detail PS-1.3). All services lines shall have 12 AWG gauge solid copper tracer wire taped to the force main pipe with metallic tape.

12.4 HYDROSTATIC TESTS

12.4.1 Pressure Test

1. After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valved section thereof to a pressure of 200 psi. All connections (if applicable) are to be laid prior to testing the main and tested as part of the test of the main.

2. The duration of each pressure test shall be at least two (2) hours.

3. Slowly fill each valved section of pipe with water, and apply the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a pump connected to the pipe in a manner satisfactory to the Town. Furnish the water, pump, pipe, connections, gauges, and all necessary apparatus.

4. Before applying the specified test pressure, expel all air from the pipe. If air/vacuum assemblies are not available at high places, make the necessary taps at the points of highest elevation before testing, and insert plugs after the test

has been completed.

5. Carefully examine all exposed pipes, fittings, and valves, during the test. Remove any cracked or defective pipes, fittings, and/or valves, discovered in consequence of this pressure test, and replace with sound material in the manner specified. Repeat the test until the results are satisfactory to the Town.

12.4.2 Leakage Test

1. Conduct the leakage test after the pressure test has been satisfactorily completed. Furnish the water, pump, pipe, connections, gauges, measuring devices, and all other necessary apparatus as well as all necessary assistance to conduct the test.

2. The duration of each leakage test shall be two (2) hours; during the test, subject the main to a pressure of 200 psi.

3. Leakage is defined as the amount of water which must be supplied to the newly laid pipe or any valved section in order to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

4. No pipe installation will be accepted until the leakage is less than the number of gallons per two (2) hour period listed below:

Pipe Sizes	**Gallons per 1,000 Feet of Pipe**
2" - 2-1'4"	0.2
3"	0.5
4"	0.6
6"	0.9
8"	1.2
10"	1.5
12"	1.9
14"	2.2
16"	2.6
18”	2.9
20"	3.2
24"	3.8

5. Should any test of pipe laid disclose leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

12.5 Cleanup of Construction Site

After completing each section of force main, remove all debris and all construction materials and equipment from the work site. Then grade and smooth over the surface on both sides of the main. The entire area shall be clean and left in a condition satisfactory to the Town. Seed and mulch as required elsewhere in these specifications.

SECTION 13 – SANITARY SEWAGE LIFT STATIONS

13.0 GENERAL

The purpose of this section is to provide guidance to the developers, engineers, and contractors in order to achieve an acceptable installation for furnishing of sewer system components for a sanitary sewage lift station to subdivisions and other developments. Summarized below are requirements and conditions that apply to the granting of sewer service by the Town of Smyrna.

When constructing a sanitary sewer lift station, one(1) CONTRACTOR will be held responsible for its construction. This construction includes installing the force main, installation of submersible pump(s), remote telemetry, installing the pump station's remote terminals, flow detection instruments, power generators (in needed and/or requested by the Wastewater Treatment Plant), fencing, control panels, cabinets and components.

This shall pertain to and includes any machinery and/or specialty item that will be needed for the lift station that is deemed necessary by the Town's Wastewater Treatment Plant Manager and/or staff/operators/maintenance crew.

13.1 SUBMERSIBLE PUMPS: FLYGT PUMPS

13.1.1 Requirements

Furnish and install Flygt submersible non-clog wastewater pump(s). Each pump shall be equipped with an appropriate horsepower submersible electric motor, connected for operation on 460/480 volts, three (3) Phase, and a 60 hertz submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval.

13.1.2 Pump Design Configuration (Dry pit installation)

Pump shall be capable of operating in a continuous non-submerged condition in horizontal (NZ) or vertical (NT) (select one) position in a dry pit installation and permanently connected to inlet and outlet pipes. Pump shall be of submersible construction and will continue to operate satisfactorily should the dry pit be subjected to flooding.

13.1.3 Pump Design Configuration (Wet pit installation)

The pump shall be supplied with a mating cast iron discharge connection and be Capable of delivering the appropriate flow capacity as determined by the Town of Smyrna Utilities Department. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact. **Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.** No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with the appropriate amount of stainless steel lifting chain or stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight. All anchor bolts, guide rails, and support apparatus shall be stainless steel.

13.1.4 Pump Construction

Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blowholes or other irregularities. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pump age, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump. The sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber 0-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and 0-ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical 0-rings, grease or other devices shall be used.

13.1.5 Cooling System

A. Non-cooling Jacket Equipped

Each pump motor shall be sufficiently cooled by the surrounding environment or by submergence in the pumped media.

B. Cooling Jacket Equipped

Each unit shall be provided with an integral motor cooling system. A motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C.). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

13.1.6 Cable Entry Seal

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

13.1.7 Motor Requirements

The pump motor shall be a 3 phase NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be

insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31.The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation processes is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

13.1.8 Bearings

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently greased and lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two-row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve

13.1.9 Mechanical Seals

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particles entering the seal cavity to be forced out away from the seal due to centrifugal action.

A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

13.1.10 Pump Shaft

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel — ASTM A479 543100-T. Shaft sleeves will not be acceptable.

13.1.11 Impellers

(Cast Iron - .181 and .091 versions)
The impeller shall be of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 6% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The Impeller shall be locked to the shaft and held by an impeller bolt.

(High-chrome iron - .185 and .095 versions)
The impeller shall be of ASTM A 532 (Alloy III A) , 25% chrome cast iron, dynamically balanced, semi -open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 6% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The Impeller shall be locked to the shaft and held by an impeller bolt.

13.1.12 Volute/Suction Cover

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller.

Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable volute insert ring containing spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide the relief path and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so as to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute. The insert ring shall be cast of (ASTM A-48 Class 35B cast iron or ASTM A 532 (Alloy III A), 25% chrome cast iron)

13.1.13 Protection

Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

The thermal switches and float switch shall be connected to a Mini CAS control and status-monitoring unit. The Mini CAS unit shall be designed to be mounted in the pump control panel.

13.1.14 System Controls

The control system shall be designed to operate the required number of pumps specified on the drawing at the power characteristics shown on the plans.

The control function shall provide for the operation of the pumps under normal conditions, and shall alternate the pumps on each pump down cycle to equalize the run time. In the event the incoming flow exceeds the pumping capacity of the lead pump, subsequent pumps shall automatically start to handle the increased flow. As the flow decreases, the pumps shall cut off at the elevations as shown on the plans.

The control shall function as described below. The equipment listed below is a guide and does not relieve the supplier from supplying a system that will function as required.

13.1.15 Mechanical:

The enclosure shall be a NEMA 4X Stainless steel enclosure. The enclosure shall be a wall mount type with a minimum depth of 10" sized to adequately house all the components. Enclosures larger than 60" high x 36" wide shall be provided with 12" high leg stands. The enclosure door gaskets shall be rubber composition with a retainer or seamless foamed in place to assure a positive weatherproof seal. The gasket material shall not retain memory. The door shall open a minimum of 180 degrees.

A polished aluminum dead front inner door shall be mounted on a continuous aircraft type hinge and shall contain cutouts for mounted equipment and provide protection of personnel from live internal wiring. Cutouts for breaker handles shall be provided to allow operation of breakers without entering the compartment. All control switches, indicator pilot lights, elapsed time meters, and other operational devices shall be mounted on the external surface of the dead front. The dead front shall open a minimum of 150 degrees to allow access to equipment for maintenance. A 3/4" break shall be formed around the perimeter of the dead front to provide rigidity

The back plate shall be manufactured of 12 gauge sheet steel and be finished with a primer coat and two [2] coats of baked on white enamel. All hardware mounted to the subpanel shall be accomplished with machine thread tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified using engraved nameplates. Use of DYMO type labels is not acceptable

13.1.16 Electrical:

The panel power distribution shall include all necessary components and be completely wired with tinned, stranded copper conductors rated at 90 degrees c. All conductor terminations shall be as recommended by the device manufacturer.

All circuit breakers shall be heavy-duty thermal magnetic or motor circuit protectors similar and equal to SQUARE D type FAL. Each motor breaker shall be adequately sized to meet the pump motor operating characteristics and shall have a minimum of 10,000 amps interrupting capacity for 230 VAC and 18,000 amps at 480 VAC. The control circuit shall individually be controlled by a heavy-duty breaker.

Circuit breakers shall be indicating type, providing "on-off-trip" positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position indicating "trip".

Thermal magnetic motor breakers shall be quick-make and quick-break on manual and automatic operation and have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip.

Breakers shall be designed so that an overload on one pole automatically trips and opens all legs. Field installed handle ties shall not be acceptable. Motor starters shall be open frame, across the line NEMA rated with individual overload protection in each leg. Motor starter contact and coil shall be replaceable from the front of the starter without removing from its mounted position. Overload heaters shall be block type, utilizing melting alloy spindles, and shall have visual trip indication. Overload shall be sized for the full load amperage draw of the pumps. Definite purpose contactors, fractional size starters and IEC contactor relays shall not be acceptable.

Control transformers shall be provided to provide the 120 VAC and/or 24 VAC for control circuits when required. Transformers shall be fused on the primary and secondary circuits. The secondary windings shall be grounded.

A lightning-transient protector with tell-tale warning lights on each phase to indicate loss of protection on the individual phases shall be provided. The device shall be solid state with a response time of less than 5 nanoseconds with withstanding surge capacity of 6500 amperes. Unit shall be instant recovery, long life and have no holdover currents

The Phase Monitor shall be a 12 pin, plug in style unit. The Phase Monitor shall monitor Under Voltage, Phase Reversal, Loss of Power and Phase Imbalance. The motor starter circuits shall be de-energized upon sensing any of the faults and shall automatically restore service upon return to normal power. The Phase Monitor shall be available to monitor Over Voltage as an option. The output relay shall be DPDT rated at 10A at 240 VAC. The Phase Monitor shall be model 001-2301212, or model 001-480-1212 as manufactured by Motor Protection Electronics, Apopka, Florida, and (407) 299-3825.

13.1.17 Alarm System:

The alarm light shall be a weatherproof, shatterproof, red light
fixture with a 40-watt bulb to indicate alarm conditions. The alarm light shall be turned on by the high-level alarm and flash until the condition has been corrected. An open contact shall be provided for remote monitoring.

The alarm horn shall be mounted on the exterior of the cabinet.
The alarm horn shall provide a signal of not less than 90db at 10 feet. The alarm horn shall not degrade the listing of the enclosure. An alarm silence switch shall deactivate the alarm horn; however, the alarm light will flash until the alarm condition ceases to exist. At that time, the alarm reset function will reset for normal operation.

13.1.18 Level Control System:

I. 24V Float Relay System:

A 24-volt ac control system shall be provided for the float control system. The system shall provide for the automatic and manual control and alternation of the pumps to maintain a pumped down condition of the wet well. Float regulators adjusted to the level shown on the plans shall sense levels. A float regulator shall control each pump and when tilted shall turn the pump on. The pump (s) shall remain "on" until a common "off' level is reached. In the event the "off' float regulator fails, the system shall sense the failure and switch the "off' level to the second float regulator. The system shall provide indication for the regulators and indicate a failure of the "off' unit.

Control systems contingent on the "off' float regulator supplying control power to the other units is not acceptable.

A three-position HOA switch shall be provided for each pump. The switch shall be NEMA 4x rated with 10 amp contacts except when provided on a dedicated controller. A position indicating legend plate shall be provided. The HOA switches shall be mounted on the inner dead front door unless provided in the controller units.

A green run pilot indicator shall be mounted on the dead front door. Level indicator lights or indicators shall be provided.

An elapsed time meter shall be mounted on the dead front door. The meter shall operate on 120 VAC, shall indicate in hours [6 digits] and tenths and shall be non-resettable.

The alternator shall be a plug in, solid-state unit with lead-lagauto selector and test switches except when provided in a dedicated control device. The unit shall operate on 120 vac and provide DPDT ten amp rated contacts. Two LEDs shall indicate the next position to run as lead pump.

A thermal heater and thermostat shall be installed to maintain the internal temperature of the enclosure above the dew point.

Control wiring shall be copper, tinned, UL1O15, 18ga. minimum.
II. Mini Cas

One Mini-Cas 120 unit shall be supplied for each pump to monitor the pump for over-temp and leakage. The unit shall have an 11 pin, round base to mate with a standard 11-pin socket. The unit shall also be flanged in order to allow dead front door mounting with use of 11 pin reverse socket, Omron part number P3GA-11. The unit is to be able to be powered by 24VAC, 24VDC, or 12OVAC, and to contain LED indication for power on, over-temp, and leakage conditions. The unit shall contain an over-temp reset push-button to reset the unit after the fault has cleared, as well as a selector switch that allows the selection of manual or auto reset. The sensor input circuitry is to contain both hardware and software filters for noise immunity, as well as sensor input short circuit protection. The Mini-Cas 12O unit shall be model 14-4O7129, as supplied by Flygt Corporation.

III. Float Switch

A mechanical float switch shall be supplied for level control and be suspended at the desired height from its own cable. The float switch case shall be made of polypropylene and the cable is sheathed with a special PVC compound. The float switch cables shall be supplied with 40' of cable.

IV. Submersible Pressure Transducer

A submersible pressure transducer shall be lowered to the bottom of the wet well and connected to the control system at the top of the well for the lift station. The transducer shall monitor the level of the wet well during pumping. The transducer shall be able to reach the designed recommended threshold that is stated by the lift station’s design engineer. The transducer shall be a non-clogging submersible pressure transducer. The transducer shall be able to be viewed/report data to the SCADA monitoring system.

13.1.19 Manufacturer:

A final as built drawing encapsulated in mylar shall be attached to the inside of the front door. Schematics shall be done in ladder logic with wire numbers and line numbers. Real time cross-referencing of relay contact to line numbers shall be given as well as written description of component function on each circuit of the drawings. From/ to wire and termination reports shall be shown on the as built drawings. Drawings shall be available in HTML format. Terminal strip layouts shall be provided for ease of connecting external devices.

All component parts in the control panel shall be permanently identified with engraved legend plates as designated on the drawings. A list of all legends shall be available in Excel format and attached with the schematics on the panel door.

All equipment shall be tested to the operational requirements. Each control function shall be activated to check for proper indication.

All equipment shall be guaranteed for a period of one year from the date of acceptance. The guarantee is effective against all defects in workmanship and/or defective components. The warranty is limited to replacement of or repair of the defective equipment.

The manufacturer shall be a UL508 shop and provide evidence on the end product.

13.2 REMOTE TELEMETRY UNIT

13.2.1 Submittals

A. General:

All Shop Drawings and O&M Manuals shall be furnished in hard copy and in Adobe PDF electronic format on compact disk

B. Radio Survey:

1. Has been previously completed by others. A copy of the radio survey results will be submitted to the Systems Integrator.

2. To be reviewed by Systems Integrator to confirm that radio communication links will be reliable.

3. Any required towers, poles, or masts are not included in this Specification Section.

C. Hardware:

1. Submit full details, shop drawings, wiring diagrams, catalog cuts and such descriptive literature and documentation as may be required to demonstrate conformance to these specifications. These submittals shall clearly identify specific items and options proposed to be provided. In addition, these submittals shall clearly identify installed spares and other provisions for future work (e.g. reserved panel space, unused components, wiring, terminals, etc.)

2. Legends and Abbreviations Lists: As part of the first Design Related Submittals for each subsection, submit a complete definition of symbols and abbreviations used on this project. For example: engineering units, flow streams, instruments, structures and other process items used in nameplates, legends, data sheets, point descriptions, CRT displays, alarm/status logs and reports. The same abbreviations shall be used for the subsections. Submit updated versions with subsequent submittals and a final version with the O&M Manuals.

3. Cross Referencing of Components: The Table of Contents of the Submittal and O&M manual shall provide for each item: Component Data Sheet No., Specification Section Reference No., Manufacturer, Model No-, Description, Instrument 1.D., Tag No. and Calibration Range (or field devices). Furthermore, each item's individual Component Data Sheet shall reference the Specification Section Reference No., the Supplier's Drawing No. that has the Bill of Material for the Panel in which the component is mounted, the Item number for the component in said Bill of Material, Instrument I.D.Tag No. and Calibration Range (for field devices). This information will be in addition to the items specified in sections entitled Component Data Sheets and Bill-of- Materials. The Table of Contents shall be sorted by Specification Section in ascending order.

4. Notification of Minor Deviations from Specification: Any deviation from specifications shall be noted at the front of the submittal in a separate section labeled Items of Interest, Comments, and Requests for Clarification. This section shall detail any minor deviations from specifications herein- Each Item of Interest, Comment, or Request for Clarification shall be numbered and the specification section in question shall be referenced. These items shall be sorted by Specification Section in ascending order. The intent of this section is to make Engineer(s) aware of any minor change from specification because of outdated equipment, differences in panel manufacturing from supplier to supplier, etc. Approval of such minor deviations will be at the sole discretion of the Engineer. No change in contract price will be allowed if the minor deviations are acceptable.

D. Software:

1. All software submittals shall be in accordance with the requirements of the associated subsection sections. Their sequences of development shall also be in accordance with the associated requirements stated herein.

13.2.2 Testing

A. General:

1. All elements of the SCADA System, both hardware and software, shall be tested to demonstrate that the total system satisfies all of the requirements of this specification.

2. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and upon the system's or sub-section's producing the correct result (effect), the specific test requirement will have been satisfied.

3. All tests shall be conducted in accordance with, and documented on, prior engineer approved procedures, forms and checklists. Each specific test to be performed shall be described and a space provided after it for sign off by the appropriate party after its satisfactory completion.

4. Copies of these sign off test procedures, forms and checklists will constitute the required test documentation.

5. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment and data. Where it is not practical to test with real process variables, equipment and data, provide suitable means of simulation. Define these simulation techniques in the test procedures.

13.2.3 O&M Manuals

A. General:

1. Provide up to (10) complete sets of separately bound Operation and Maintenance (O&M) Manuals for each subsection of the SCADA System. O&M Manuals shall also be furnished in Adobe PDF electronic format on compact disk.

2. These manuals shall include operating and maintenance information for all subsections (and their components) provided in this section. The O&M information shall be in sufficient detail to allow the operation, removal, installation, adjustment, calibration and maintenance of each component provided under this section to the printed circuit board level.

3. Each manual shall include a legend and abbreviation list.

4. Each set of manuals for each subsection shall be assembled in one or more 3-ring binders; each with a title page, table of contents, and heavy section dividers with labeled index tabs. Where more than one binder is required, the binders shall be labeled "Volume 1', "Volume 21", etc. The table of contents shall encompass the entire set of O&M Manuals, shall list the contents of each volume and shall appear in each binder.

5. Operational Readiness Test Component and I/O Module Calibration Sheets shall be included as part of the Analog Subsection O&M Manual sets.

13.2.4 On-site

A. General:

1. The Contractor shall require the SCADA System supplier to provide experienced personnel and management on-site to coordinate the complete SCADA System which shall include the following as a minimum:

a. Instrument calibration and adjustment
b. All on-site testing
c. Owner training
d. Start-up assistance

B. Start-up and Testing Team:

1. The Contractor shall require the SCADA System supplier to provide, on-site, a team of experienced engineering, technician and software/configuring personnel during the total period required to:

a. Thoroughly check the installation, termination and adjustment of all of the subsections and their components.
b. Perform and complete all on-site tests.
c. Provide start-up assistance to the Contractor and Owner.

13.3 PUMP STATION REMOTE TERMINAL UNIT

Panel hardware:

1. Allen-Bradley Micro Logix 1400
2. NEMA 4 Enclosure with sub-pan
3. Door operated switch for enclosure
4. MDS 9810 Radio
5. 24 VDC Power Supply
6. 700 VA UPS
7. Cable & Polyphaser
8. Yagi 12db Gain Antenna
9. Heater with Thermostat & Fan
10. Duplex Receptacle
11. Fuses and breakers as required
12. Name Plates
13. A/C Surge suppressor
14. Surge suppressor for each outside mounted analog signal
15. Weidmuller terminal blocks as needed

Discrete I/O (supply 20% spare):

1. Pump 1 Run Status
2. Pump 2 Run Status
3. Pump 3 Run Status
4. Pump 1 Alarm
5. Pump 2 Alarm
6. Pump 3 Alarm
7. Utility Power OK
8. Utility Power Failure
9. Generator Failure
10. Sump High Water Level Switch
11. Sump High High Water Level Switch
12. Door Switch Status
13. Grinder 1 Run Status
14. Grinder 2 Run Status
15. Bar Screen 1 Run Status
16. Bar Screen 2 Run Status

Analog I/O (supply 20% spare)

1. Wet well Level
2. Pump 1 Speed (0-100%)
3. Pump 2 Speed (0-100%)
4. Pump 3 Speed (0-100%)
5. Pump Station Flow (where required)

13.4 INSTRUMENTS

13.4.1 Magnetic Flow Meter with remote mounted transmitter and display (where required)

1. Magmeter is to be Danfoss with MAG 6000 remote display transmitter.

2. ANSI Class 150 lb flanges
3. 0.25% accuracy with improved accuracy at low flow
4. Hard elastomer lined bore
5. Soft elastomer facing
6. Stainless steel measuring and grounding electrodes
7. Conforms to OIML R49 and ISO 4064 custody transfer standards
8. Operating temperature from 23 — 195 °F
9. Confirms to EEC directives: PED, 97/23/EC pressure directive for EN1092-1 flanges
10. UL approved

13.4.2 Pressure Level Transducer & Transmitter

1. Each pressure level transmitter shall be a microprocessor-based electronic unit consisting of a sensor assembly, a signal converter/transmitter, and an interconnecting cable.

2. The sensor shall be encapsulated in a chemical- and corrosion-resistant material such as kynar or CPVC, and shall be suitable for operation over a temperature range of -20 to 150 °F, with a relative humidity of 10 to 100 percent.

3. Sensors shall be compatible with the process media being measured. The sensor shall be mounted directly over the Process and shall measure the fluid level by means of reflected high frequency sound waves.

4. Sensors mounted in areas subject to freezing condensation shall be protected against icing with special transducers or heaters. Sensors mounted in direct sunlight shall be provided with sunshades.

5. The supplier shall coordinate the sensor mounting requirements and shall furnish drawings, complete with dimensions and elevations, to ensure a proper and satisfactory installation. General installation requirements are indicated on the drawings.

6. The pressure level transmitter shall have automatic compensation for changes in air temperature at the sensor location. If separate temperature sensing probes are provided, they shall be mounted with or adjacent to the ultrasonic sensor, as recommended by the manufacturer.

7. The transmitter shall have a four-digit LCD display scaled to read in engineering units of level. Digit height shall be approximately 0.5 inch. The transmitter shall be designed to ignore momentary level spikes, false targets, or momentary loss-of-echo. A loss-of-echo condition shall be indicated on the transmitter unit and shall be available as an alarm contact output.

8. The transmitter output shall be an isolated 4-20 mA dc signal linearly proportional to level.

9. Calibration parameters shall be stored in nonvolatile EEPROM memory.

10. Accuracy of the transmitted signal shall be 01.0 % of the level range.

11. A sufficient length of sensor-to-transmitter signal cable shall be furnished.

12. The signal converter electronics shall be housed in a NEMA Type 4 enclosure suitable for wall or pipe stand mounting and for operating temperatures of -15 to 125 °F., and a relative humidity of 10 to 100 percent. A thermostatically controlled strip heater shall be provided in the signal converter enclosure. The signal converter shall be powered from 120 volts ac, 60 Hz.

13. The ultrasonic level transmitter shall be a Pulsar. The instruments shall be suitable for the locations in which they will be installed so that they will not be affected by adjacent walls, etc.

14. Pressure Level Transmitter shall be provided for the wet well.

13.4.3 Level Switch (Float Type)

1. Type: Submersible coated 316 stainless steel, polypropylene, or polyethylene body; non mercury switch contact rated 4 amps at 120 VAC; normally open, normally closed, or Form C (N.0 and N-C.) contact configuration as indicated. Mercury float switches are unacceptable.

2. Cable. Minimum 18 gauge, 300 volt (minimum) rated; heavy-duty type SOW or equivalent Provide sufficient length for mounting.

3. Junction Box: Provide NEMA 4X stainless steel junction box, mounted near the switch, for terminating vendor supplied cable and discrete control wiring to control panel.

4. Switch Mounting: All mounting components shall be aluminum or stainless steel. The Electrical Contractor shall provide 3/4 or 1 inch Schedule 40, 316 stainless steel pipe for mounting. The pipe shall extend from two feet above the highest switch setting (up to the top of the vessel) to two feet below the lowest level setting (down to the vessel bottom) for the vessel or well and allow for adjustment of the switch or along the length of the pipe. The method for fixing the float to the pipe shall be easily adjustable and shall vide for protection and strain relief for the float switch cable. Provide a minimum of two mounting brackets for fixing the pipe to the vessel wall while maintaining appropriate standoff distance. The System Manufacturer shall ensure mounting is in accordance with the manufacturer's recommendations.

(Note: installation and mounting of all instruments is the responsibility of the General Contractor.)

13.5. CONTROL PANELS, CABINETS, AND COMPONENTS

13.5.1 General Requirements

1. Furnish all labor, materials, equipment, and incidentals required to fabricate and startup, complete and ready for operation. The panels listed in this section to be supplied by the System Integrator.

2. All control panels furnished under this Section shall carry a UL label which certifies the control panel meets the requirements of UL-508A (latest version).

3. The Control systems shall be Underwriters Laboratories UL508A approved and all components shall be NEMA rated. IEC components will not be accepted. All control panels shall be assembled by a UL approved shop and labeled to that effect.

4. All electrical work shall be in accordance with the National Electrical Code (NEC), latest revision.

5. Submit full details, shop drawings, wiring diagrams, catalog cuts and such descriptive literature and documentation as may be required to demonstrate conformance to these specifications. These submittals shall clearly identify specific items and options proposed to be provided. In addition, these submittals shall clearly identify installed spares and other provisions for future work (e.g. reserved panel space, unused components, wiring, terminals, etc.)

6. All Shop Drawings and O&M Manuals shall be furnished in hard copy and in Adobe PDF electronic format on compact disk.

SECTION 14 – BORING AND CASING FOR SEWER LINES

14.0 GENERAL

The work to be performed hereunder shall consist of the installation of casing pipe and carrier pipe for water lines as shown on the drawings or as called for in these specifications. For the open cut casing pipes (only as approved by the Town of Smyrna), it shall include the excavation of the trench, placing proper bedding material, furnishing and installing the casing pipe, furnishing and installing the carrier pipe, furnishing and installing casing spacers, (specifically designed and manufactured for the application, no hand fabricated or homemade spacers will be allowed), furnishing and installing casing end caps (specifically designed and manufactured for this type application), backfilling, and disposing of the excess excavated materials at an approved location secured by the contractor. For the boring and jacking of casing pipes, it shall include the excavation of a boring pit, auger boring between the point as specified on the drawings, furnishing and installing of the carrier pipe, furnishing and installing casing spacers, (specifically designed and manufactured for the application, no hand fabricated or homemade spacers will be allowed), furnishing and installing casing end caps (specifically designed and manufactured for this type application) and disposing of the excavated materials at an approved location secured by the contractor.

The minimum casing pipe size and wall thickness shall be as shown in the following table for the water or wastewater carrier pipe size indicated. For sizes not included therein, or for special design considerations, approval shall be obtained from the Director of Utilities.

14.1 CASING PIPE

14.1.1 The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association Specifications for “Pipelines for Carrying Flammable and Nonflammable Substances”. Casings shall be pipe conforming to the requirements of ASTM Designation A-139 Ductile Iron Pipe Class 250. The steel casing pipe shall have minimum yield strength of 35,000 PSI and shall have the minimum wall thickness shown in the following table:

Table of Minimum Wall Thickness for Steel Casing Pipes for E72 Loading

Carrier Pipe Diameter	Casing Pipe Diameter	Nominal Thickness
4”	12”	0.250”
6”	18”	0.312”
8”	20”	0.375”
10”	24”	0.375”
12”	24”	0.375”
14”	26”	0.500”
16”	30”	0.500”
18”	30”	0.500”
20”	36”	0.500”
24”	42”	0.500”
30”	48”	0.500”
36”	54”	0.625”
42”	60”	0.625”
48”	66”	0.625”

14.1.2 When the casing pipe is installed without benefit of a protective coating, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of

1/16 inches greater than the thickness shown. The casing pipe shall be a minimum of twice the size of the carrier pipe. Refer to the Table of Minimum Wall Thickness for Steel Casing Pipes for verification for the allowed size of casing pipe.

14.2 CARRIER PIPE

The carrier pipe shall have a casing pipe when it is located underneath a paved area and crossing other utilities when there is not a minimum of 18 inches of vertical separation. The carrier pipe inside the casing pipe shall be installed with restraining gaskets or a bell restraint harness.

14.3 BORING

The boring shall be accomplished by means of auguring to the size, line and grade shown on the drawings.

14.4 INSTALLATION OF CASING PIPE

14.4.1 Casing pipes crossing under roadways/railroads shall be located at suitable approved alignments in order to eliminate possible conflicts with existing or future utilities and structures. A minimum 36-inch depth of cover between the top of the casing pipe and the surface of the roadway shall be maintained. Casing length shall extend a minimum of ten (10) feet beyond the edge of pavement or curbing. For open cut of casing pipes, install the steel casing pipe into the open cut as the trench excavation proceeds. Weld sections of casing pipe together to provide watertight joints, and replace the protective coatings in areas where it is damaged by welding.

14.4.2 For boring casing pipes, jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints.

14.4.3 All casing pipes shall have a rubber boot at the ends of the casing pipe. The rubber boot shall cover the entire outer diameter of the casing pipe and the carrier pipe. The rubber boot shall be held together by a stainless steel band

14.4.4 Do not remove unacceptable casing without prior approval from the Director of Utilities. If the removal of the casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.

14.5 INSTALLATION OF CARRIER PIPE

14.5.1 The carrier pipe shall be furnished by the Contractor. Upon acceptance of the casing, install the carrier pipe in the casing by jacking it through the casing. In order to achieve proper line and grade on the carrier pipe, install pipe spacers at each bell of the pipe and in the middle of the pipe segment to offset any deviations in the casing grade and as to allow true design grade and to secure the carrier pipe within the casing pipe.

14.6 LAYOUT OF WORK

14.6.1 The Developer’s or Owner’s Engineer will provide the necessary control points

required by the contractor for this construction. The Contractor will provide the detailed layout required to keep the excavation and pipe installation on grade.

14.7 GUARANTEE OF WORK

14.7.1 Guarantee a usable completed casing between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the casing shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the drawings and on the bottom by an elevation no lower than the existing inlet pipe invert.

14.7.2 The allowable tolerance at the upstream end point of the casing shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the drawings.

SECTION 15 – CONCRETE UTILITY LINES

15.0 GENERAL

This item shall include furnishing and installing concrete manholes, blocking, cradles, anchors, caps, pipe protection, and/or encasement at the locations shown on the drawings and/or directed by the Town of Smyrna's representative.

15.1 CONCRETE REGULATIONS AND TESTING

Concrete work shall conform to ACI 301-72 (as revised), as modified by the supplemental requirements below:

A. Strength

1. The strength of concrete shall be 3,000 psi unless otherwise shown on the drawings. Manholes shall have a 28-day compressive strength of minimum 5,000 psi.

B. Durability

1. All concrete exposed to weather shall be air entrained.

C. Slump

1. Concrete shall be proportional and produced to have a slump of 3 inches with a 1 inch tolerance.

D. Admixtures

1. Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture (retarding, normal, or accelerating, depending on placing temperature), may be used if approved by the Town of Smyrna's representative.

E. Reinforcing Steel

1. Yield strength of reinforcing steel shall be 60,000 psi.

SECTION 16 – INSTALLATION OF RE-PURIFIED PIPES

16.0 GENERAL

16.0.1 Contractor shall be responsible for safely storing materials needed for the work that have been accepted by him until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

16.0.2 Wherever reaction blocking is necessary, it shall be considered an integral part of the water line work, and no separate payment shall be made for it.

16.0.3 Pipe sizes 4" – 12" diameter shall be PVC in conformance with AWWA C900 DR-14 standards and specifications, unless specified otherwise by the Town.

16.0.4 Pipe sizes 14" and greater shall be ductile iron meeting the design thickness as specified by ANSI A21.50/AWWA C150 and meet the minimum pressure class of 350 psi, unless specified otherwise by the Town. The ductile iron pipe shall be centrifugally cast in metal or sand-lined molds and conforming to ANSI A21.51/AWWA C151 specifications. Pipe joints shall meet ANSI A21.11/AWWA C111. Ductile iron pipe shall contain cement lining in accordance with ANSI A21.4/AWWA C 104.

16.1 DUCTILE IRON PIPE AND FITTINGS

16.1.1 Ductile cast iron pipe shall be made of good quality ductile iron that meets the requirements for nodular iron castings of ASTM E8. It shall be plain end ductile iron pipe with push-on, single gasket joints. The design thickness shall be that specified by ANSI A21.50/AWWA C150 except that all pipe with a diameter of 12 inches or less shall have a wall thickness of 0.25 inches and all pipe with a diameter of 14 inches or more shall have a thickness of 0.28 inches or greater.

16.1.2 Ductile iron pipe shall be centrifugally cast in metal or sand-lined molds and shall conform to the specifications of ANSI A21.51/AWWA C151. It shall be made and tested in accordance with ASTM A339 and shall be subjected to and able to withstand a hydrostatic pressure of 500 psi. The maximum depth of pits shall be half that allowed in the AWWA specifications.

16.1.3 The push-on, single gasket joints shall be either Fastite (manufactured by American Cast Iron Pipe Company), Tyton (U. S. Pipe and Foundry Company), Super Bell-Tite (Clow Corporation), or other joints of similar type and equal quality. They shall be UL approved and able to withstand 200 psi of operating pressure.

16.1.4 The bell of each pipe shall have a tapered annular opening and a cast or machined retaining groove for the gasket. The gasket groove shall have a flared design so that maximum deflection will be provided. The plain spigot end of the pipe shall be beveled in order to simplify its entry into and centering within the bell and the compression of the gasket.

16.1.5 The gasket shall be of high quality vulcanized rubber made in the form of a solid ring to exact dimensions. The design of the gasket groove in the bell of the pipe and the design, hardness, and other properties of the gasket itself shall be such that the joint is

liquid tight for all pressures from a vacuum to a maximum rating of 350 psi of internal liquid pressure.

16.1.6 Enough lubricant shall be furnished with each order to provide a thin coat on the spigot end of each pipe. This lubricant shall be approved for being in contact with potable water and shall be nontoxic, impart no taste of smell to the water, and have no harmful effect on the rubber gasket. It shall have a consistency that will allow it to be easily applied to the pipe in either hot or cold weather and that will enable it to adhere to either wet or dry pipe. In no case shall lubricant other than that supplied by the pipe manufacturer be used.

16.1.7 Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.10/AWWA C110.

16.1.8 Pipe and fittings shall be lined with enameling or a thin cement lining as specified in ANSI A21.4/AWWA C104. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

16.1.9 Fitting laying lengths shall conform to ANSI A21.10/AWWA C110, short body.

16.1.10 Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

16.1.11 The pipe manufacturer is to furnish the A/E a certificate of inspection, sworn to by the factory inspector in the presence of a notary public, stating that the pieces of pipe in the shipment were made and tested in accordance with ANSI A21.51 and that they were subjected to and with-stood a hydrostatic pressure of 500 psi. Each statement is to give the number of pieces of pipe in the shipment, the length of each piece of pipe, and the serial number of each piece of pipe making up the shipment. In addition, the weight of each individual piece of pipe making up the shipment is to be listed opposite the serial number of each pipe length and attached to the certificate of inspection.

16.1.12 If installing reclaimed/re-purified water lines, the ductile iron pipe shall have the message “Caution – Re-purified Water – Do Not Drink” stamped on opposite sides of the pipe at 180 degrees apart.

16.1.13 If installing reclaimed/re-purified water lines, a continuous 3-inch wide non-detectable warning adhesive tape reading “Caution – Re-purified Water Line Below” shall be wrapped around the line at 12” spacing.

16.2 GATE VALVES

Valves on water lines ten inches and smaller shall be of double disc, parallel seat, iron body bronze mounted type or resilient wedge, iron body, iron gate with bond-in-place Nitrile elastomer designed to work equally well with pressure on either side of the gate. All gate valves shall be in accordance with or exceed AWWA C500. Working pressure shall be 200 psi.

Valves ten inches and smaller shall be Mueller A2380-20, American Darling No. 55, Clow F-5065, or American Flow Control Series 2500, or equal, with mechanical joints. All gate valves

shall be resilient seated, manufactured to meet or exceed the requirement of AWWA C509 latest revision. Valves shall be suitable for installation in an approximate vertical position in buried pipelines. Stem seal shall consist of three (3) 0-ring seals. All valves shall open to the left (counterclockwise) with non-rising stems and shall be provided with a 2-inch square operating nut. All internal and external exposed surfaces shall be fusion-bonded epoxy coated with an approved epoxy coating to a minimum thickness of 6 mils, complying fully with AWWA 550 and certified to NSF61. Bodies shall be constructed of cast iron (ASTM A126, Class B) and shall have integrally cast mechanical joint ends in accordance with AWWA C111. Accessories (bolts, glands, and gaskets) shall be supplied by the valve manufacturer. Valves shall be a steel body of molded-in vulcanized Buna-N bonded to the valve body. Valves shall be furnished with mechanical joint ends in accordance with ANSI A21.11 unless otherwise shown or directed.

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

16.3 BUTTERFLY VALVES

Valves on water lines 12 inches and larger shall be butterfly valves, be designed for direct burial service, and meet or exceed performance requirements for water application of applicable standards such as AWWA C504. Valves shall be fitted with operators designed to accept Metro Valve Box “John Bouchard & Sons Company, No. 8006"; valves shall open to the left. All butterfly valves shall be of the tight closing, rubber-seat type. Valves shall be bubble-tight at rated pressures in either direction, and shall be satisfactory for applications involving throttling service and/or operation and for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90º from the full open position to the tight shut position. Regardless of valve size, angular mis-position of disc can be 1º off center without leakage. The manufacturer shall have manufactured tight-closing, rubber-seat butterfly valves for a period of at least five (5) years.

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

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

Valves shall be Dresser Manufacturing Company No. 450 butterfly valve, Henry Pratt Company "Groundhog," American Darling Class 150B, or equal.

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

All seats shall be of a synthetic rubber compound. Seats shall be a full 360º without interruption and have a plurality of grooves mating with a spherical disc edge-seating surface. Valve seats shall be field adjustable around the full 360º circumference and replaceable without dismantling

operator, disc or shaft and without removing the valve from the line. Manufacturer shall certify that the rubber seat is field replaceable.

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

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

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

16.4 TAPPING SLEEVES AND VALVES

The tapping sleeves shall consist of a cast iron body with removable bolts, mechanical joint gasket design giving 360° pipe coverage and cast iron flange to accept standard tapping valves. Tapping sleeve shall be Mueller H-615 or approved equal. All tapping sleeves shall be hydrostatically tested at 200 psi for two (2) hours, and shall be manufactured as tapping valves with line up grooves. Tapping valve shall be Mueller T-2360, T-2361 or approved equal.

16.5 VALVE BOXES

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

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

Valve boxes shall have an inside opening of not less than 11" by 13". Standard precast reinforced concrete boxes having the same opening shall be provided. Concrete boxes and footing blocks shall be made of 4,500 psi concrete by an approved manufacturer. Cast iron valve boxes shall be as manufactured by an approved supplier shall require prior approval before installation.

16.6 FIRE HYDRANTS

Fire hydrants shall be iron bodied, fully bronze mounted, hydrants manufactured to equal or exceed AWWA Standard C502, UL246 and FM1510 specifications latest revision. Hydrants shall be suitable for 200 psi working pressure and shall be subjected to a test pressure of 400 psi. Inlet connection shall be 6" mechanical joint. Main hydrant valve shall be reversible compression type, closing with the pressure, with 5 ¼” valve opening.

All hydrants shall be equipped with two (2) 2½" hose nozzles, one 4 ½” pumper nozzle, breakable safety flange, and stem coupling. Threads on hose and steamer nipples, operating

nuts, and cap nuts shall conform to local Water Department standards. Bronze nozzles shall be securely locked to prevent them from blowing off. Hose and pumper nozzles shall be field replaceable. Hose threads shall be National Standard. Nozzle caps shall be equipped with non-kink chains.

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

Fire hydrants shall be supplied with multi-port drain ports. Drain valves operated by springs or gravity will not be acceptable. A positive stop shall be provided on the operating stem to prevent over travel when operating the valve. It should not be necessary to excavate to repair or inspect internal parts. It should be removable without disturbing the line joint or nozzle section of the hydrant. Fire hydrants shall be supplied with a bituminous coating for the buried portion of hydrant and a high visibility purple enamel finish for above ground portions of the hydrant. The bonnet shall be painted the color purple to signify it is a re-used water fire hydrant. Inside of the hydrant shoe shall be covered with thermoset epoxy coating.

Hydrants shall be Mueller "Centurion" or approved equal. The body and the bonnet of the hydrant shall be painted purple.

16.7 CASING PIPE

The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association Specifications for “Pipelines for Carrying Flammable and Nonflammable Substances”. Casings shall be pipe conforming to the requirements of ASTM Designation A-139 Ductile Iron Pipe Class 250. The steel casing pipe shall have a minimum yield strength of 35,000 PSI and shall have the minimum wall thickness shown in the following table:

Table of Minimum Wall Thickness for Steel Casing Pipes for E72 Loading

Carrier Pipe Diameter	Casing Pipe Diameter	Nominal Thickness
4”	10”	0.250”
6”	12”	0.312”
8”	16”	0.375”
10”	20”	0.375”
12”	24”	0.375”
14”	26”	0.500”
16”	30”	0.500”
18”	30”	0.500”
20”	36”	0.500”
24”	42”	0.500”
30”	48”	0.500”
36”	54”	0.625”
42”	60”	0.625”
48”	66”	0.625”

When the casing pipe is installed without benefit of a protective coating, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 1/16 inches greater than the thickness shown. The casing pipe shall be a minimum of twice the size of the carrier pipe. Refer to the Table of Minimum Wall Thickness for Steel Casing Pipes for verification for the allowed size of casing pipe.

All service lines crossing pavement shall be encased in a casing pipe. All re-purified water mains crossing paved areas and/ or roadways shall be encased in a casing pipe. The casing pipe shall be a minimum of twice the size of the carrier pipe. Refer to the Table of Minimum Wall Thickness for Steel Casing Pipes for verification for the allowed size of casing pipe. All casing pipes shall extend 10 feet beyond the curb or outside of the paved area. If the re-purified water main has less than 18 inches of vertical separation between other utilities, then the re-purified water main shall be encased in a casing pipe. The carrier pipe inside the casing pipe shall be installed with restraining gaskets or a bell restraint harness.

16.8 PVC PIPE

16.8.1 All plastic pipes shall be made from Class 12454-B polyvinyl chloride plastic (PVC 1120) as defined by ASTM D1784 as defined by ASTM D1784. All PVC pipes shall meet the specifications of AWWA C900 (DR-14) with a minimum pressure class of 200 psi.

16.8.2 All Class 200, 250, or 315 pipes shall have NSF approval and be manufactured in accordance with ASTM D2241. The following tests shall be run for each machine on each size and type of pipe being produced, as specified below:

1. Flattening Test: once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.

2. Acetone Test (Extrusion Quality Test): once per shift in accordance with ASTM D2152. There shall be no flaking, peeling, cracking, or visible deterioration on the inside or outside surface after completion of the test.

3. Quick Burst Test: once per 24 hours in accordance with ASTM D1599.

DR	Minimum Bursting Pressure Rating	Pressure, psi
14	200	985

4. Impact Tests: for 6 inches and larger, once per shift in accordance with ASTM D2444; for 4 inches and smaller, once each two hours in accordance with ASTM D2444.

5. Wall Thickness and Outside Dimensions Tests: once per hour in accordance with ASTM D2122.

6. Bell Dimension Test: once per hour in accordance with ASTM D3139.

16.8.3 If any specimen fails to meet any of the above mentioned tests, all pipe of that size and type manufactured between the test periods must be scrapped and a full set of tests shall be re-ran.

16.8.4 Furnish a certificate from the pipe manufacturer stating that he is fully competent to manufacture PVC pipe of uniform texture and strength and in full compliance with these specifications and further stating that he has manufactured such pipe and done so in sufficient quantities to be certain that it will meet all normal field conditions. In addition, the manufacturer's equipment and quality control facilities must be adequate to ensure that each extrusion of pipe is uniform in texture, dimensions, and strength. Also furnish a certificate from the manufacturer certifying that the pipe furnished for this project meets the requirements of these specifications.

16.8.5 All pipes shall be manufactured in the United States of America. All pipes for any one project shall be made by the same manufacturer.

16.8.6 All 4 inches and 6 inches pipe may be furnished in the manufacturer's standard laying lengths of 20 feet, 38 feet, or 40 feet. Pipe 8 inches and larger shall be furnished in 20 feet lengths. The Contractor's methods of storing and handling the pipe shall be approved by the A/E. All pipe shall be supported within 5 feet of each end; in between the end supports, there shall be additional supports at least every 15 feet. The pipe shall be stored away from heat or direct sunlight. The practice of stringing pipes out along the proposed water line routes will not be allowed.

16.8.7 Certain information shall be applied to each piece of pipe. At the least, this shall consist of:

1. Nominal size
2. Type of material
3. SDR or class
4. Manufacturer
5. NSF Seal of Approval

16.8.8 Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.

16.8.9 The pipe shall have push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber will be allowed. Gasket materials shall meet the requirements of ASTM F477. The gaskets shall be of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal.

16.8.10 The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be able to accommodate the thermal expansions and contractions experienced with a temperature shift of at least 75 degrees F.

16.8.11 Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be approved for being in contact with potable water and shall be nontoxic, impart no taste or smell to the water, have no harmful effect on the gasket or pipe material, and support or promote any bacterial growth. The lubricant containers shall be labeled with the manufacturer's name. In no case shall lubricant other than that supplied by the pipe manufacturer be used.

16.8.12 Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, as a minimum, equal to that of the barrel. Joints shall be either integral bell and ring joints with rubber compression gaskets as manufactured by the Clow Corporation, Johns-Manville, or Vulcan Plastic Corporation; twin gasket couplings as manufactured by the Certain-Teed Products Corporation; or equal. However, the pipe and bell must be made by the same manufacturer.

16.8.13 Standard and special fittings shall be gray iron or ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.10/AWWA C110. The gaskets shall be ducked tipped transition gaskets for use with PVC pipe.

16.8.14 Fittings shall be lines with enameling or a thin cement lining as specified in ANSI A21.4/AWWA C104. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

16.8.15 Fitting laying lengths shall conform to ANSI A21.10/AWWA C110.

16.8.16 Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

16.8.17 When installing reclaimed/re-purified water lines, the PVC pipe shall be **colored purple** and have the message **"Caution – Re-purified Water – Do Not Drink"** stamped on opposite sides of the pipe at 180 degrees apart.

16.8.18 When installing reclaimed/re-purified water lines, a continuous 3-inch wide non-detectable warning tape reading "Caution – Re-purified Water Line Below" shall be installed over the re-purified water lines no less than 12 inches above the line.

16.9 METER AND SERVICE INSTALLATIONS

16.9.1 The service assembly shall include a corporation stop, purple colored PEX, meter, purple meter box, and tapping saddle as required. No gooseneck assembly shall be used at any time when installing a service line.

16.9.2 The corporation stop shall be of solid bronze suitable for a compression flange on the service pipe and for tapping into the water main at a vertical angle. This corporation stop shall be similar to Mueller H-15000, or equal. The threads on the corporation stop shall be Mueller.

16.9.3 Service pipe shall be 3/4 inch or 1 inch PEX pipe meeting ASTM F876, CSA B137.5 and PPI TR-3. The color of the pipe shall be purple. No gooseneck assembly shall be used at any time.

16.9.4 All meters shall be frost proof, sealed register, displacement type with bronze cast and made by Badger Meters, Inc. Meters shall be straight reading in gallons. Meters 1 inch in size shall be Badger M70. Meters 1-1/2 inch in size shall be Badger M120 B81. Meters 2 inches in size shall be Badger M170 B81. Larger meters shall have flanged connections and shall be Badger M25. All meter housings and indexes shall be colored purple.

16.9.5 12 gauge solid copper tracer wire shall be taped to the reclaimed water service line. The connection between the reclaimed water main wire and reclaimed water service shall be connected with a water tight wire nut fasteners (Example: Dryconn) and wrapped. The ends of the wire shall terminate from the main to the meter. The wire shall have a minimum of 24-inches inside the meter box. The wire shall be the color purple.

16.9.6 All reclaimed water service lines shall be backfilled with quarter down (dust) with 6-inches on the bottom and sides and 12-inches on top. This shall be done from the main to the meter.

16.9.7 Meter boxes for 5/8 inch x 3/4 inch assemblies shall be colored purple plastic meter boxes, Carson MSBCF 1324 18XL and MSBCF 1760 18XL. Larger meter boxes may be required for different applications and larger meters and will require approval from the Town of Smyrna Water Department prior to ordering or installing the meter boxes.

16.10 INSTALLATION OF RE-PURIFIED/RECLAIMED WATER LINES

16.10.1 Lay water lines to and maintain at the lines and grades required by the drawings. All fittings, valves, and hydrants shall be at the required locations, the spigots centered in the bells, and all valves and hydrant stems plumb.

16.10.2 Unless otherwise indicated by the drawings, all water pipes shall have at least 30 inches of cover. No departure from this policy shall be made except with the approval of the A/E.

16.10.3 Provide and use tools and facilities that are satisfactory to the A/E and that will allow the work to be done in a safe and convenient manner. All pipe, fittings, valves, and hydrants are to be unloaded from the trucks using suitable tools and equipment. Use a derrick, ropes, or other suitable tools or equipment to lower all pipe, fittings, valves, and hydrants into the trench one piece at a time. Lower each piece carefully so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances drop or dump water line materials into the trench.

16.10.4 Any pipes strung out along the route of the proposed lines before the actual installation of those lines is due to take place shall not be lowered into the trench until they have been swabbed to remove any mud, debris, etc., that may have accumulated within them. PVC pipe shall be strung out a maximum of one day ahead of pipe laying. Remove all unnecessary material from the bell and spigot end of each pipe. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell, and leave dry and oil-free.

16.10.5 Take every precaution to keep foreign material from getting into the pipe while it is being placed in the line. If the crew laying the pipe cannot put it into the trench and in

place without allowing earth to get inside, then put a heavy, tightly woven canvas bag of suitable size over each end of the pipe, and leave in place until it is time to connect that pipe to the one adjacent to it.

16.10.6 Place no debris, tools, clothing, or other materials in the pipe during laying operations.

16.10.7 After a length of pipe has been placed in the trench, center the spigot end in the bell of the adjacent pipe, and then insert to the depth specified by the manufacturer and bring to the correct line and grade. Secure the pipe in place by tamping an approved backfill material around it.

16.10.8 Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so that each pipe barrel will rest on a solid foundation for its entire length.

16.10.9 Whenever pipe laying is not in progress, close the open ends of pipe either with a watertight plug or by other means approved by the A/E. If the joints of any pipe in the trench cannot be completed until a later time, caulk them with packing in order to make them as watertight as possible; this shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, leave this seal in place until the trench has been pumped completely dry.

16.10.10 Cut pipe so that valves, fittings, or closure pieces can be inserted in a neat and workmanlike manner and without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.

16.10.11 Lay pipe with the bell ends facing in the direction of laying unless otherwise directed by the A/E.

16.10.12 Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer, and shall be approved by the A/E.

16.10.13 Lay no pipe in water or when it is the A/E's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, its use is considered incidental to the project, and no separate payment will be made for its use.

16.10.14 Where a water line crosses over a sanitary sewer, use a full joint of pipe with a standard mechanical joint, and center over the sewer and seal the open ends. Where a water line is to be parallel to a sanitary or storm sewer, lay it at least 10 feet from the sewer. If it is not practical for the water and sewer lines to be separated as described above, then lay the water line at least 18 inches above the top of the sewer.

16.10.15 Joint all pipe in the exact manner specified by the manufacturer of the pipe and jointing materials.

16.10.16 For detection purposes, a 12 gauge solid strand copper tracing wire (shielded) or an approved metallic tape shall be installed as per the manufacturers' instructions. Tracer wire shall be purple in color. Connections between wires shall be connected with wire nut fasteners (Example: Dryconn) and wrapped.

16.11 HYDROSTATIC TEST

16.11.1 Pressure Test

1. After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valved section thereof to a pressure of 200 psi. All services are to be laid prior to testing the main and tested as part of the test of the main.

2. The duration of each pressure test shall be at least two (2) hours.

3. Slowly fill each valved section of pipe with water, and apply the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a pump connected to the pipe in a manner satisfactory to the A/E. Furnish the pump, pipe, connections, gauges, and all necessary apparatus.

4. Before applying the specified test pressure, expel all air from the pipe. If hydrants or blowoffs are not available at high places, make the necessary taps at the points of highest elevation before testing, and insert plugs after the test has been completed.

5. Carefully examine all exposed pipes, fittings, valves, and hydrants during the test. Remove any cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this pressure test, and replace with sound material in the manner specified. Repeat the test until the results are satisfactory to the A/E.

16.12 CLEANUP OF CONSTRUCTION SITE

After completing each section of the water line, remove all debris and all construction materials from the work site. Then grade and smooth over the surface of both sides of the line. Leave the entire area clean and in a condition satisfactory to the A/E.

SECTION 17 – STORAGE AND PROTECTION

17.0 GENERAL

17.0.1 Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.

17.0.2 Arrange storage in a manner to provide access for maintenance of stored items and for inspection.

17.1 EXTERIOR STORAGE

17.1.1 Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Provide protection against ultraviolet (UV) light for polyvinyl chloride (PVC) piping, ductile iron (DIP) piping and products subject to damage by UV light. Protect products from soiling and staining.

17.1.2 Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.

17.1.3 Provide surface drainage to prevent erosion and ponding of water.

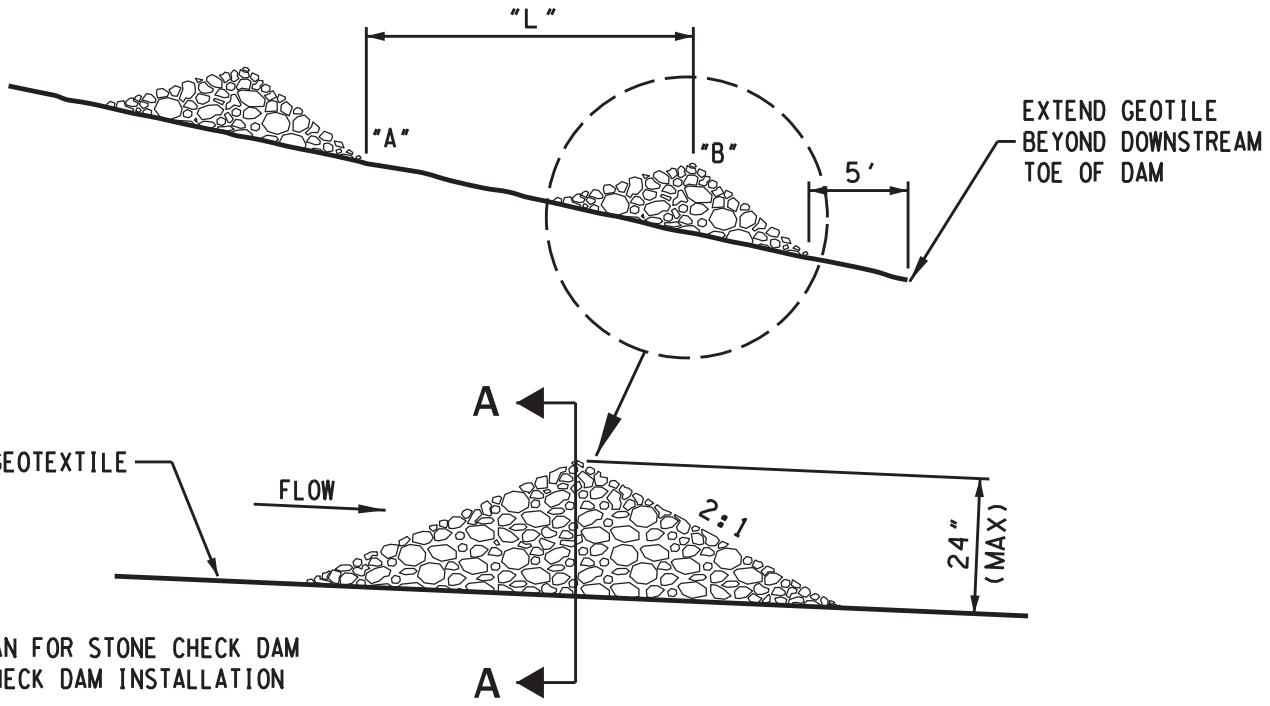
17.2 MAINTENANCE OF STORAGE

17.1.1 Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.

SECTION 18

STANDARD DETAILS

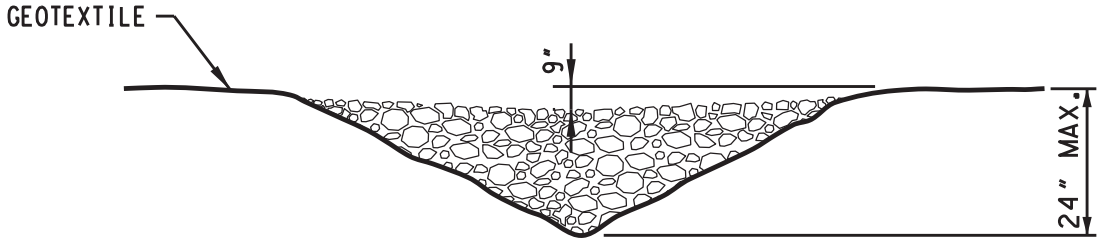
SEWER LINE ADDITIONS



NOTES:

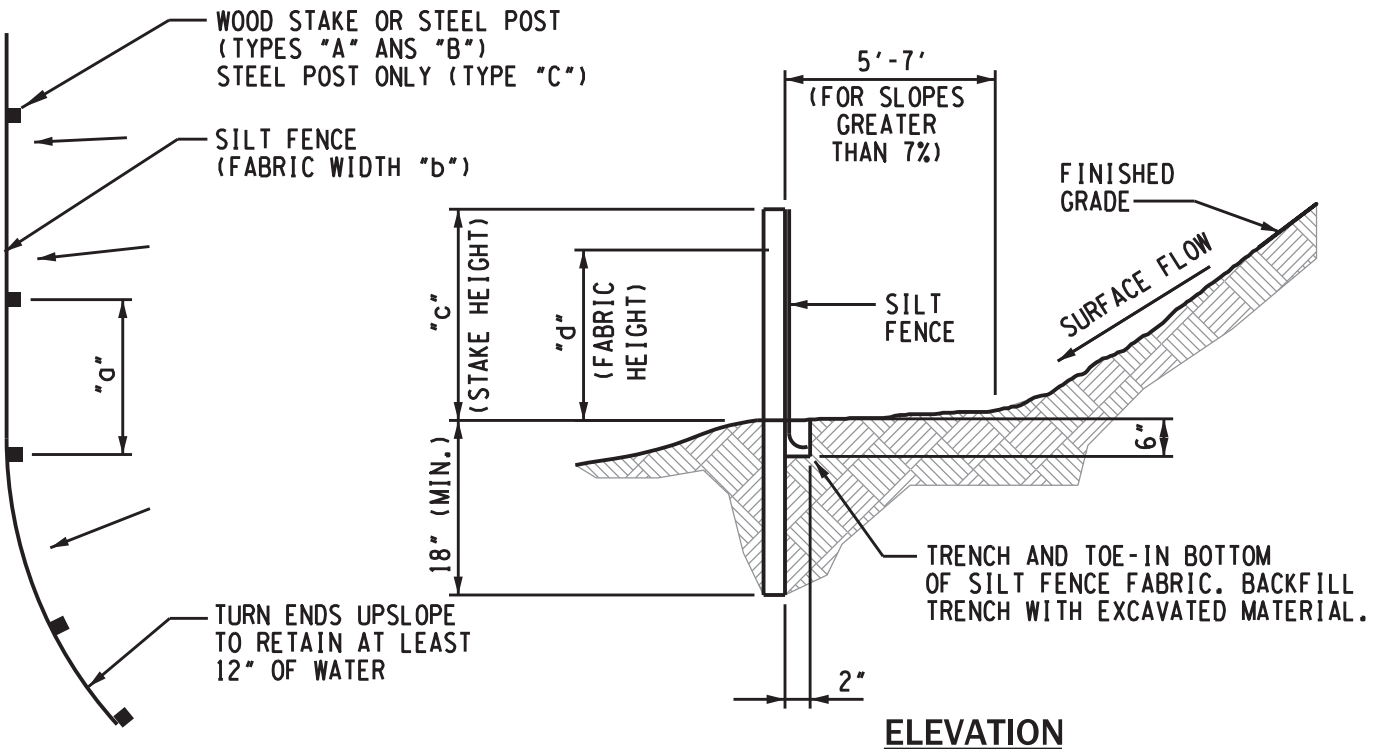
1. SEE PLAN FOR STONE CHECK DAM OR ROCK CHECK DAM INSTALLATION

2. L = THE DISTANCE SUCH THAT POINTS "A" AND "B" ARE OF EQUAL ELEVATION.



SECTION "A-A"

ROCK CHECK DAM DETAIL



PLAN

ELEVATION

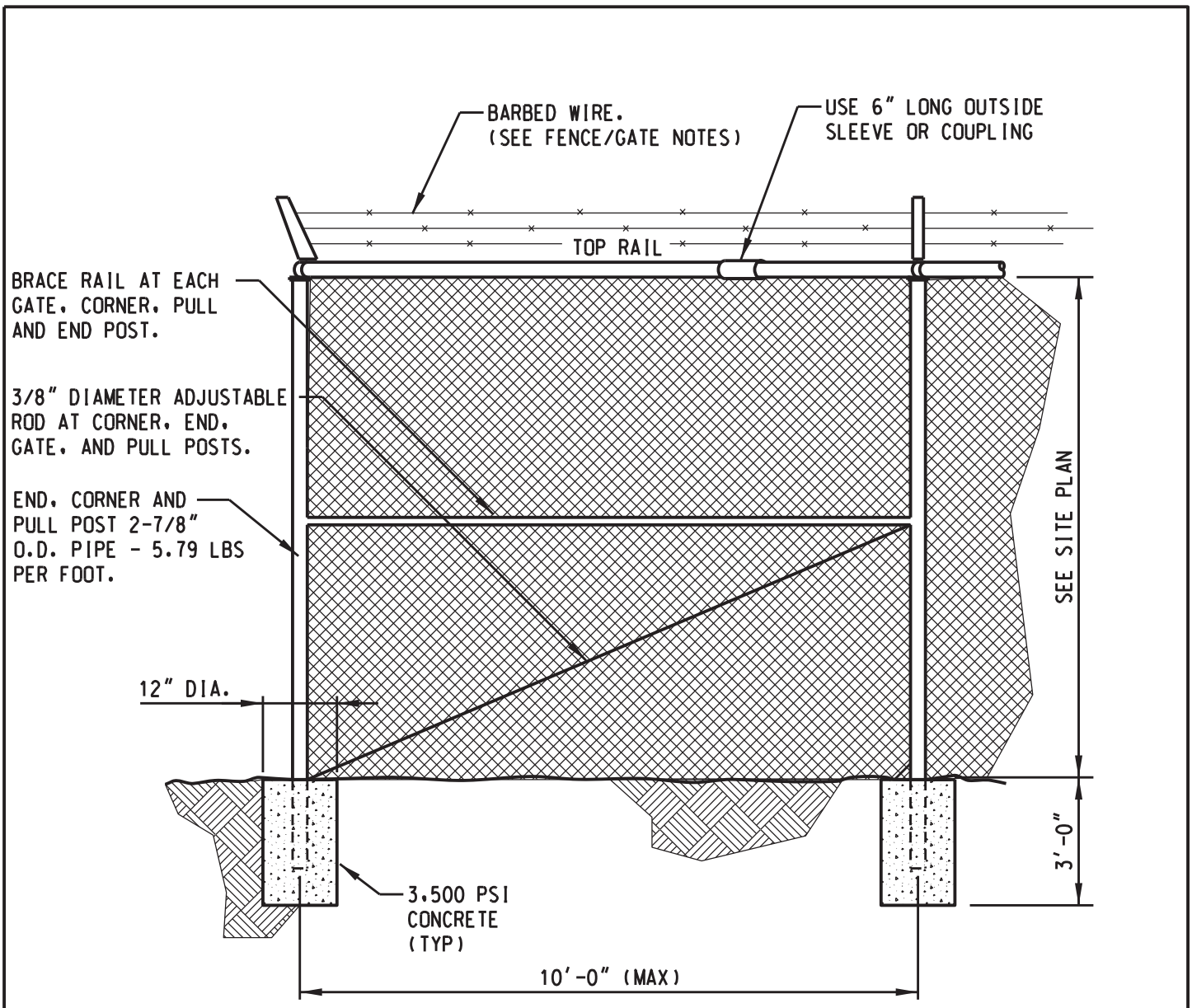
NOTES:

1. WOOD STAKES OR STEEL POSTS MAY BE USED WITH SILT FENCE TYPES "A" AND"B". ONLY STEEL POSTS SHALL BE USED WITH TYPE "C" SILT FENCE.

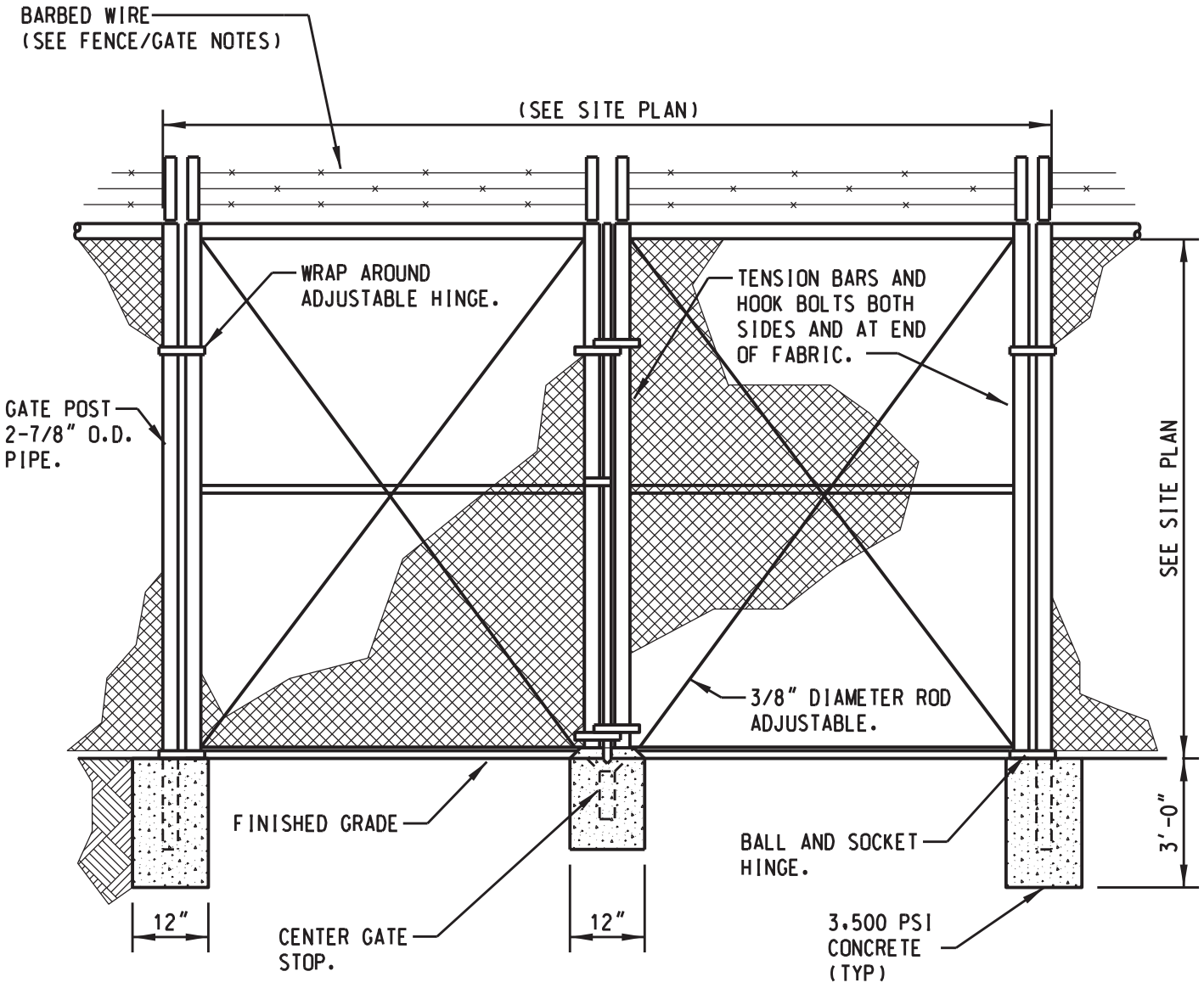
2. TYPE "C" SILT FENCE SHALL BE WIRE REINFORCED.

SILT FENCE TABLE						
TYPE	"a"	"b"	"c"	"d"	APPARENT OPENING SIZE	FLOW RATE (GPM)
A	6'	36"	30"	28"	#30 SIEVE	25
B	6'	22"	18"	16"	#30 SIEVE	25
C	4'	36"	30"	28"	#30 SIEVE	70

SILT FENCE DETAIL



TYPICAL FENCE & GATE DETAIL (1 OF 4)



TYPICAL FENCE & GATE DETAIL (2 OF 4)

NOTES:

1. PROVIDE POSITIVE TYPE LATCHING DEVICE WITH PROVISIONS FOR PADLOCKING, CENTER PLUNGER ROD, CATCH AND SEMI-AUTOMATIC OUTER CATCHES.

2. BARBED WIRE TO BE THREE 12-1/2 GAUGE STRANDS WITH 14 GAUGE - 4 POINT BARBS AT 5" CENTERS AND COATED WITH 0.25 OSF ZINC COATING.

3. FENCE FABRIC TO BE 9 GAUGE STEEL, 2.0 OSF ZINC COATED AND WOVEN INTO 2" DIAMOND MESH.

4. FABRIC CONNECTIONS AS FOLLOWS: TERMINAL POSTS - 3/16" x 3/4" STRETCHER BAR WITH 1/8" x 7/8" STEEL BANDS @ 15" O.C.; LINE POSTS - 9 GAUGE WIRE CLIPS @ 15" O.C.; TOP RAIL - 9 GAUGE TIE WIRE @ 24" O.C.

5. ALL POSTS AND OTHER APPURTENANCES SHALL BE HOT DIPPED GALVANIZED WITH MINIMUM 1.2 OSF ZINC COATING. ALL FITTINGS SHALL BE MALLEABLE DUCTILE IRON OR STEEL.

TYPICAL FENCE & GATE DETAIL (3 OF 4)

NOTES:

1. PROVIDE POSITIVE TYPE LATCHING DEVICE WITH PROVISIONS FOR PADLOCKING, CENTER PLUNGER ROD, CATCH AND SEMI-AUTOMATIC OUTER CATCHES OR HOLD BACKS.

2. FENCE FABRIC: 6'-0" (72"), 9 GA., 2" MESH, KNUCKLED TOP & BOTTOM, BLACK VINYL COATED, ALL COMPONENTS OF THE FENCE SHELL BE BLACK.

3. FENCE FRAME MEMBERS TO BE TYPE II - LG40 STEEL PIPE (ASTM F1043, GROUP 1C):
TERMINAL POSTS (CORNER, END, PULL AND GATE POSTS): 3" O.D. (5.79 LBS. / FT):
LINE POSTS: 2" O.D. (2.74 LBS. / FT.):
TOP, BOTTOM AND BRACE RAILS: 1 5/8" O.D. (2.27 LBS. / FT.):
JOIN WITH 1 5/8" - 6" LONG SLEEVES:
ALL POSTS SHALL BE HOT DIPPED GALVANIZED WITH MINIMUM 1.8 OZ. / S.F. ZINC COATING.

4. SINGLE AND DOUBLE SWING GATE FRAMEWORK: 1 5/8" O.D. (2.27 LBS. / FT.):

5. FITTINGS:
POST CAPS: STEEL, CAST IRON OR ALUMINUM ALLOY:
RAIL ENDS: FORMED STEEL OR IRON:
TIE WIRES: 9 GA., GALVANIZED STEEL OR ALUMINUM: 15" SPACING FOR TERMINAL POSTS AND 24" SPACING FOR TOP AND BRACE RAILS:
HOG RINGS: 9 GA.:
FABRIC AND RAIL BANDS: 12 GA. X 3/4" PRESSED STEEL: 15" SPACING:
STRETCHER BAR: 3/16 " x 3/4 " GALVANIZED STEEL:
LINE POSTS - 9 GA TIE WIRES @ 15" O.C.:
TOP RAILS - 9 GA TIE WIRES @ 24" O.C.
TENSION WIRE-6 GA. CORE WIRE (75.000 PSI TENSILE STRENGTH):
TRUSS RODS AND TIGHTENERS: 5/16" ROD:
FASTENERS: GALVANIZED:

6. BARBED WIRE: PVC COATED PER ASTM F1665 CLASS 2A: TWO STRANDED STEEL WIRE, 13-3/4 GA. TWISTED LINE WIRE: 4 POINT BARBS AT 5" CENTERS AND COATED WITH 0.25 OSF ZINC COATING.

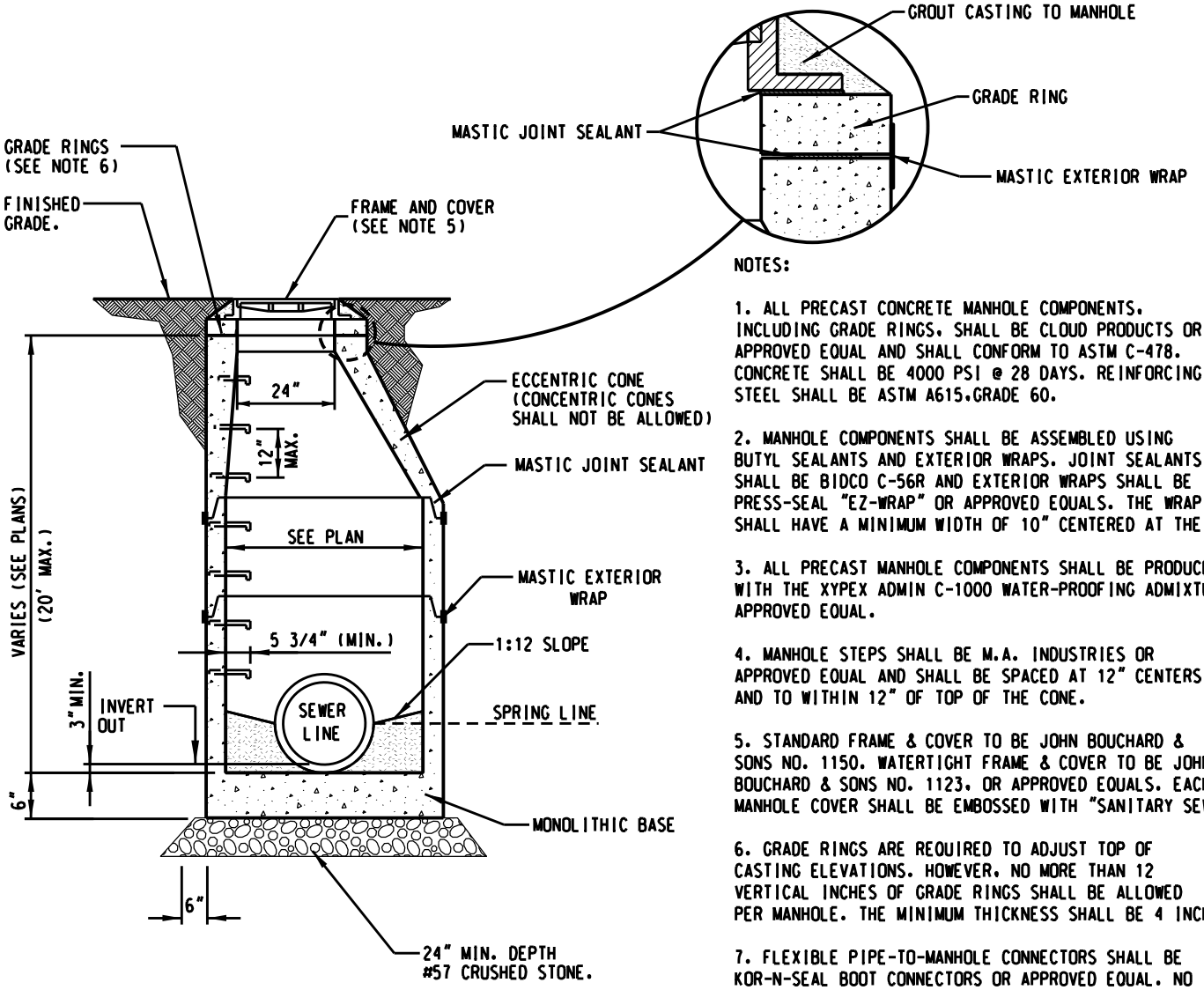
7. BARBED WIRE SUPPORT ARMS: SUITABLE FOR 3 STRANDS OF BARBED WIRE: WITHSTAND A 250 LB DOWNWARD PULL.

8. CONCRETE: 3000 PSI PLANT MIX ONLY. BAG CONCRETE SHALL NOT BE ALLOWED.

9. ALL FENCE FABRIC, POST, RAILS AND HARDWARE SHALL RECEIVE A BLACK PVC COATING OF 6 MIL TO 10 MIL PER ASTM F688 CLASS 2B: PER ASTM F1664 CLASS 2A FOR TENSION WIRE AND ASTM F1665 CLASS 2A FOR BARBED WIRE. FASTENERS SHALL BE PAINTED BLACK.

TYPICAL FENCE & GATE DETAIL (4 OF 4)

ADDITIONAL FENCE NOTES



NOTES:

1. ALL PRECAST CONCRETE MANHOLE COMPONENTS, INCLUDING GRADE RINGS, SHALL BE CLOUD PRODUCTS OR APPROVED EQUAL AND SHALL CONFORM TO ASTM C-478. CONCRETE SHALL BE 4000 PSI @ 28 DAYS. REINFORCING STEEL SHALL BE ASTM A615,GRADE 60.

2. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS. THE WRAP SHALL HAVE A MINIMUM WIDTH OF 10" CENTERED AT THE JOINT.

3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.

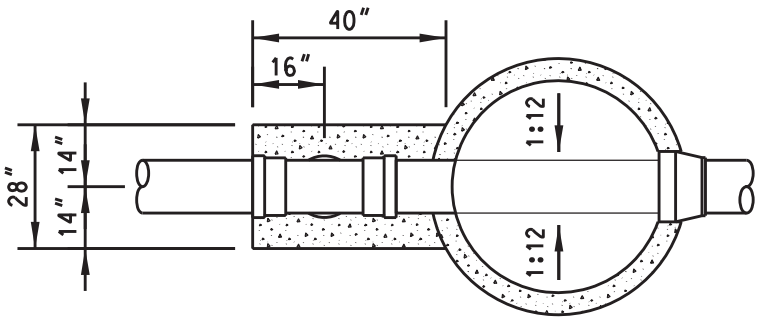
4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.

5. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150. WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. EACH MANHOLE COVER SHALL BE EMBOSSED WITH "SANITARY SEWER".

6. GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.

7. FLEXIBLE PIPE-TO-MANHOLE CONNECTORS SHALL BE KOR-N-SEAL BOOT CONNECTORS OR APPROVED EQUAL. NO MORE THAN THREE SERVICES ARE ALLOWED INTO A MANHOLE OR OTHERWISE APPROVED BY THE TOWN'S ENGINEER.

STANDARD PRECAST MANHOLE DETAIL



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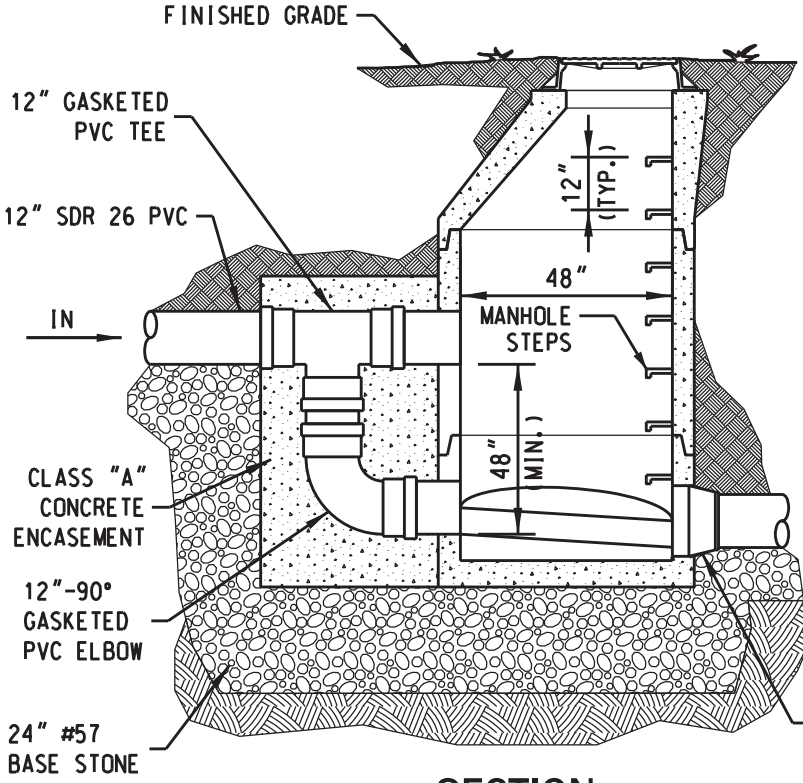


SECTION

48" DROP MANHOLE (12" SEWER) DETAIL

NOTES:

1. ALL PRECAST CONCRETE MANHOLE COMPONENTS, INCLUDING GRADE RINGS, SHALL BE CLOUD PRODUCTS OR APPROVED EQUAL AND SHALL CONFORM TO ASTM C-478. CONCRETE SHALL BE 4000 PSI @ 28 DAYS. REINFORCING STEEL SHALL BE ASTM A615.GRADE 60.

2. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS.

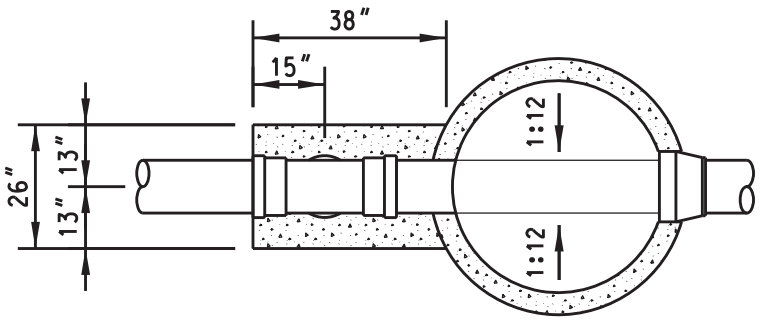
3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.

4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.

5. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150. WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. EACH MANHOLE COVER SHALL BE EMBOSSED WITH "SANITARY SEWER".

6. GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.

7. FLEXIBLE PIPE-TO-MANHOLE CONNECTORS SHALL BE KOR-N-SEAL BOOT CONNECTORS OR APPROVED EQUAL.



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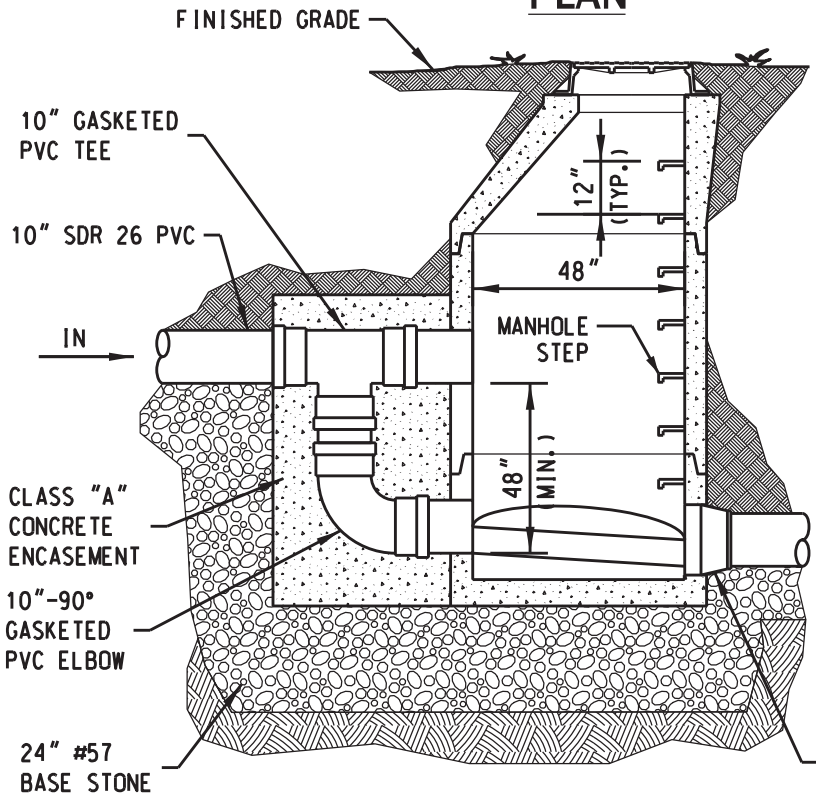


SECTION

48" DROP MANHOLE (10" SEWER) DETAIL

NOTES:

1. ALL PRECAST CONCRETE MANHOLE COMPONENTS, INCLUDING GRADE RINGS, SHALL BE CLOUD PRODUCTS OR APPROVED EQUAL AND SHALL CONFORM TO ASTM C-478. CONCRETE SHALL BE 4000 PSI @ 28 DAYS. REINFORCING STEEL SHALL BE ASTM A615.GRADE 60.

2. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS.

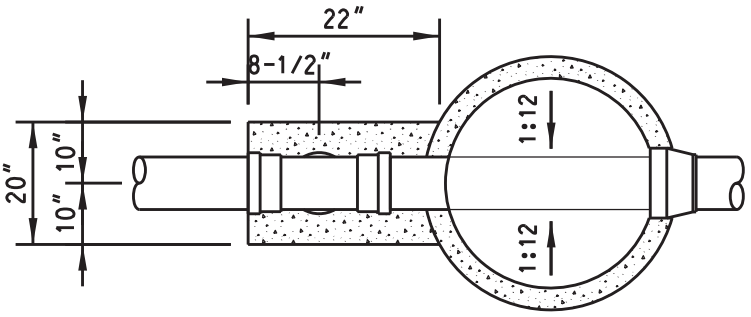
3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.

4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.

5. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150. WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123. OR APPROVED EQUALS. EACH MANHOLE COVER SHALL BE EMBOSSED WITH "SANITARY SEWER".

6. GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.

7. FLEXIBLE PIPE-TO-MANHOLE CONNECTORS SHALL BE KOR-N-SEAL BOOT CONNECTORS OR APPROVED EQUAL.



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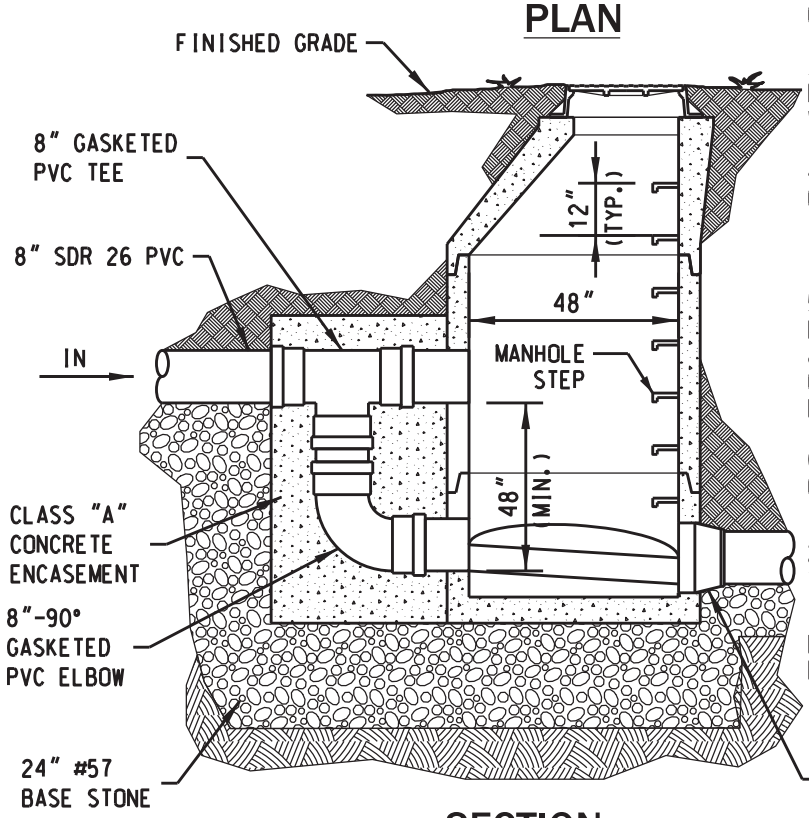


SECTION

48" DROP MANHOLE (8" SEWER) DETAIL

NOTES:

1. ALL PRECAST CONCRETE MANHOLE COMPONENTS, INCLUDING GRADE RINGS, SHALL BE CLOUD PRODUCTS OR APPROVED EQUAL AND SHALL CONFORM TO ASTM C-478. CONCRETE SHALL BE 4000 PSI @ 28 DAYS. REINFORCING STEEL SHALL BE ASTM A615,GRADE 60.

2. MANHOLE COMPONENTS SHALL BE ASSEMBLED USING BUTYL SEALANTS AND EXTERIOR WRAPS. JOINT SEALANTS SHALL BE BIDCO C-56R AND EXTERIOR WRAPS SHALL BE PRESS-SEAL "EZ-WRAP" OR APPROVED EQUALS.

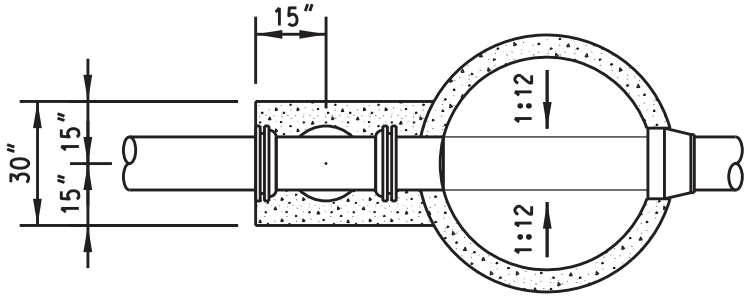
3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.

4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.

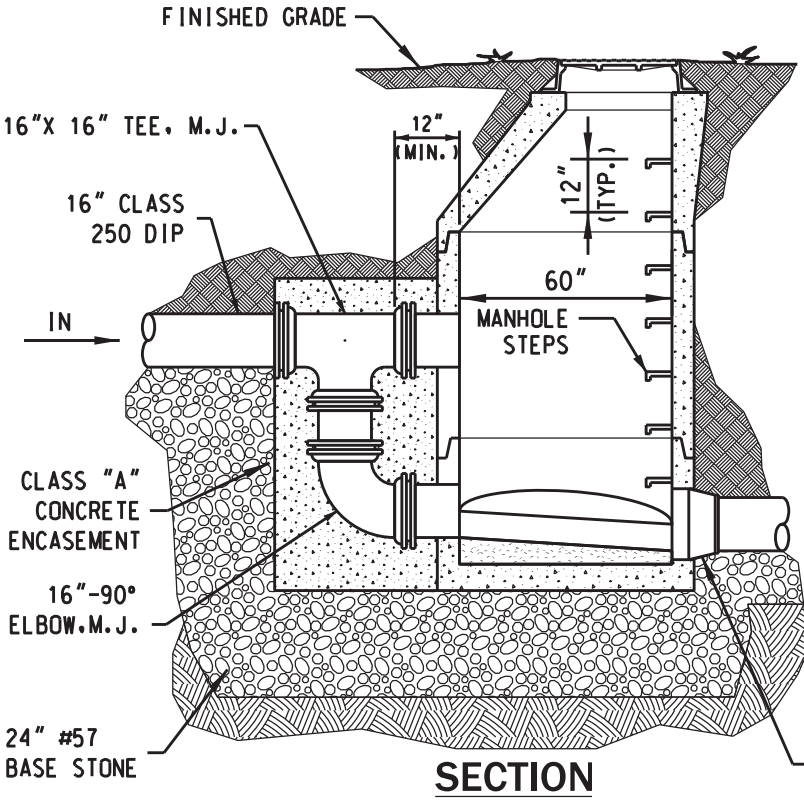
5. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150. WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. EACH MANHOLE COVER SHALL BE EMBOSSED WITH "SANITARY SEWER".

6. GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.

7. FLEXIBLE PIPE-TO-MANHOLE CONNECTORS SHALL BE KOR-N-SEAL BOOT CONNECTORS OR APPROVED EQUAL.



PLAN



SECTION

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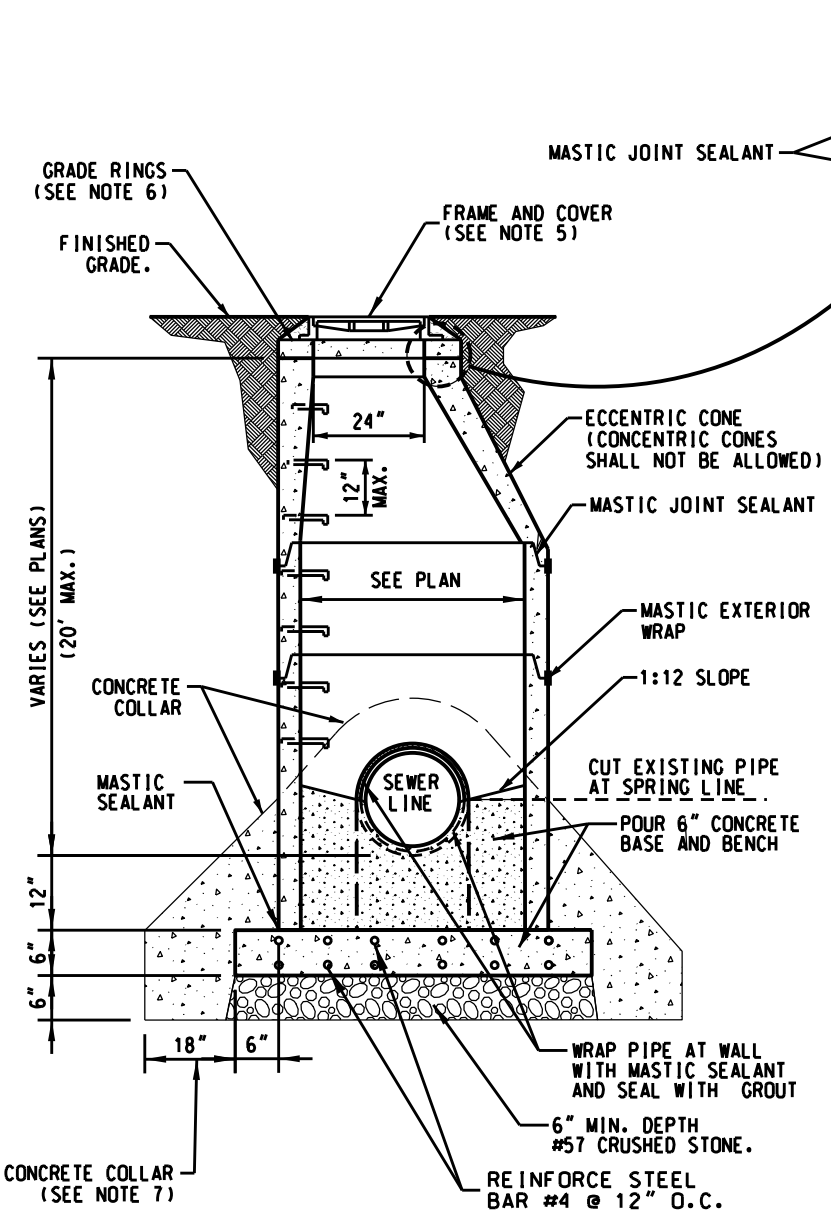
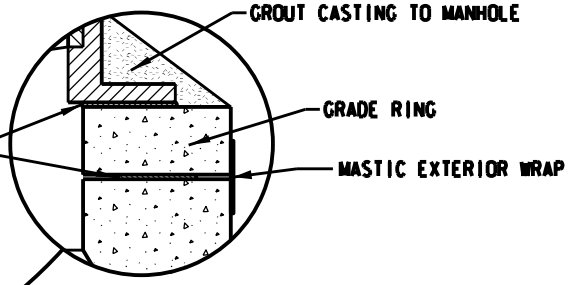
7. FLEXIBLE PIPE-TO-MANHOLE CONNECTORS SHALL BE KOR-N-SEAL BOOT CONNECTORS OR APPROVED EQUAL.

8. DUCTILE IRON FITTINGS SHALL BE AWWA C110.

60" DROP MANHOLE (16" SEWER) DETAIL





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3. ALL PRECAST MANHOLE COMPONENTS SHALL BE PRODUCED WITH THE XYPEX ADMIN C-1000 WATER-PROOFING ADMIXTURE OR APPROVED EQUAL.

4. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL AND SHALL BE SPACED AT 12" CENTERS AND TO WITHIN 12" OF TOP OF THE CONE.

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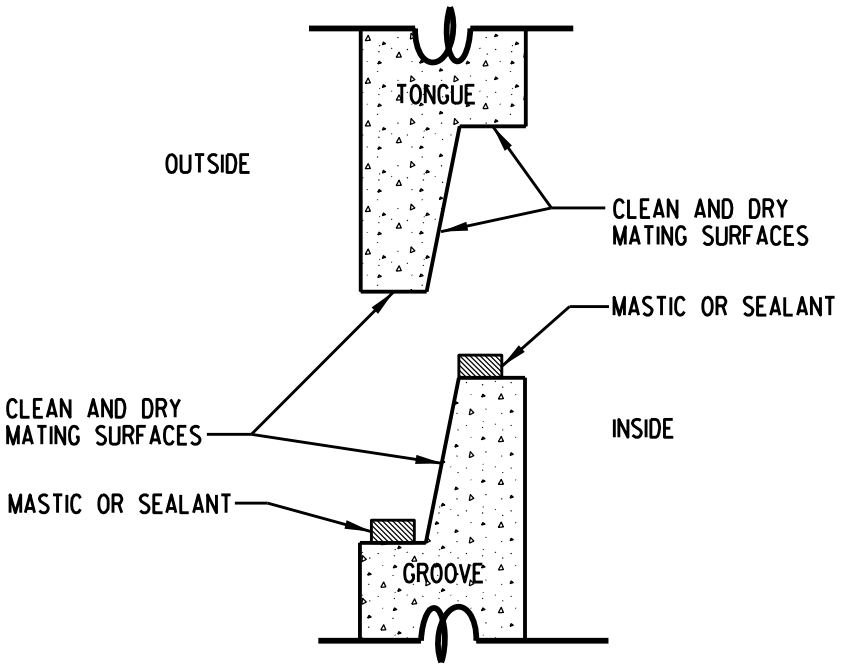
6. GRADE RINGS ARE REQUIRED TO ADJUST TOP OF CASTING ELEVATIONS. HOWEVER, NO MORE THAN 12 VERTICAL INCHES OF GRADE RINGS SHALL BE ALLOWED PER MANHOLE. THE MINIMUM THICKNESS SHALL BE 4 INCHES.

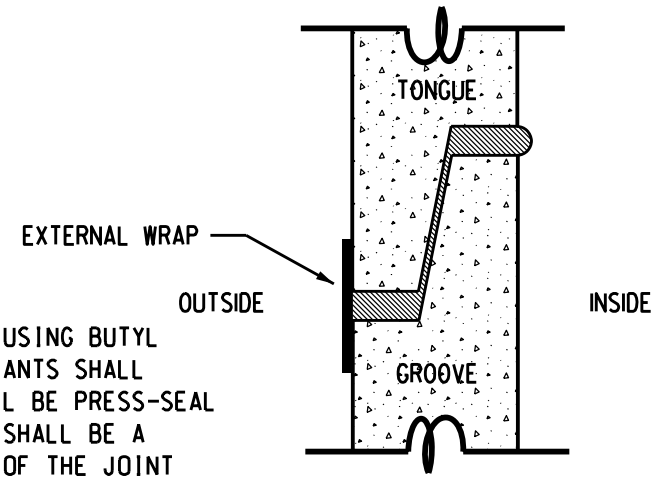
7. THE 6" CONCRETE BASE SHALL BE POURED AND CURED PRIOR TO SETTING MANHOLE BASE. A CONCRETE COLLAR SHALL BE POURED AROUND THE FULL CIRCUMFERENCE OF THE DOGHOUSE MANHOLE AND EXTEND 6" ABOVE THE PIPE AND 6" BELOW THE MANHOLE BASE. THE CONCRETE BASE SHALL HAVE REINFORCED STEEL BAR #4 LOCATED AT 12" ON-CENTER.

8. DOGHOUSE MANHOLE SHALL BE VACUUM TESTED PER SPECIFICATIONS.

DOGHOUSE MANHOLE DETAIL



OPEN JOINT



CLOSED JOINT

NOTES:

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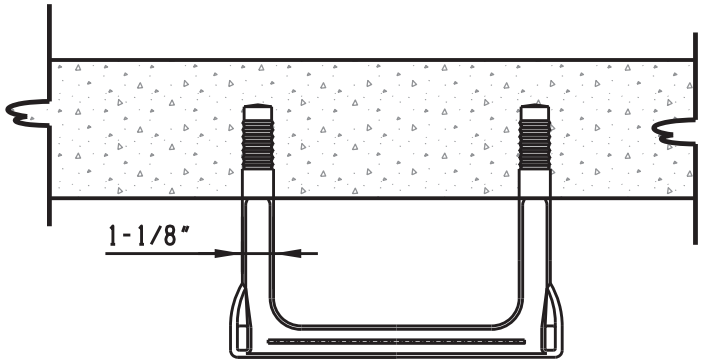
2. WHERE GASKET MATERIAL DOES NOT PROTRUDE FROM JOINTS, POINT UP INSIDE JOINT WITH GROUT.

PLASTIC GASKET JOINT FOR PRECAST MANHOLES



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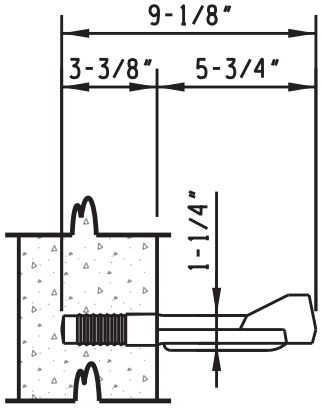
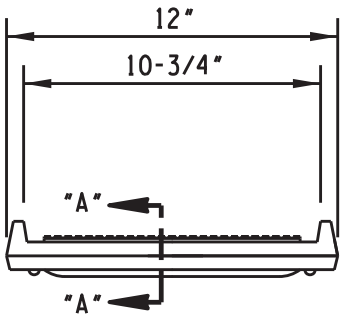


SIDE



END

NOTES:

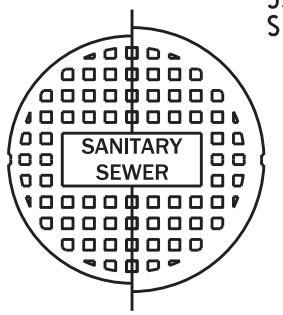
1. MANHOLE STEPS SHALL BE M.A. INDUSTRIES, INC. OR APPROVED EQUL.

2. STEP SHALL BE STEEL REINFORCED AND SHALL BE ENCAPSULATED IN POLYPROPYLENE PLASTTIC.

3. 1/2" DIAMETER STEEL REINFORCEMENT (GRADE 60).

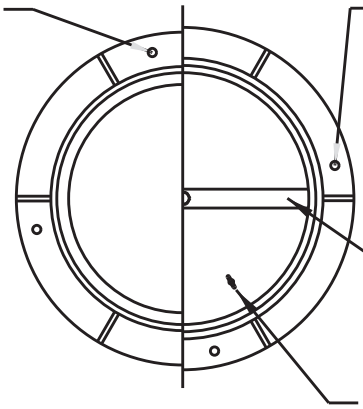
SECTION "A-A"

MANHOLE STEP DETAIL



COVER

FOUR 1" HOLES FOR 3/4" DIAMETER STAINLESS STEEL ANCHOR BOLTS.

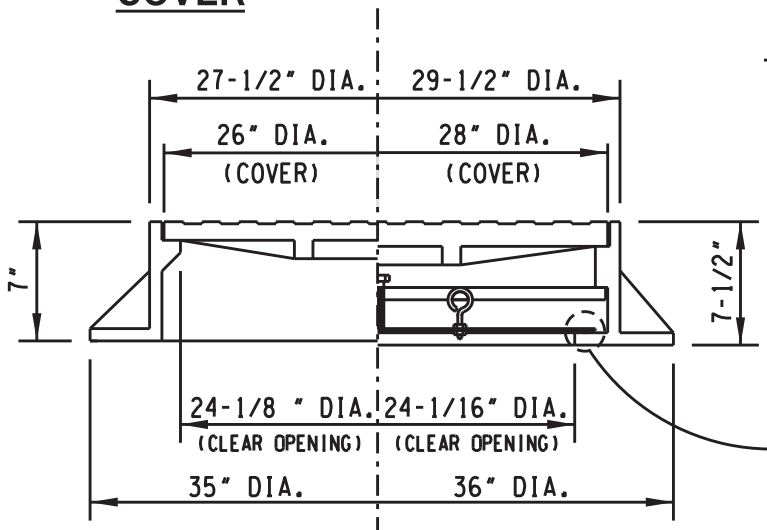


FOUR 7/8" HOLES FOR 3/4" DIAMETER STAINLESS STEEL ANCHOR BOLTS.

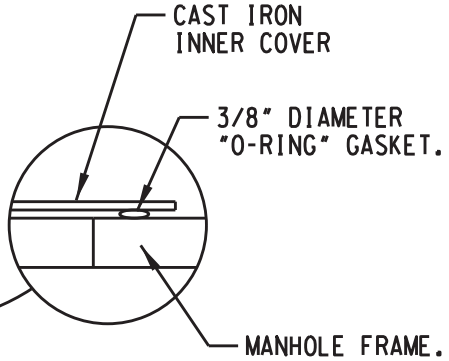
STEEL LOCKING BAR.

3/8" DIAMETER EYE-BOLT (TYPICAL FOR 2)

FRAME



STANDARD WATERTIGHT



DETAIL "A"

NOTES:

1. STANDARD FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1150, WATERTIGHT FRAME & COVER TO BE JOHN BOUCHARD & SONS NO. 1123, OR APPROVED EQUALS. IN EACH CASE, THE WORDS "SANITARY SEWER" SHALL BE CAST WITH THE COVERS.

2. MANHOLE FRAMES AND COVERS SHALL BE H20 RATED.

FRAME AND COVER DETAIL

NOTES:

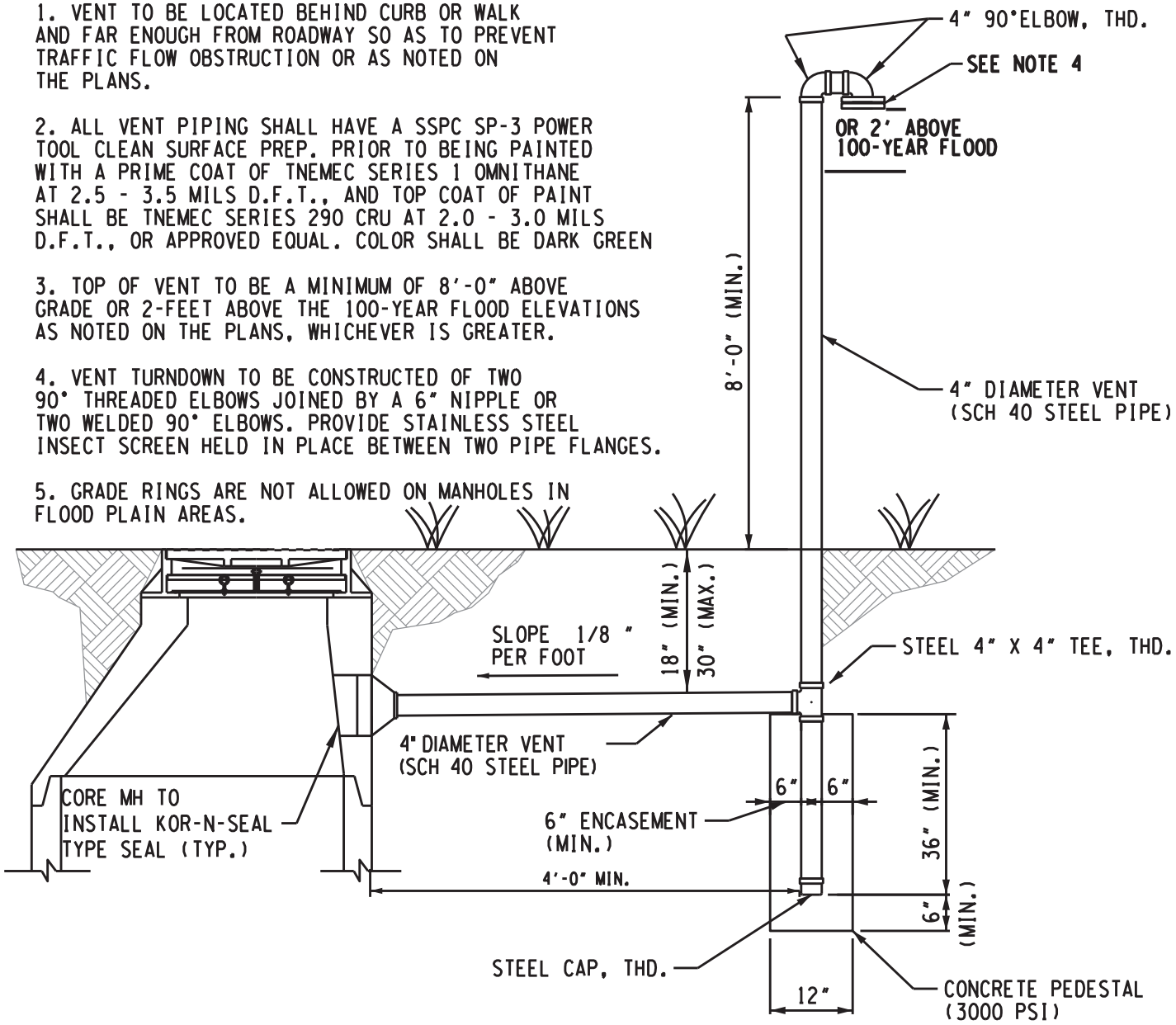
1. VENT TO BE LOCATED BEHIND CURB OR WALK AND FAR ENOUGH FROM ROADWAY SO AS TO PREVENT TRAFFIC FLOW OBSTRUCTION OR AS NOTED ON THE PLANS.

2. ALL VENT PIPING SHALL HAVE A SSPC SP-3 POWER TOOL CLEAN SURFACE PREP. PRIOR TO BEING PAINTED WITH A PRIME COAT OF TNEMEC SERIES 1 OMNITHANE AT 2.5 - 3.5 MILS D.F.T., AND TOP COAT OF PAINT SHALL BE TNEMEC SERIES 290 CRU AT 2.0 - 3.0 MILS D.F.T., OR APPROVED EQUAL. COLOR SHALL BE DARK GREEN

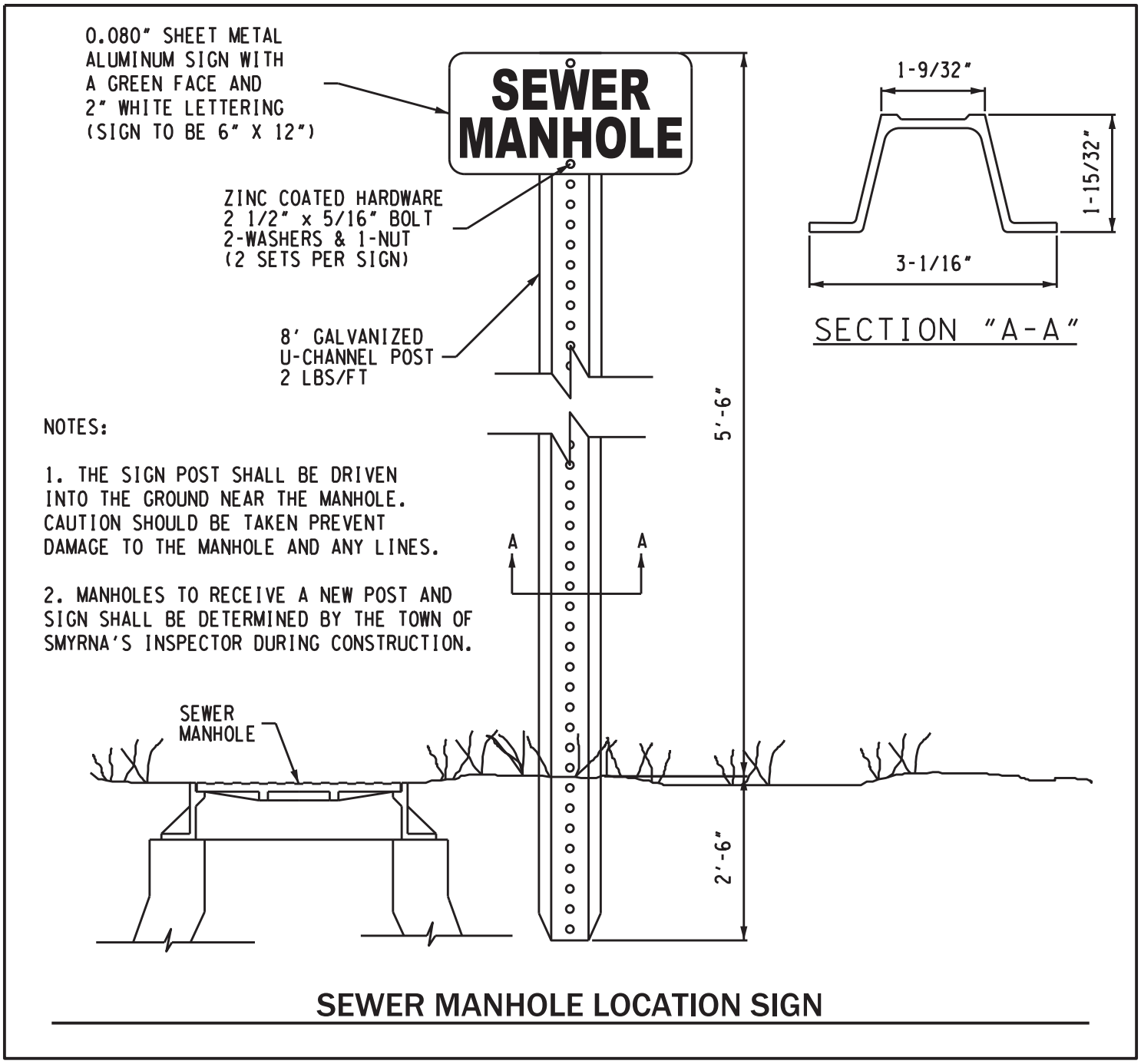
3. TOP OF VENT TO BE A MINIMUM OF 8'-0" ABOVE GRADE OR 2-FEET ABOVE THE 100-YEAR FLOOD ELEVATIONS AS NOTED ON THE PLANS, WHICHEVER IS GREATER.

4. VENT TURNDOWN TO BE CONSTRUCTED OF TWO 90° THREADED ELBOWS JOINED BY A 6" NIPPLE OR TWO WELDED 90° ELBOWS. PROVIDE STAINLESS STEEL INSECT SCREEN HELD IN PLACE BETWEEN TWO PIPE FLANGES.

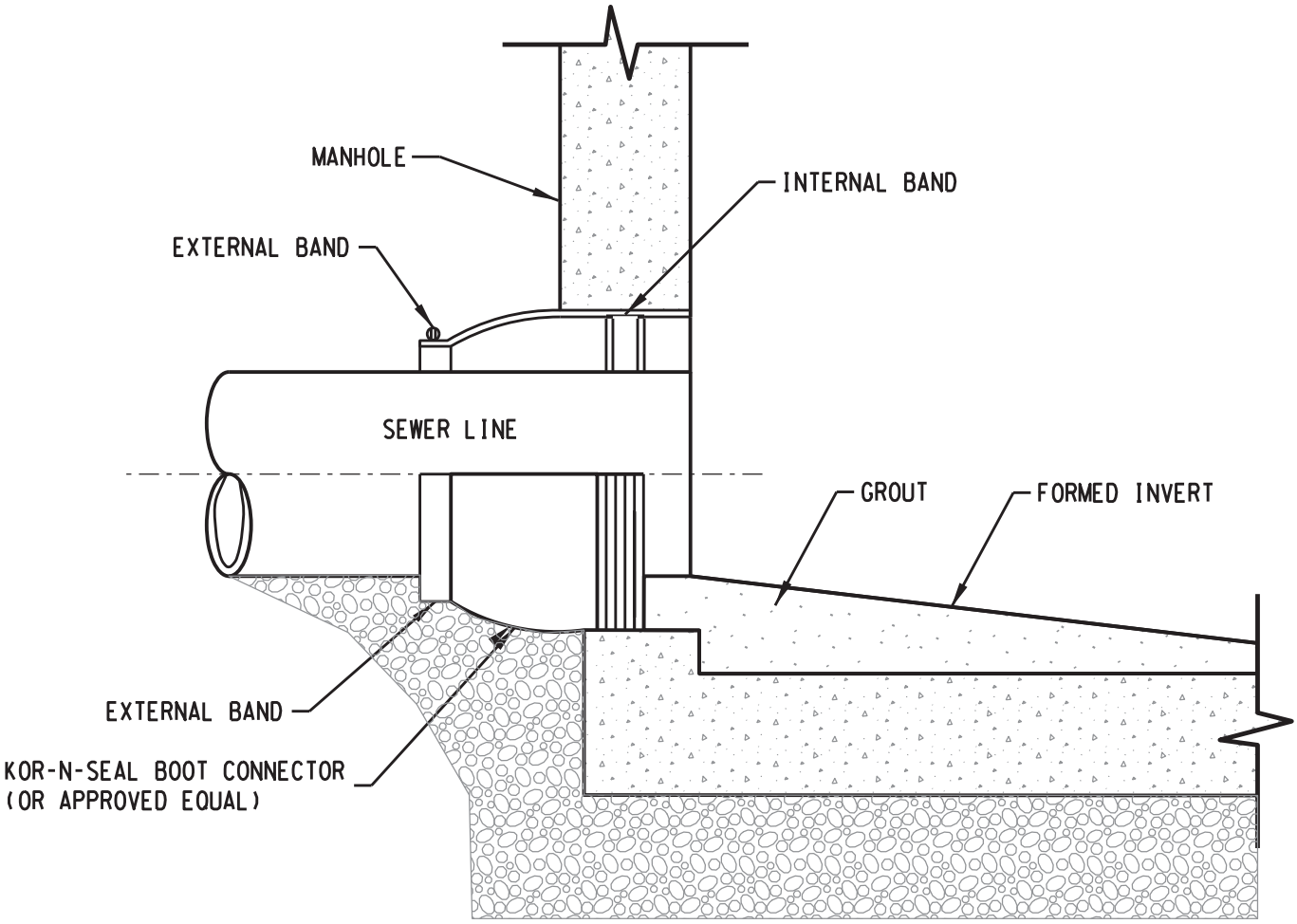
5. GRADE RINGS ARE NOT ALLOWED ON MANHOLES IN FLOOD PLAIN AREAS.



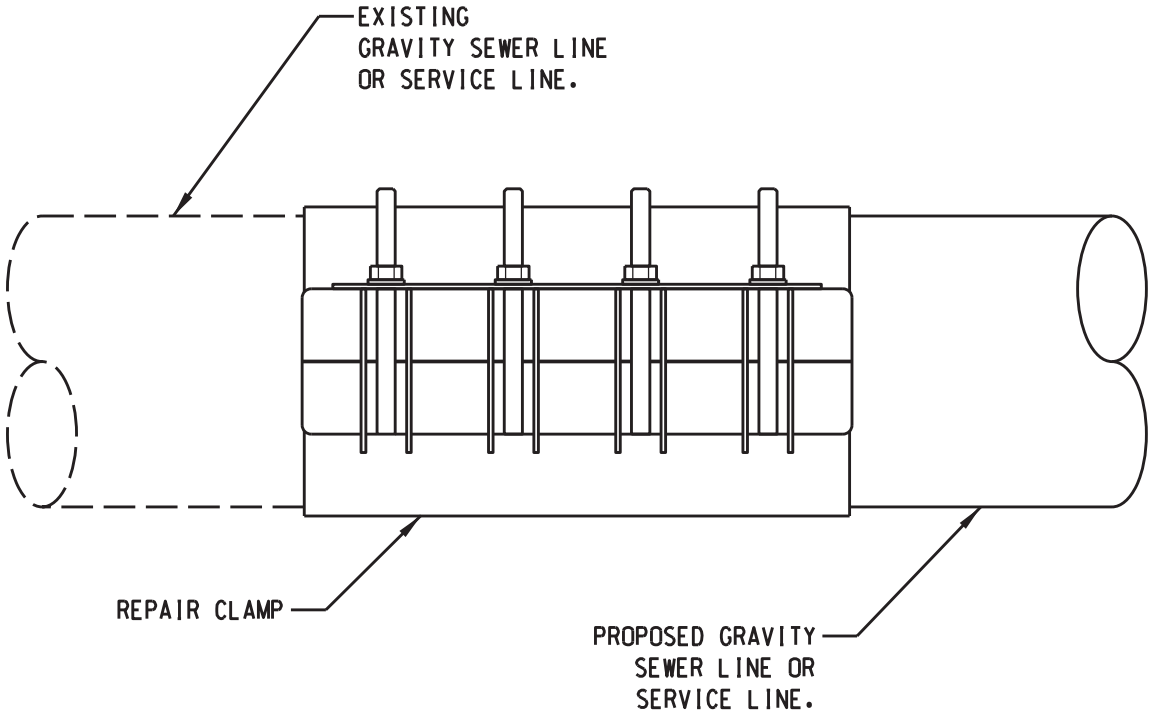
STANDARD MANHOLE VENT DETAIL



SEWER MANHOLE LOCATION SIGN



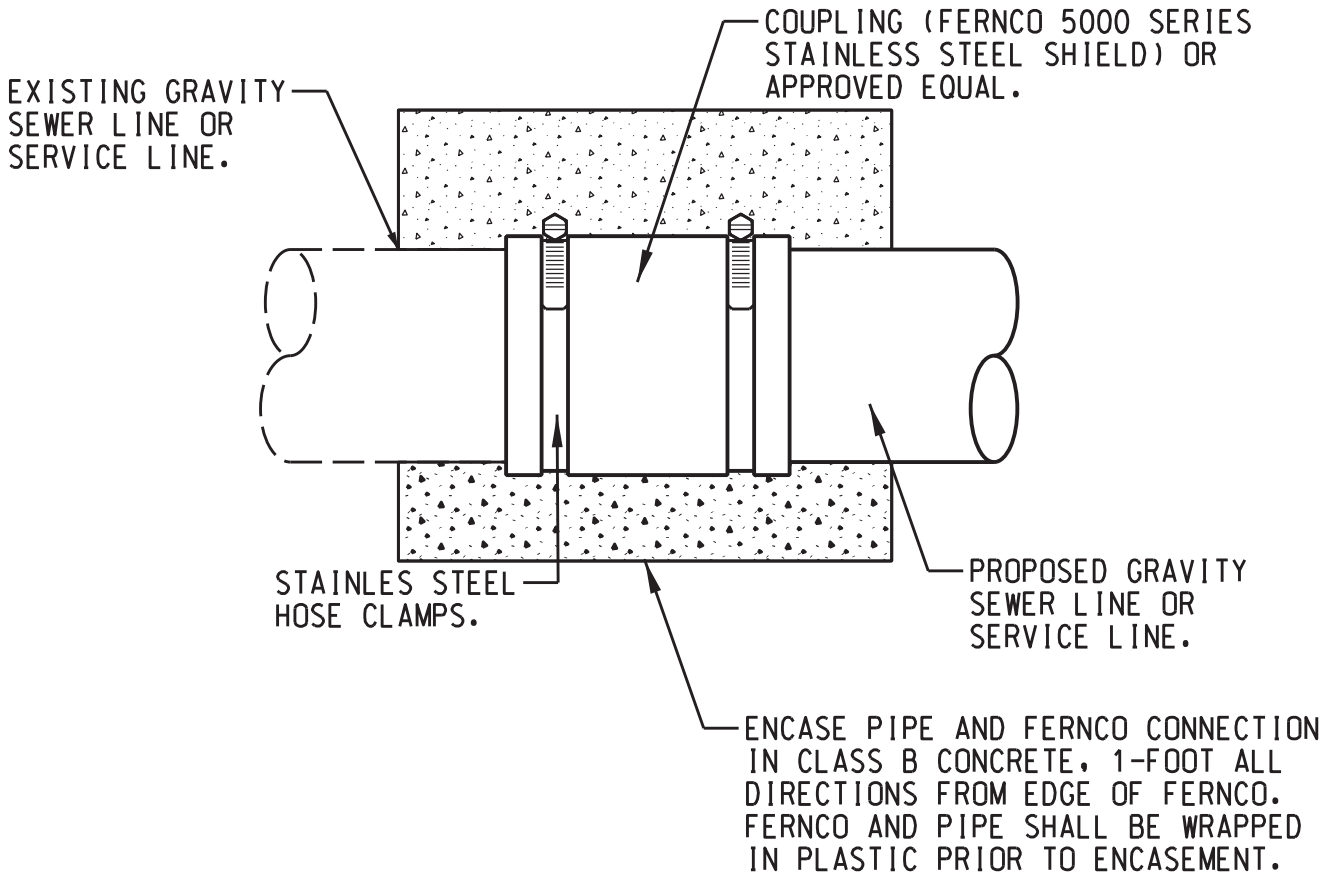
FLEXIBLE PIPE-TO-MANHOLE CONNECTOR DETAIL



NOTE:

REPAIR CLAMP SHALL BE JCM INDUSTRIES MODEL 101 OR APPROVED EQUAL (I.E. 101-0840-12 FOR 8") THE BAND SHALL BE FABRICATED OF 20 GA. TYPE 304 STAINLESS STEEL. CLAMP WIDTH SHALL BE A MINIMUM OF 12-INCHES.

GRAVITY SEWER LINE / SERVICE CONNECTION DETAIL (PVC OR DUCTILE IRON)



GRAVITY SEWER LINE / SERVICE CONNECTION DETAIL (CLAY OR CAST IRON)

NOTES:

1. THE CLEANOUT CAP SHALL BE A 6" SDR-26 OR AN APPROVED EQUAL. IN NON-TRAFFIC AREAS, THE CLEANOUT SHALL BE IN 36-H CONCRETE BOX WITH A CAST IRON LID MARKED "SEWER" FOR A 36-H BOX OR APPROVED EQUAL. IN TRAFFIC AREAS, A SQUARE JBS 8006 CASTING MARKED "SEWER" WITH A MINIMUM OF 4" SQUARE CONCRETE RISER IS TO BE INSTALLED. ALL CLEANOUTS SHALL BE IN A BOX WITH THE TOP OF THE CASTING SET TO FINAL GRADE.

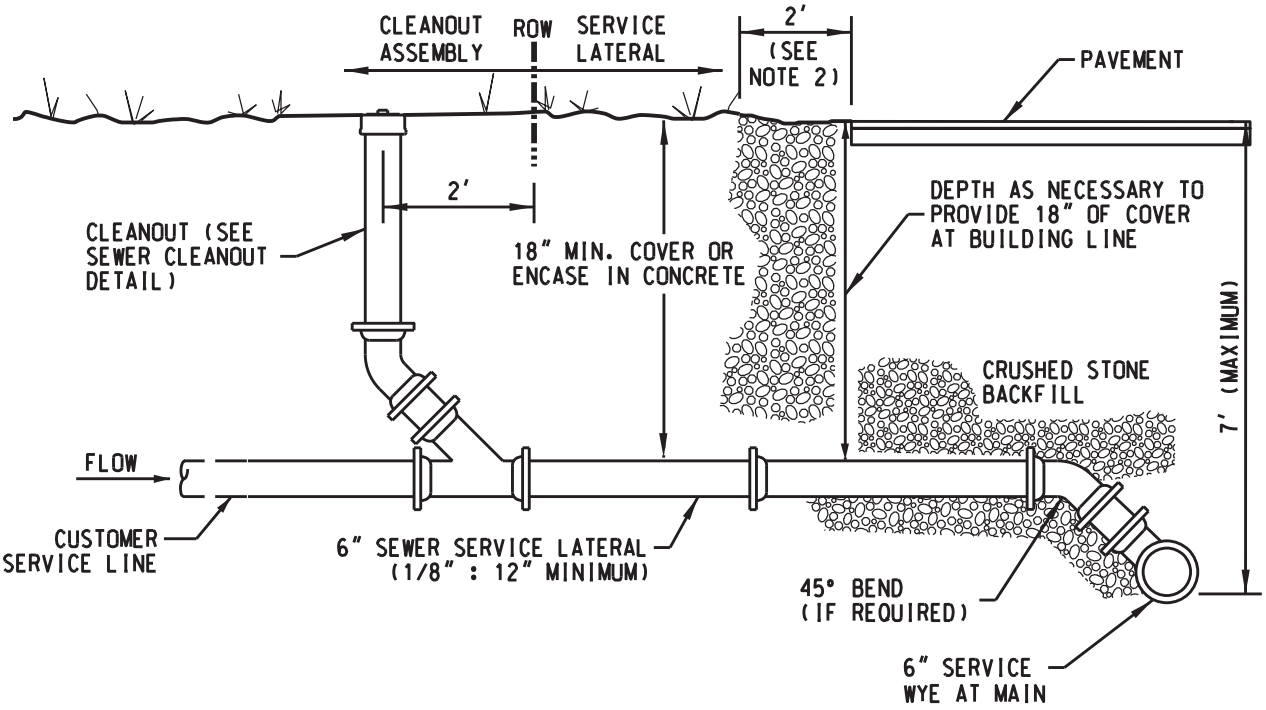
2. SERVICE LINES ARE TO BE BACKFILLED WITH CRUSHED STONE TO A POINT APPROXIMATELY 2' BEYOND THE ROAD SHOULDER OR CURB IF LOCATED IN A PAVED AREA.

3. CLEANOUTS SHALL BE LOCATED APPROXIMATELY 10 FEET FROM THE SEWER MAIN. ADDITIONAL CLEANOUTS REQUIRED ON SERVICE LINES SHALL BE INSTALLED NO FARTHER THAN 75 FEET APART.

4. CLEANOUTS AND SERVICE LINES SHALL BE 6" SDR 26 PVC WITH GASKETED FITTINGS FROM THE SEWER MAIN TO THE TOWN'S CLEANOUT. THE CLEANOUT ASSEMBLY FITTINGS SHALL HAVE PRIMER AND GLUE. UNLESS OTHERWISE SPECIFIED.

5. ALL SEWER SERVICE LATERALS SHALL BE INSTALLED BY THE CONTRACTOR (DEVELOPER) FROM THE MAIN TO THE RIGHT-OF-WAY AND TO A POINT NO LOWER THAN 7 FEET BELOW FINISHED GRADE.

6. NO MORE THAN THREE SERVICES ARE ALLOWED INTO A MANHOLE OR OTHERWISE APPROVED BY THE TOWN'S ENGINEER.



SEWER DEPTH TO 7'-0" MAX.

SANITARY SEWER SERVICE LINE CONNECTION DETAILS (1 OF 3)

NOTES:

1. THE CLEANOUT CAP SHALL BE A 6" SDR-26 OR AN APPROVED EQUAL. IN NON-TRAFFIC AREAS. THE CLEANOUT SHALL BE IN 36-H CONCRETE BOX WITH A CAST IRON LID MARKED "SEWER" FOR A 36-H BOX OR APPROVED EQUAL. IN TRAFFIC AREAS. A SQUARE JBS 8006 CASTING MARKED "SEWER" WITH A MINIMUM OF 4" SQUARE CONCRETE RISER IS TO BE INSTALLED. ALL CLEANOUTS SHALL BE IN A BOX WITH THE TOP OF THE CASTING SET TO FINAL GRADE.

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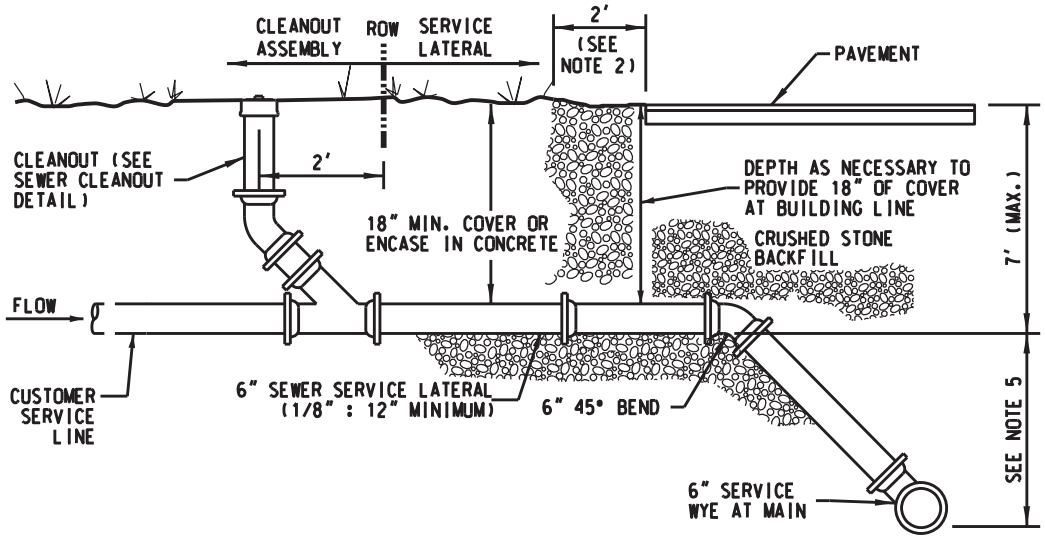
5. ALL SEWER SERVICE LATERALS SHALL BE INSTALLED BY THE CONTRACTOR (DEVELOPER) FROM THE MAIN TO THE RIGHT-OF-WAY AND TO A POINT NO GREATER THAN 7 FEET BELOW FINISHED GRADE.

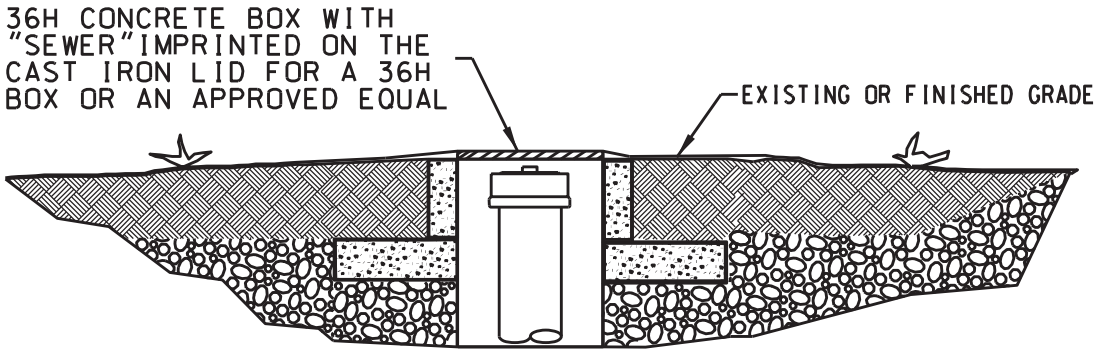
6. NO MORE THAN THREE SERVICES ARE ALLOWED INTO A MANHOLE OR OTHERWISE APPROVED BY THE TOWN'S ENGINEER.



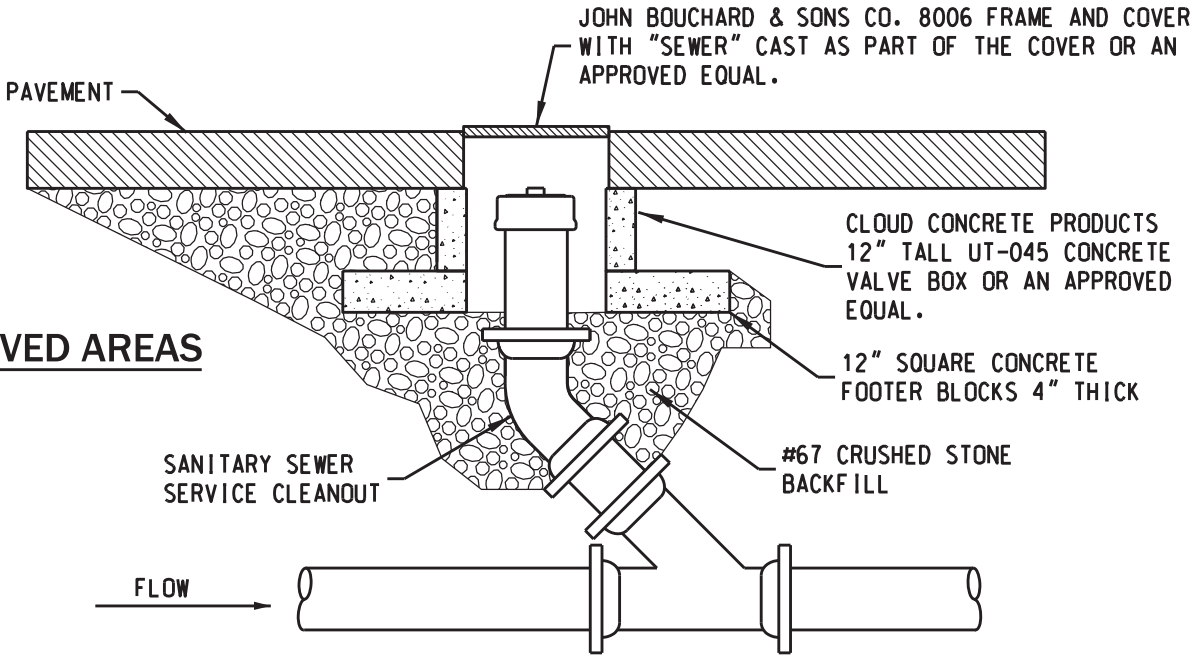
SEWER GREATER THAN 7'-0"

SANITARY SEWER SERVICE LINE CONNECTION DETAILS (2 OF 3)

IN UNPAVED AREAS



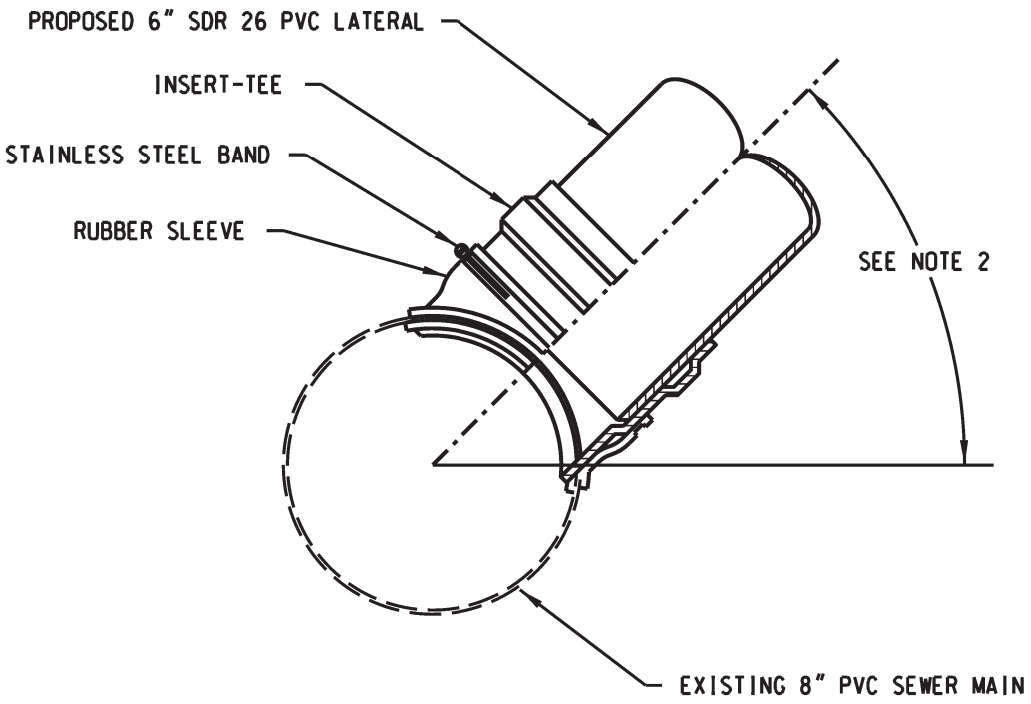
IN PAVED AREAS



NOTES:

1. THE LONG SIDE OF THE FRAME SHALL RUN PARALLEL TO THE SERVICE LINE.
2. CLEANOUTS LOCATED WITHIN A ROADWAY, DRIVEWAY, OR PARKING LOT SHALL BE PROTECTED FROM TRAFFIC USING A CAST IRON BOX & LID.
3. CLEANOUT PIPING SHALL BE 6" SDR 26 PVC UNLESS OTHERWISE SPECIFIED.
4. ALL CLEANOUTS SHALL BE IN A BOX WITH THE TOP OF THE CASTING SET TO FINAL GRADE. THE LID SHALL HAVE THE WORD "SEWER" IMPRINTED ON IT.

SEWER CLEANOUT DETAIL (3 OF 3)

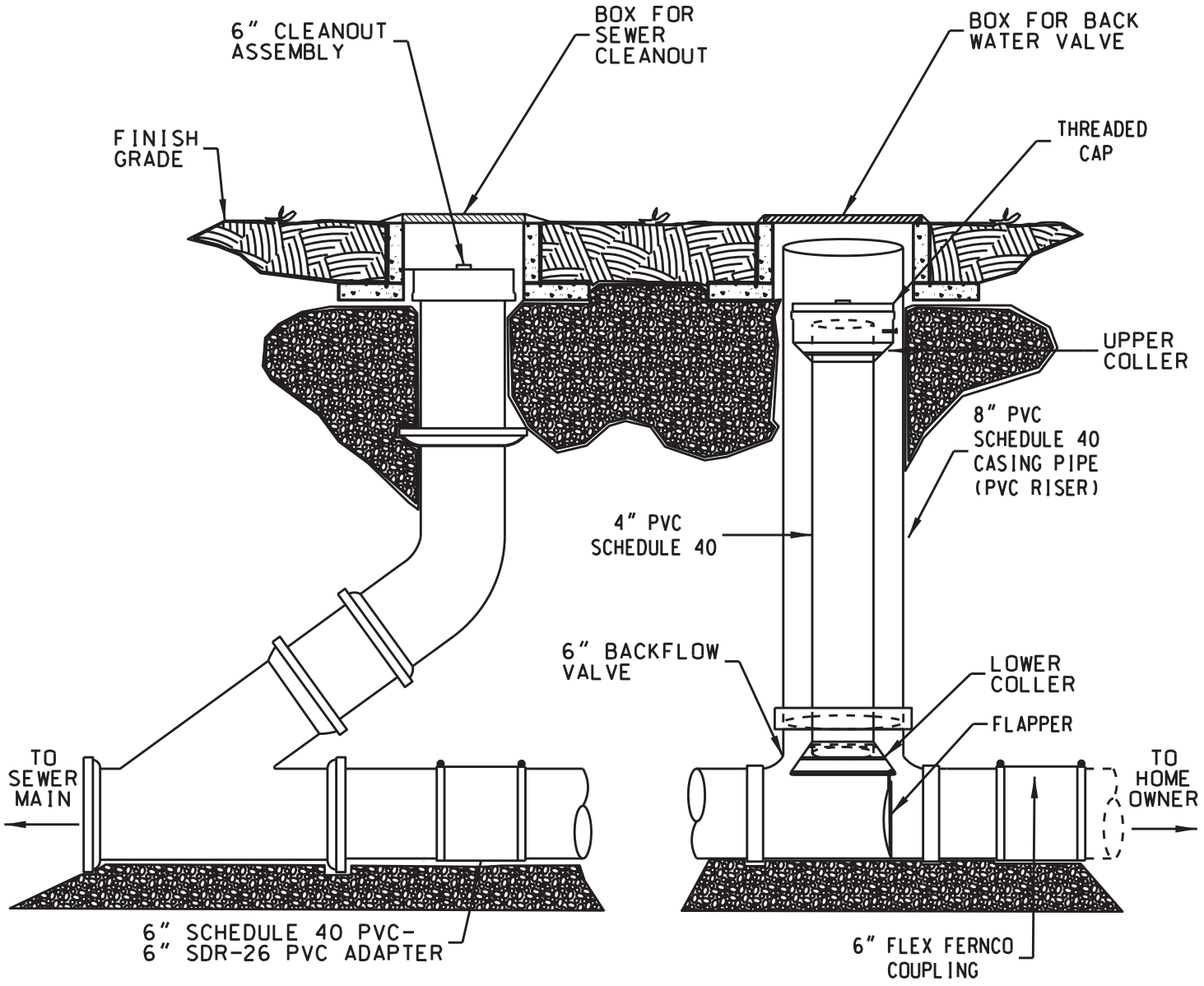


NOTES:

1. INSERTA TEE AS MANUFACTURED BY INSERTA FITTINGS CO. SHALL BE INSTALLED PER MANUFACURER'S INSTRUCTIONS.

2. CONNECTION TO BE MADE AT 45° FROM THE HORIZONTAL MINIMUM UNLESS FIELD CONDITIONS OR OBSTRUCTIONS DICTATE OTHERWISE.

INSERTA-TEE SEWER MAIN CONNECTION DETAIL



SEWER SERVICE BACKWATER VALVE DETAIL (1 OF 2)

GS-3.8

NOTES:

1. THE BACKWATER VALVE SHALL BE A RECTORSEAL CLEAN CHECK EXTENDABLE BACKWATER VALVE OR AN APPROVED EQUAL.

2. THE BACKWATER IS TO BE INSTALLED ON SEWER SERVICES OF BUILDINGS WHOSE FINAL FLOOR LEVEL IS LOWER THAN THE HEIGHT OF THE TOP OF CASTING OF THE UPSTREAM MANHOLE OF THE SEWER MAIN THAT THE SEWER SERVICE IS INSTALLED ON.

3. A 6" SEWER CLEANOUT ASSEMBLY SHALL BE INSTALLED IMMEDIATELY DOWNSTREAM OF THE BACKWATER VALVE.

4. THE CONTRACTOR IS RESPONSIBLE TO PROVIDE THE SCHEDULE 40 PVC-TO-SDR-26 PVC ADAPTER.

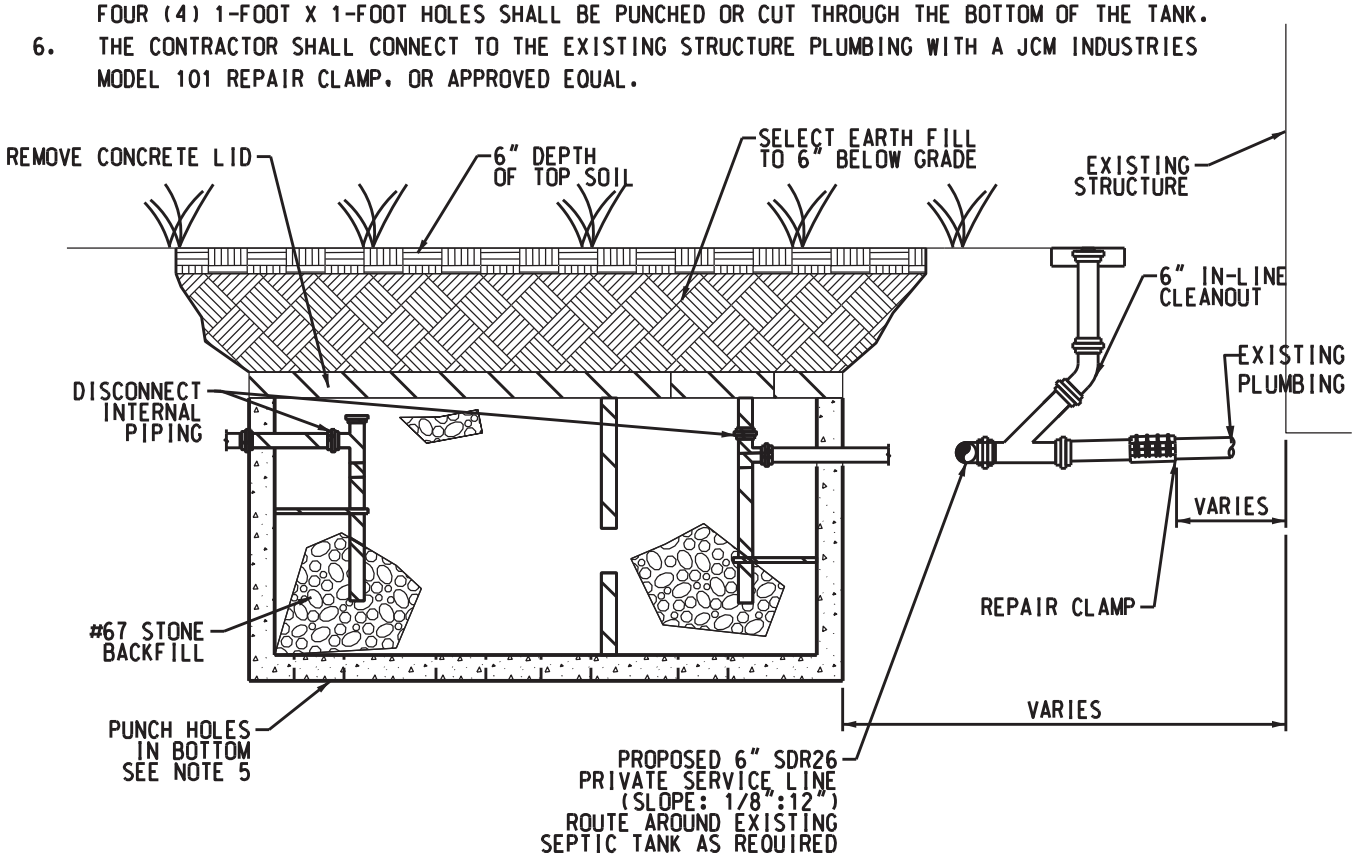
5. THE CONTRACTOR SHALL RECONNECT TO THE CUSTOMER'S SEWER SERVICE LINE PER THE TOWN'S SEWER SPECIFICATIONS AND PLUMBING CODE.

6. THE BACKWATER VALVE IS TO BE INSTALLED PER THE MANUFACTURER'S RECOMMENDATIONS.

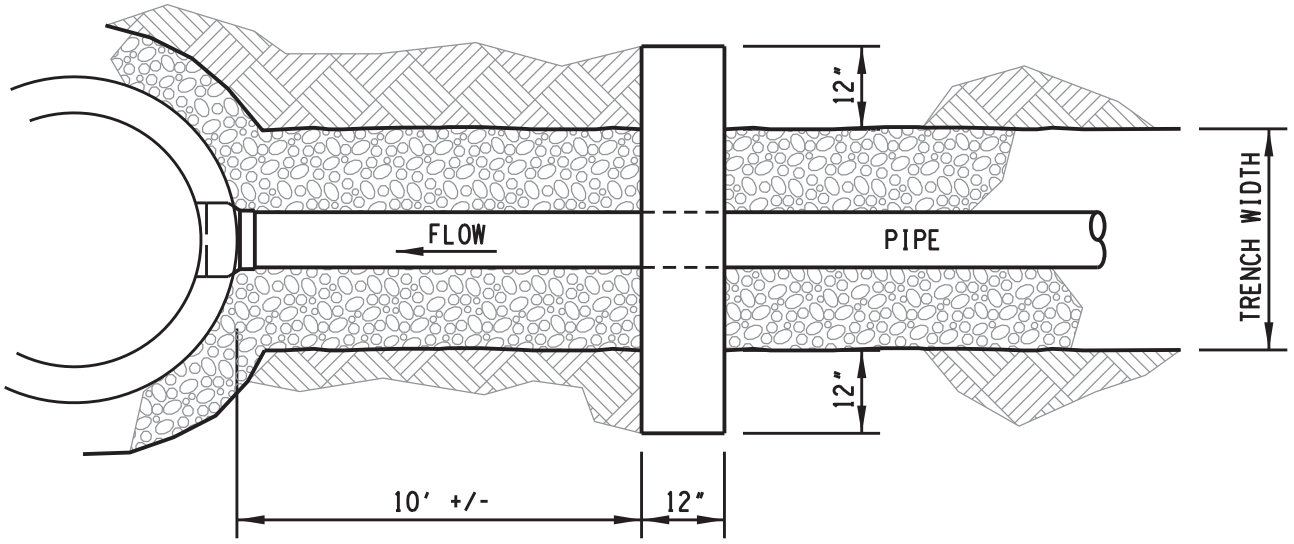
SEWER SERVICE BACKWATER VALVE DETAIL (2 OF 2)

NOTES:

1. THE SEPTIC TANK SHALL BE COMPLETELY PUMPED OUT BY A LICENSED SEPTIC DISPOSAL COMPANY.
2. THE CONCRETE TANK LID AND ANY RISERS SHALL BE REMOVED. EXISTING PIPE DISCONNECTED. HOLES PUNCHED IN THE BOTTOM OF THE TANK AND TANK FILLED WITH #67 STONE UP TO THE TOP OF THE TANK. SELECT EARTH FILL SHALL THEN BE PLACED UP TO 6" BELOW FINISHED GRADE.
3. FINAL GRADING SHALL BE PERFORMED WITH 6" OF TOP SOIL PLACED TO RESTORE EXISTING GRADE LINES AND SEED AND STRAW PLACED FOR FINAL STABILIZATION.
4. THE PROPOSED 6" PRIVATE SERVICE LINE SHALL BE ROUTED AROUND THE EXISTING SEPTIC TANK AS REQUIRED.
5. HOLES SHALL BE PUNCHED IN THE BOTTOM OF THE SEPTIC TANK TO ALLOW DRAINAGE. A MINIMUM OF FOUR (4) 1-FOOT X 1-FOOT HOLES SHALL BE PUNCHED OR CUT THROUGH THE BOTTOM OF THE TANK.
6. THE CONTRACTOR SHALL CONNECT TO THE EXISTING STRUCTURE PLUMBING WITH A JCM INDUSTRIES MODEL 101 REPAIR CLAMP, OR APPROVED EQUAL.



ABANDONMENT OF EXISTING SEPTIC TANK



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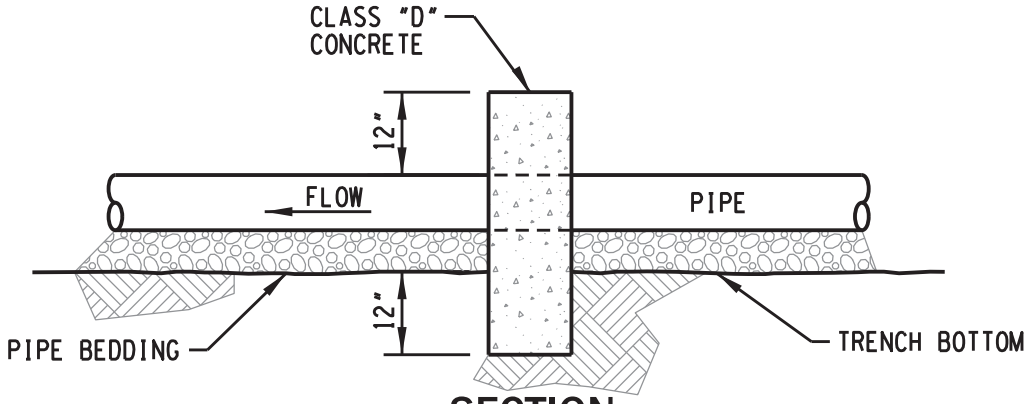
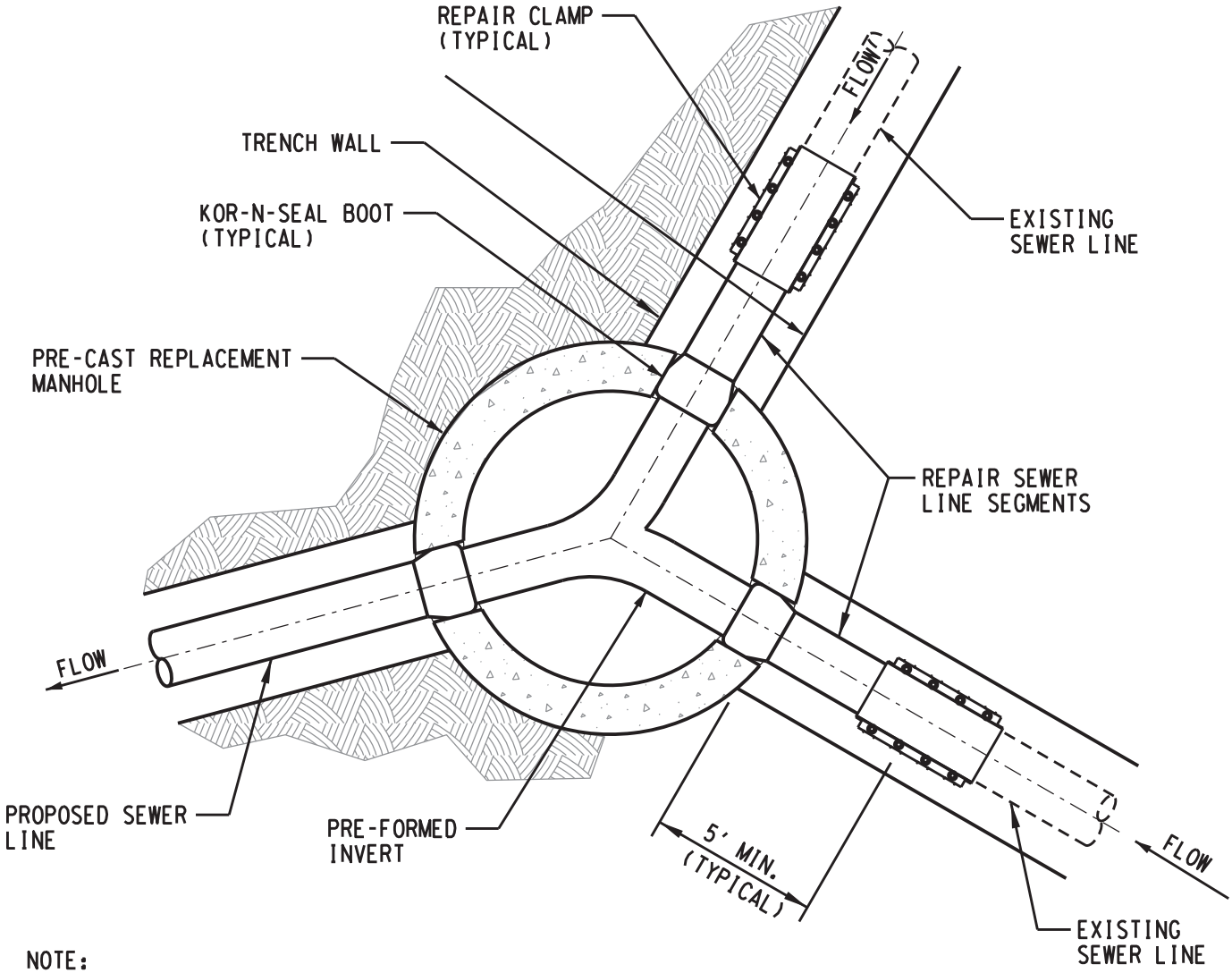


SECTION

NOTE:

A CONCRETE WATERSTOP SHALL BE CONSTRUCTED ON THE LOW END OF EACH SEWER LINE SEGMENT THAT CROSSES UNDER A STORM PIPE, CULVERT, DITCH OR WET WEATHER CONVEYANCE AND ON BOTH SIDES OF A STREAM OR CREEK. A CONCRETE WATERSTOPSHALL BE CONSTRUCTED ON EACH SEWER LINE SEGMENT THAT IS INSTALLED BELOW AND FOLLOWING A DITCH LINE.

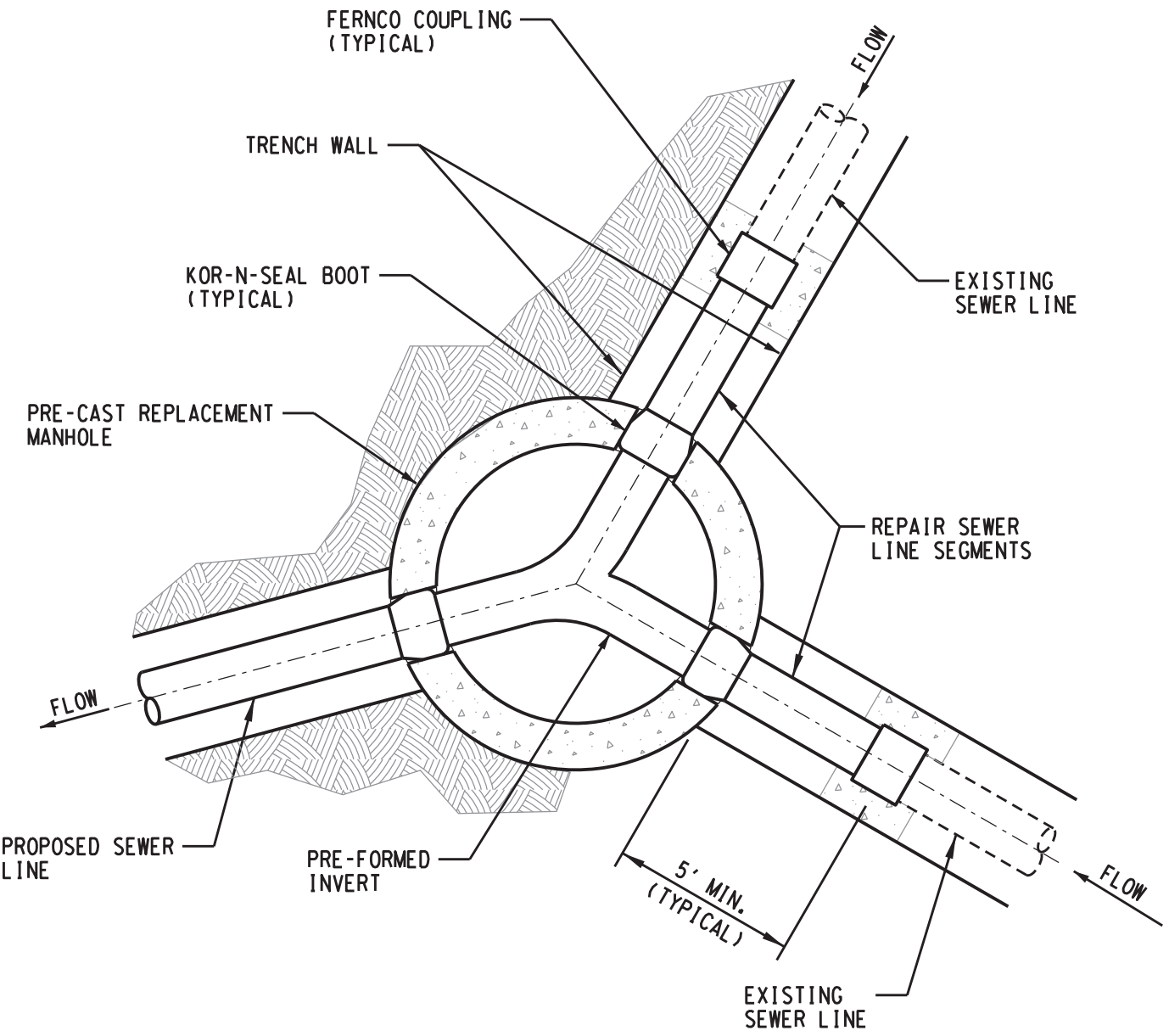
CONCRETE WATERSTOP FOR GRAVITY SEWER LINES DETAIL



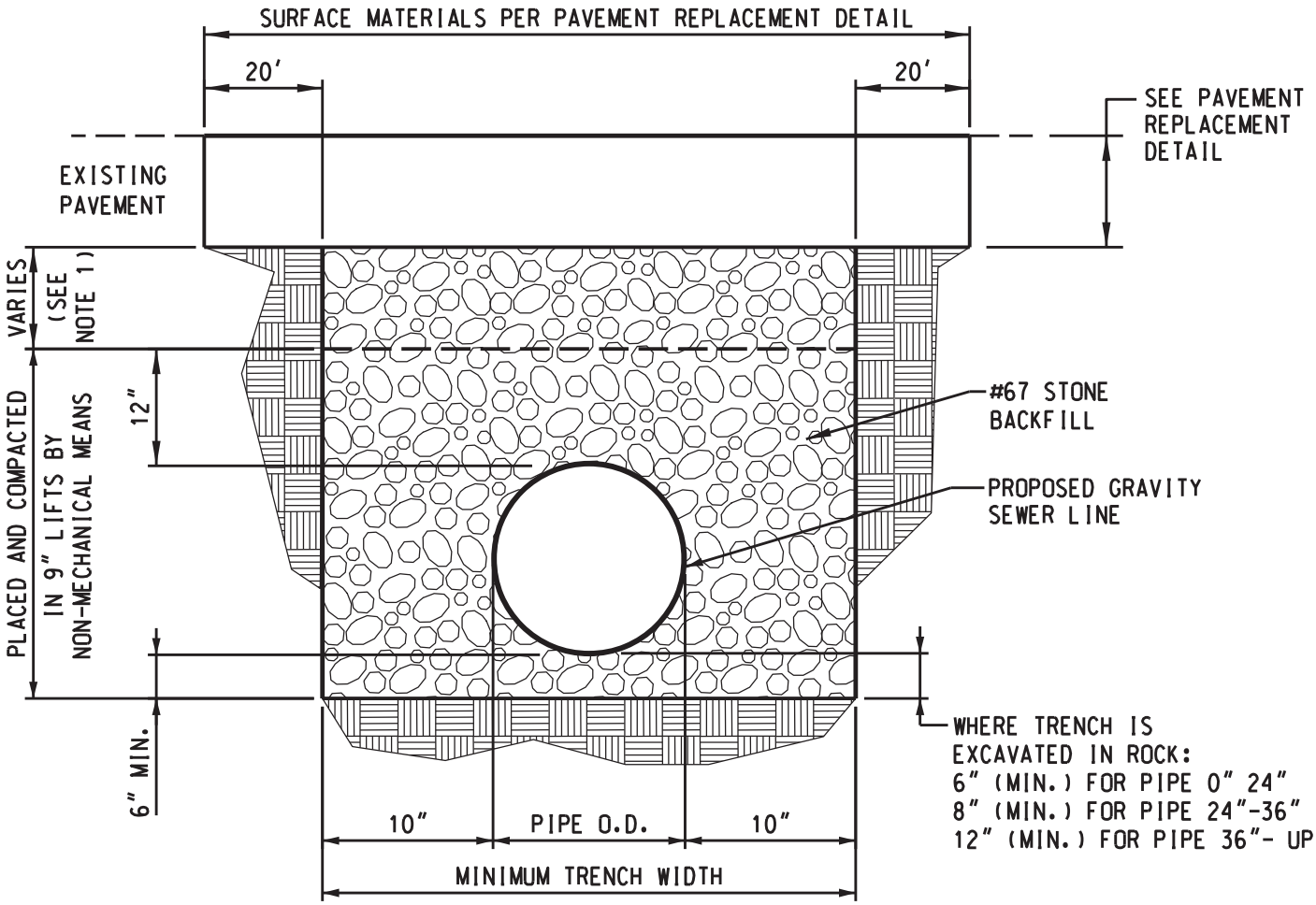
NOTE:

REPAIR CLAMP SHALL BE JCM INDUSTRIES MODEL 101 OR APPROVED EQUAL (I.E. 101-0840-12 FOR 8") THE BAND SHALL BE FABRICATED OF 20 GA. TYPE 304 STAINLESS STEEL. CLAMP WIDTH SHALL BE A MINIMUM OF 12-INCHES.

MANHOLE REPLACEMENT DETAIL (PVC OR DUCTILE IRON)



MANHOLE REPLACEMENT DETAIL (CLAY OR CAST IRON)



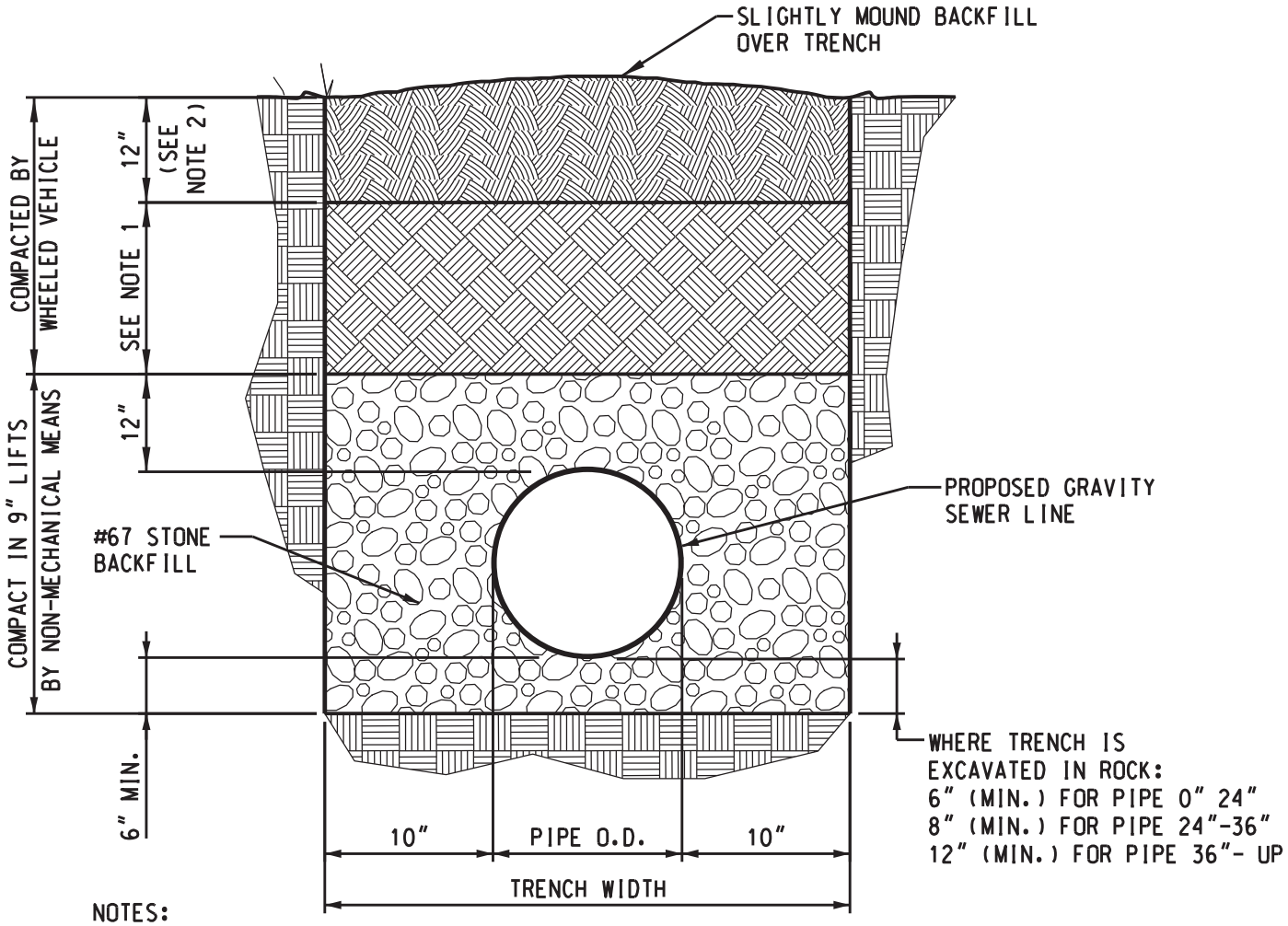
NOTE:

1. BACKFILL TO BE PLACED AND COMPACTED IN 9" LIFTS BY MECHANICAL MEANS.MATERIAL MAY BE EXCAVATED MATERIAL. HOWEVER. THIS MATERIAL SHALL NOT CONTAIN ROCKS GREATER THAN 6 INCHES IN ANY DIMENSION.

2. SEWER TAPE IS TO BE PLACE ON TOP OF THE GRAVEL ENVELOPE.

3. REPAIRS IN ROADWAYS SHALL INCLUDE MILLING AND RESURFACING A MINIMUM OF 20-FT. PAST THE TRENCH EDGE IN EACH DIRECTION.

TRENCH BACKFILLING DETAIL- PAVED AREAS



NOTES:

1. BACKFILL MATERIAL MAY BE EXCAVATED MATERIAL AND SHALL BE PLACED IN 12" LIFTS. HOWEVER. THIS MATERIAL SHALL NOT CONTAIN ROCKS GREATER THAN 6 INCHES IN ANY DIMENSION.

2. BACKFILL MATERIAL MAY BE EXCAVATED MATERIAL. HOWEVER. THIS MATERIAL SHALL NOT CONTAIN ROCKS GREATER THAN 1/ 2 INCH.

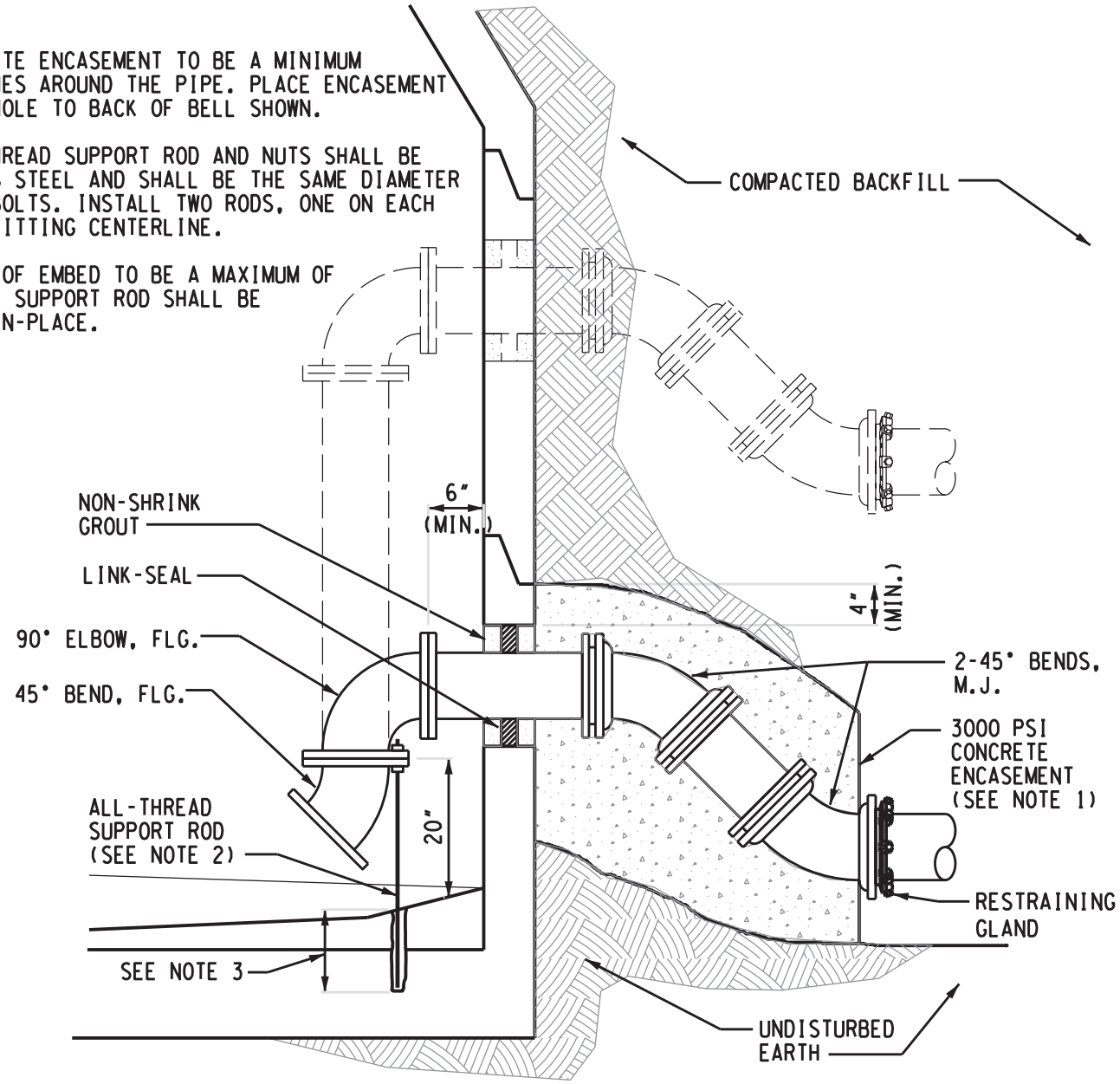
TRENCH BACKFILLING DETAIL-UNPAVED AREAS

NOTES:

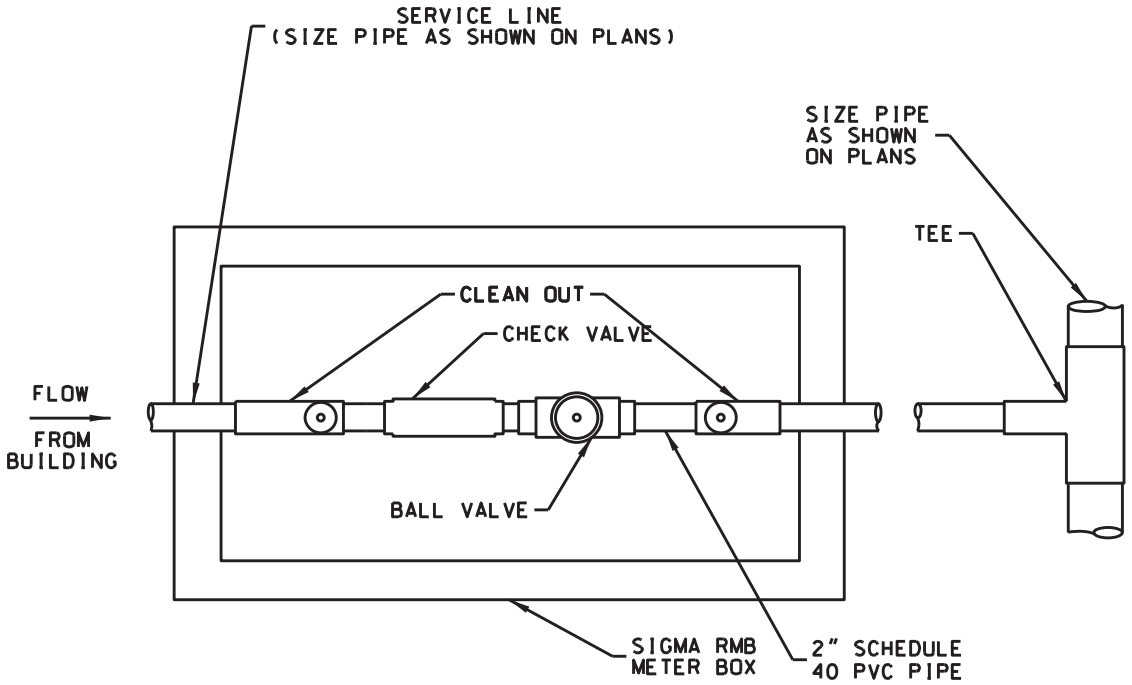
1. CONCRETE ENCASEMENT TO BE A MINIMUM OF 6 INCHES AROUND THE PIPE. PLACE ENCASEMENT FROM MANHOLE TO BACK OF BELL SHOWN.

2. ALL-THREAD SUPPORT ROD AND NUTS SHALL BE STAINLESS STEEL AND SHALL BE THE SAME DIAMETER AS PIPE BOLTS. INSTALL TWO RODS, ONE ON EACH SIDE OF FITTING CENTERLINE.

3. DEPTH OF EMBED TO BE A MAXIMUM OF 4 INCHES. SUPPORT ROD SHALL BE GROUTED IN-PLACE.



STANDARD FORCE MAIN-TO-MANHOLE CONNECTION



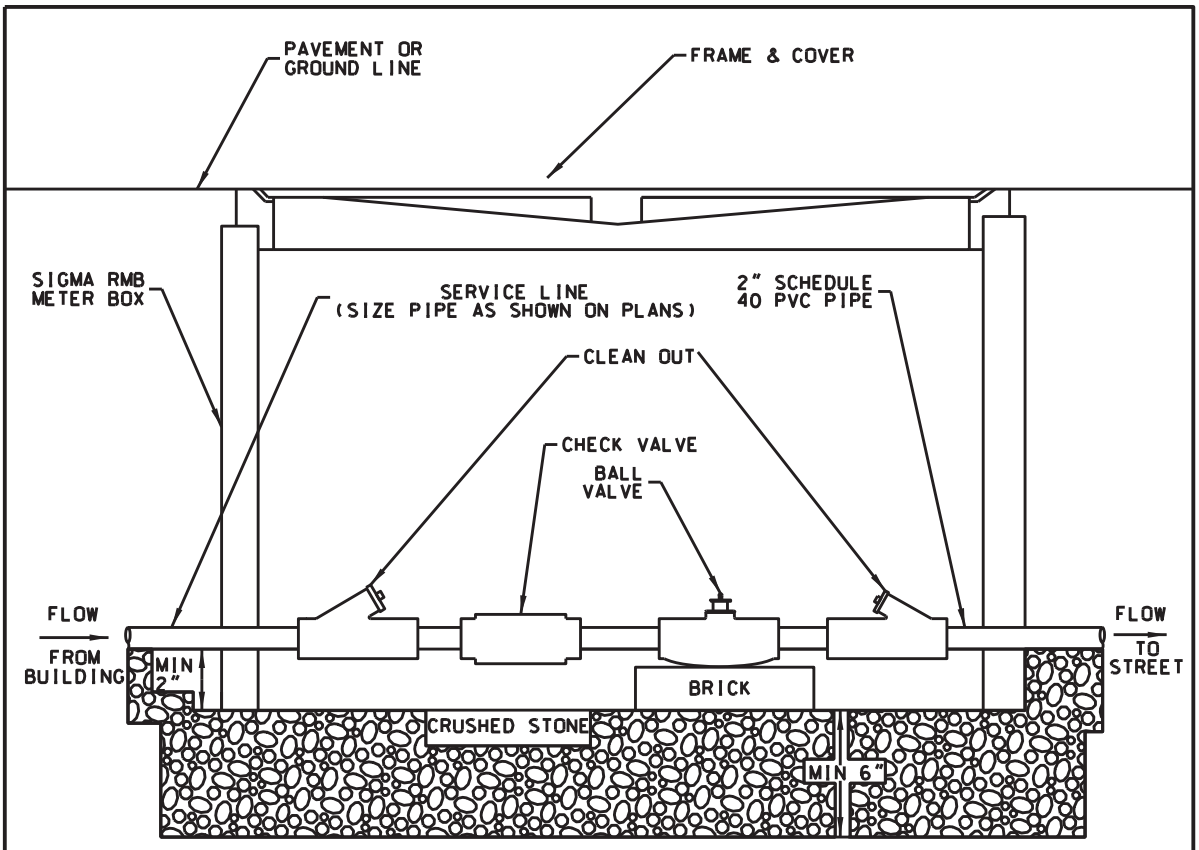
NOTES:

1. USE SIMGA RMB 173018-SW BOX WITH SOLID PLASTIC LID OR APPROVED EQUAL

2. IF A CONCRETE BOX HAS TO BE USED, THEN THE SMYRNA UTILITIES DEPARTMENT WILL HAVE AUTHORITY TO APPOVE OR DENY USE OF THE CONCRETE BOX

3. CLEAN OUTS:
   USE STANDARD WYE FITTINGS WITH THREADED PLUGS OR CAP. GLUE IS NOT ALLOWED.

GRINDER PUMP SERVICE BOX AT R.O.W. (1 OF 2)



NOTE:

1. THE LINE SHOULD BE A MINIMUM OF 2 INCHES FROM GROUND. (HIGH ENOUGH TO BE SET ON THE TOP OF THE BRICK)

2. THE CLEANOUT CAP SHALL BE A JONES STEPHENS CO. 2" GASKETED CAST IRON CLEANOUT WITH A BRONZE PLUG USED IN CONJUCTION WITH A 2" SDR-26 FERNCO COUPLING OR AN APPROVED EQUAL. THE CLEANOUT CAP MUST BE THREADED. GLUE IS NOT ALLOWED.

GRINDER PUMP SERVICE BOX AT R.O.W. (2 OF 2)

PS-1.2

NOTES:

1. THE CLEANOUT CAP SHALL BE A 6" SDR-26 OR AN APPROVED EQUAL. IN NON-TRAFFIC AREAS, THE CLEANOUT SHALL BE IN 36-H CONCRETE BOX WITH A CAST IRON LID MARKED "SEWER" FOR A 36-H BOX OR APPROVED EQUAL. IN TRAFFIC AREAS, A SQUARE JBS 8006 CASTING MARKED "SEWER" WITH A MINIMUM OF 4" SQUARE CONCRETE RISER IS TO BE INSTALLED. ALL CLEANOUTS SHALL BE IN A BOX WITH THE TOP OF THE CASTING SET TO FINAL GRADE.

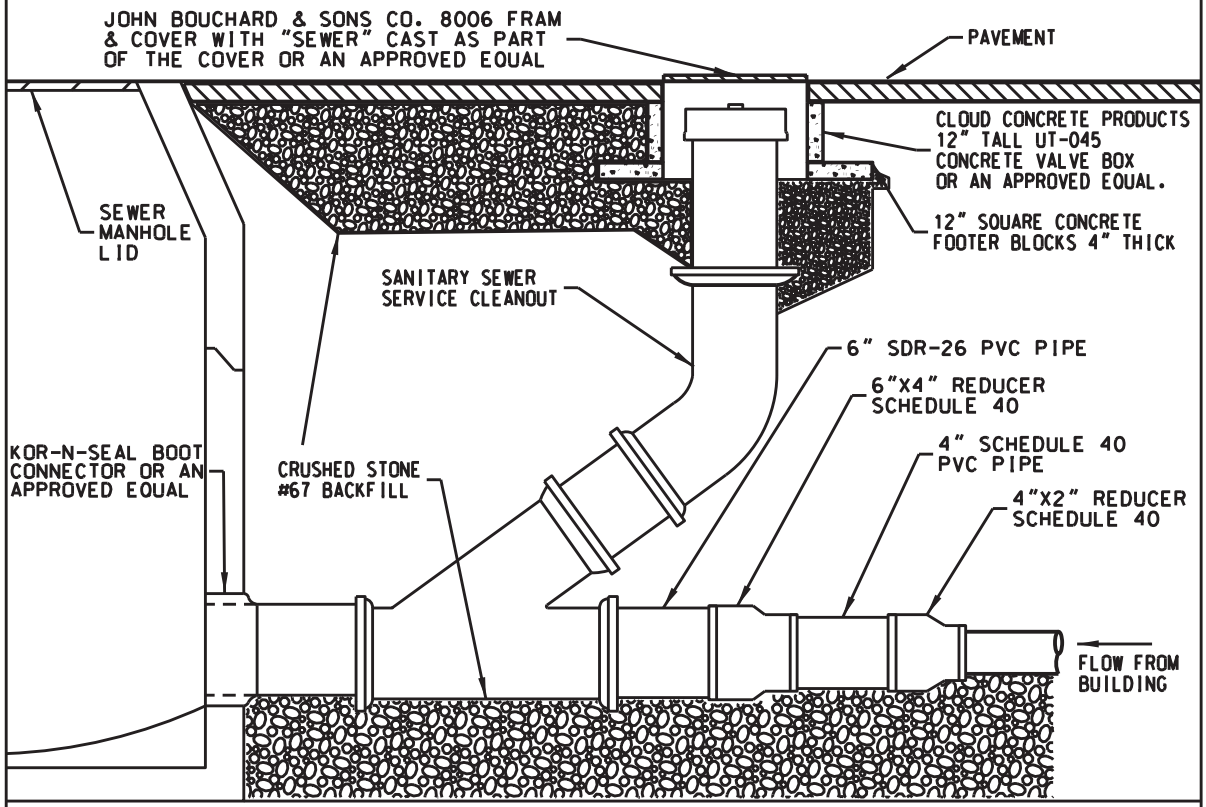
2. CLEANOUTS LOCATED WITHIN A ROADWAY, DRIVEWAY, OR PARKING LOT SHALL BE PROTECTED FROM TRAFFIC USING A CAST IRON BOX & LID. TAPERED CONCRETE COLLARS ARE REQUIRED IN PAVED AREAS.

3. CLEANOUTS AND SERVICE LINES SHALL BE 6" SDR-26 PVC WITH GASKETED FITTINGS FROM THE SEWER MAIN TO THE TOWN'S CLEANOUT. THE CLEANOUT ASSEMBLY FITTINGS SHALL HAVE PRIMER AND GLUE, UNLESS OTHERWISE SPECIFIED.

4. FOR THE SEWER SERVICE, IT SHALL BE INSTALLED ABOVE THE FLOW LINE, AND A SWEEP SHALL BE MADE FOR THE SEWER SERVICE AT THE BASE OF THE MANHOLE IN THE TROUGH. THE SWEEP SHALL BE CREATED TO GO WITH THE FLOW OF THE WATER IN THE SEWER MAIN.

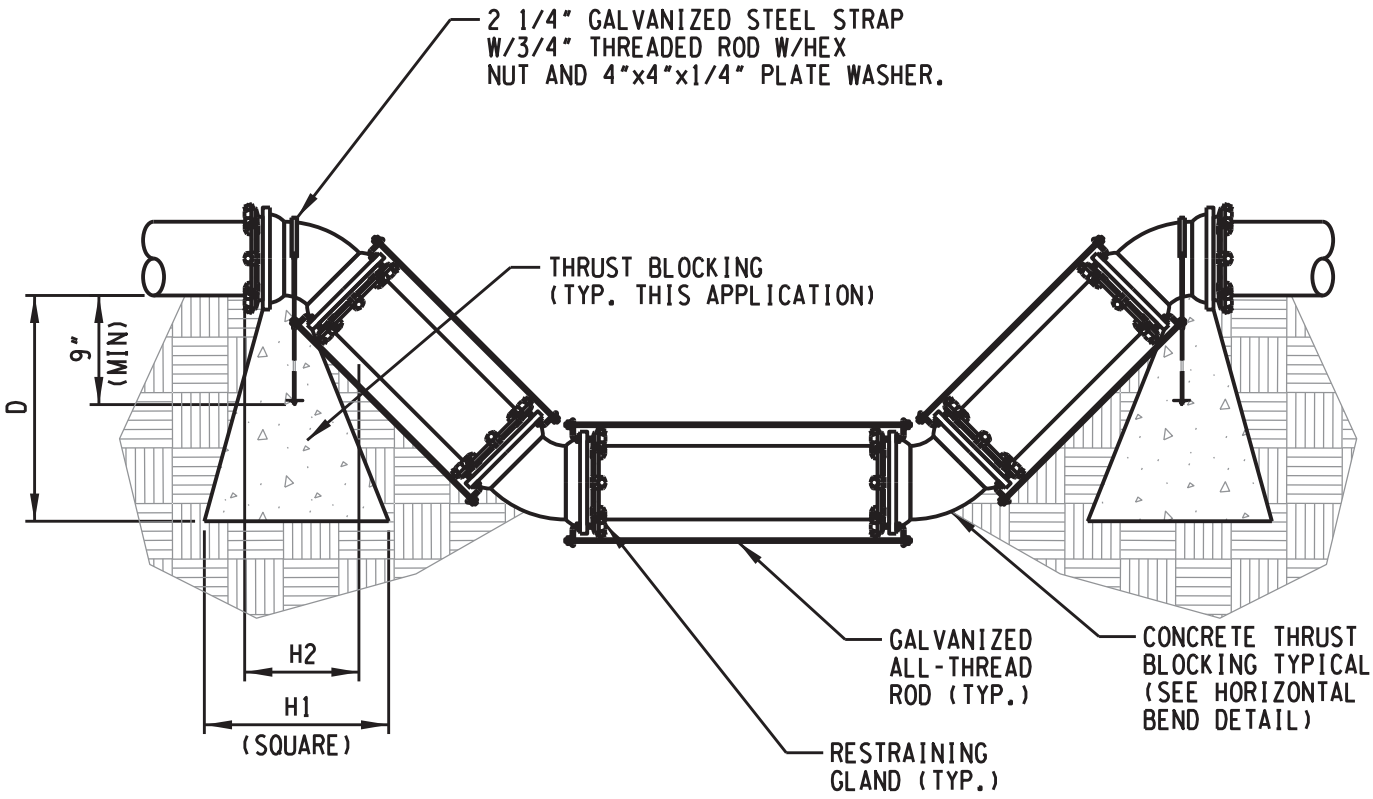
5. THE CLEANOUT ASSEMBLY SHALL HAVE A GRAVEL ENVELOPE WITH CRUSH STONE NO. 67, 6" ON BOTTOM & SIDES, AND 12" ON TOP.

6. NO MORE THAN THREE SERVICES ARE ALLOWED INTO A MANHOLE OR OTHERWISE APPROVED BY THE TOWN'S ENGINEER.



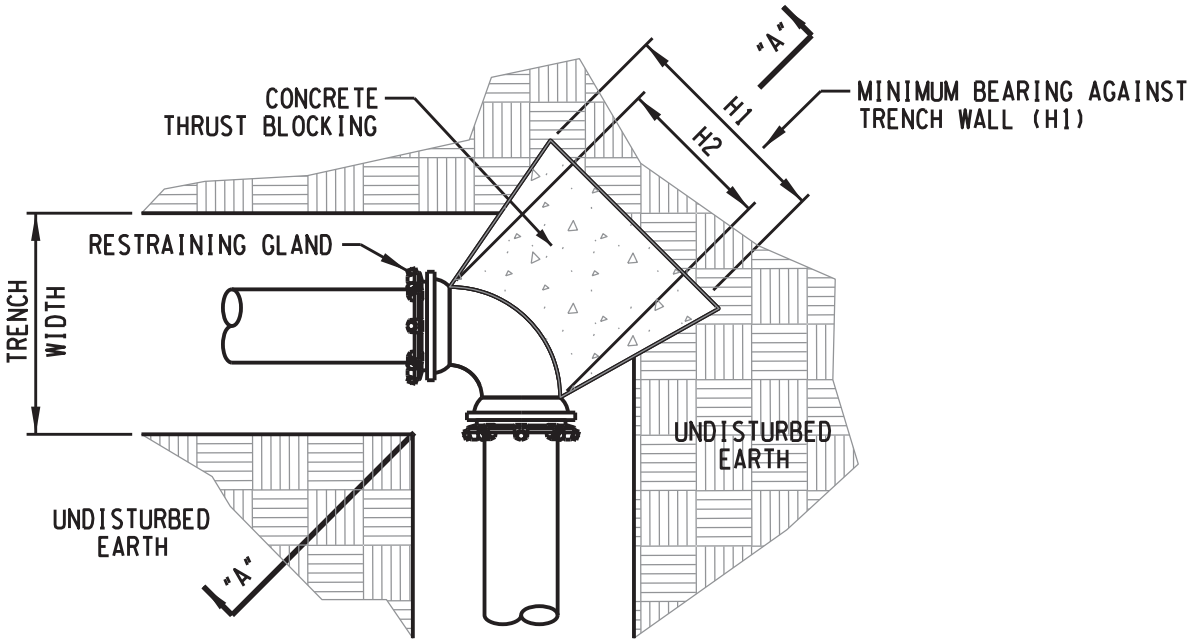
SEWER CLEANOUT DETAIL FOR GRINDER PUMP FORCE MAIN

PS-1.3

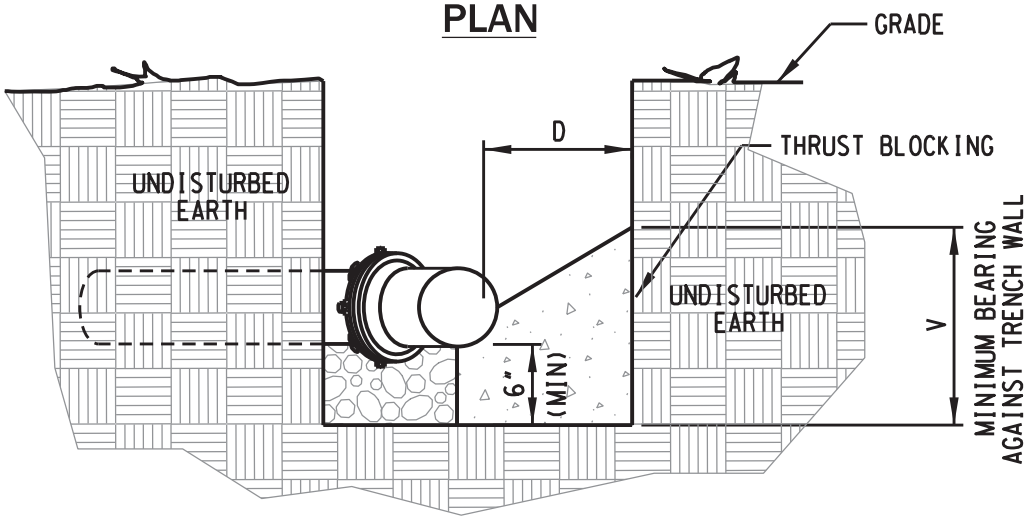


VERTICAL BENDS

CONCRETE THRUST BLOCKING (1 OF 4)

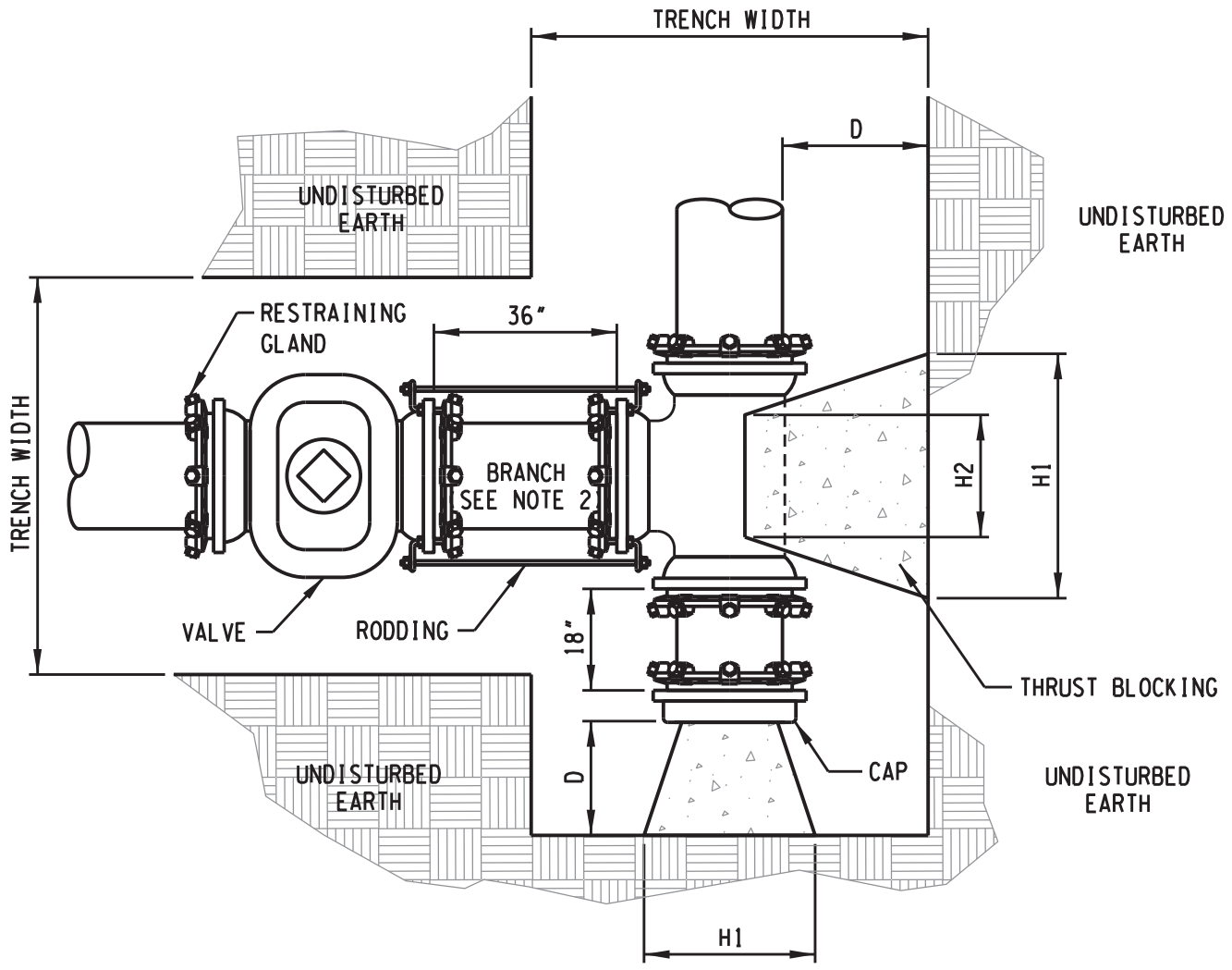


PLAN



SECTION "A-A"

CONCRETE THRUST BLOCKING (2 OF 4)



TEES AND CAPS

CONCRETE THRUST BLOCKING (3 OF 4)

TEES. CROSSES. AND PLUGS					90° BENDS					45° BENDS					22-1/2° BENDS					11-1/4° BENDS					PIPE SIZE	MIN.# OF 3/4" ALL THREAD RODS
H1	H2	V	D	Cu.Ft.	H1	H2	V	D	Cu.Ft.	H1	H2	V	D	Cu.Ft.	H1	H2	V	D	Cu.Ft.	H1	H2	V	D	Cu.Ft.		
18"	10"	12"	18"	1.90	18"	10"	12"	18"	1.90	18"	6"	12"	18"	1.50	18"	6"	12"	18"	1.50	18"	6"	12"	18"	1.50	2" - 2¼"	2
24"	12"	12"	18"	2.25	24"	12"	12"	18"	2.25	18"	8"	12"	18"	1.60	18"	8"	12"	18"	1.60	18"	8"	12"	18"	1.60	3" - 4"	2
24"	16"	18"	18"	3.50	30"	16"	18"	18"	4.05	24"	10"	16"	18"	3.20	24"	10"	16"	18"	3.20	24"	10"	16"	18"	3.20	6"	4
36"	18"	18"	24"	5.05	39"	18"	24"	18"	7.30	30"	12"	18"	18"	3.95	24"	12"	18"	18"	3.45	24"	12"	16"	18"	3.40	8"	4
48"	24"	18"	24"	7.15	54"	32"	24"	18"	10.25	36"	18"	21"	18"	4.60	24"	18"	21"	18"	4.60	24"	18"	21"	18"	4.60	10"	6
54"	30"	24"	24"	13.40	54"	32"	36"	24"	18.15	42"	18"	24"	24"	9.60	24"	18"	24"	24"	6.60	24"	18"	21"	24"	6.10	12"	6
60"	32"	30"	24"	17.90	60"	40"	42"	24"	25.00	44"	24"	30"	24"	13.20	30"	24"	24"	24"	9.20	27"	21"	24"	24"	7.90	14"	8
66"	34"	36"	24"	22.50	69"	48"	48"	24"	29.00	48"	30"	36"	24"	17.00	36"	30"	27"	24"	11.80	27"	24"	27"	24"	9.10	16"	8
66"	36"	40"	24"	27.50	69"	48"	48"	24"	33.00	48"	30"	36"	24"	17.00	36"	30"	29"	24"	13.00	27"	30"	29"	24"	11.00	18"	8
	38"		24"			48"		24"			40"		24"			36"		24"		30"	40"		28"		20"	10
	42"		24"			60"		24"			48"		24"			42"		24"			42"		32"		24"	12
	58"		24"			96"		24"			72"		24"			72"		24"			48"		36"		36"	18

NOTES:

1. THRUST BLOCKING WILL BE PAID FOR AT THE CONTRACT UNIT PRICE FOR 3000 PSI CONCRETE FOR THE VOLUME SHOWN IN THE ABOVE TABLE FOR EACH FITTING SO BLOCKED ONLY IF A SEPARATE ITEM APPEARS IN THE SCHEDULE OF A PROPOSAL FOR A UNIT PRICE CONTRACT. OTHERWISE. THERE WILL BE NO SEPARATE PAYMENT FOR CONCRETE THRUST BLOCKING.

2. DIMENSIONS ARE CONTROLLED BY DIAMETER OF BRANCH MAIN.

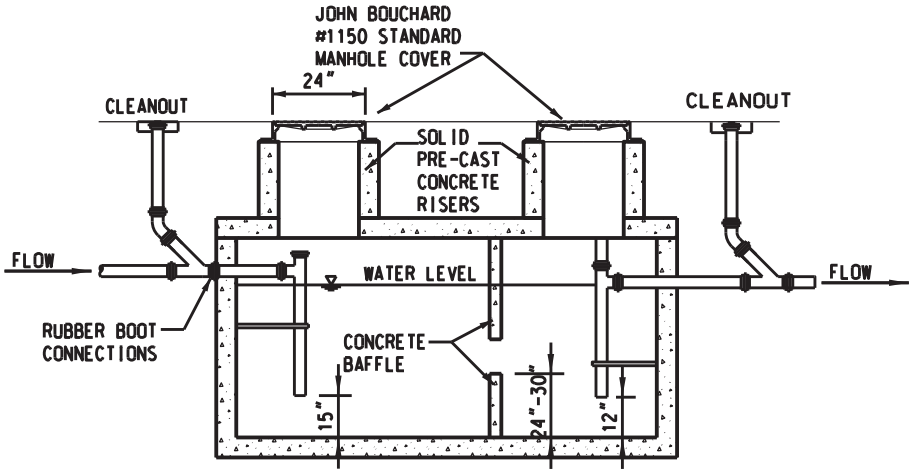
3. THRUST BLOCKING SHALL BE PLANT MIX CONCRETE. SAC CRETE OR BAGGED CONCRETE MIX SHALL NOT BE ALLOWED.

4. RODS SHALL BE GALVANIZED. TWO RODS SHALL BE INSTALLED FOR PIPE DIAMETERS 8" AND LESS. FOUR RODS SHALL BE INSTALLED FOR PIPE DIAMETERS 10" AND GREATER.

CONCRETE THRUST BLOCKING (4 OF 4)

NOTE:

1. THE GREASE TRAP SHALL BE INSTALLED 8-15-ft. AWAY FROM THE BUILDING
2. THERE SHALL BE CLEANOUTS INSTALLED ON THE UPSTREAM AND DOWNSTREAM SIDES OF THE GREASE TRAP
3. THE CONCRETE GREASE TRAP/OIL-WATER SEPARATOR SHALL BE A TRAFFIC RATED CONCRETE STRUCTURE.
4. THE SHALL NOT BE OVER 25-in. OF RISERS USED ON THE GREASE TRAP/ OIL-WATER SEPARATOR

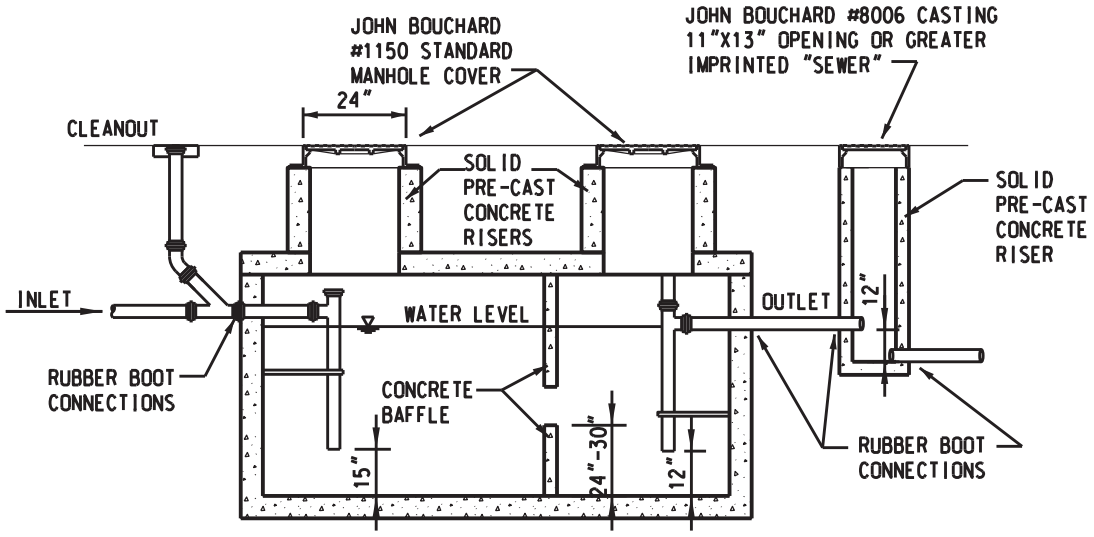


1500 GALLON GREASE TRAP/ OIL-WATER SEPARATOR

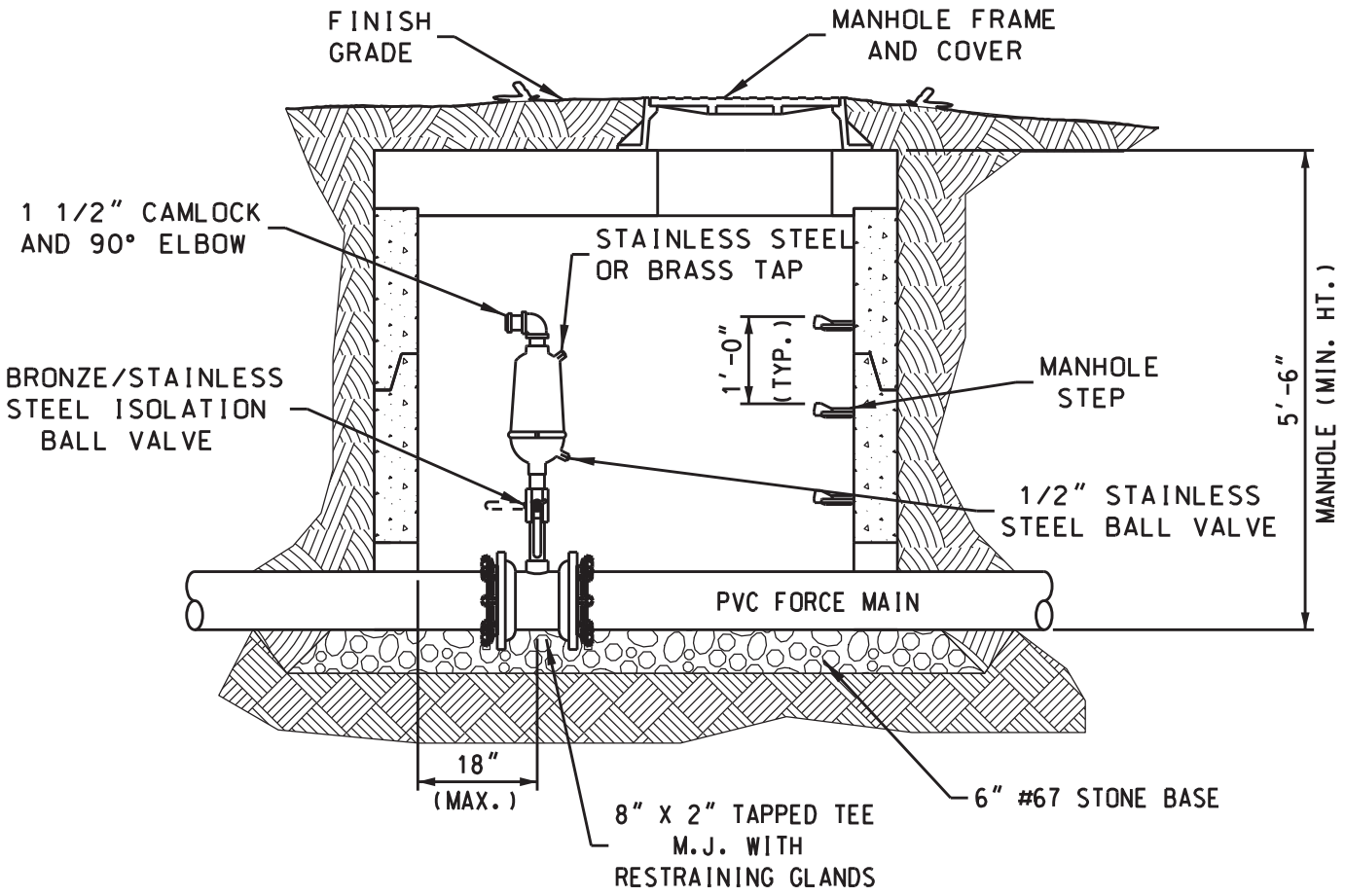
PS5.4

NOTE:

1. THE GREASE TRAP SHALL BE INSTALLED 8-15-ft. AWAY FROM THE BUILDING
2. THERE SHALL BE CLEANOUTS INSTALLED ON THE UPSTREAM AND DOWNSTREAM SIDES OF THE GREASE TRAP
3. THE CONCRETE GREASE TRAP/OIL-WATER SEPARATOR SHALL BE A TRAFFIC RATED CONCRETE STRUCTURE.
4. THE SHALL NOT BE OVER 25-in. OF RISERS USED ON THE GREASE TRAP/ OIL-WATER SEPARATOR



1500 GALLON GREASE TRAP WITH SAMPLING BOX



1" - 3" WASTEWATER COMBINATION AIR VALVE DETAIL (1 OF 2)

NOTES:

1. THIS DETAIL ILLUSTRATES A SINGLE-BODY WASTEWATER COMBINATION AIR/VACCUM RELEASE VALVE. REFER TO THE PROJECT DRAWINGS FOR THE LOCATION OF EACH TYPE AND SIZE. THE VALVE SHALL BE ROTATED AS NECESSARY TO MEET CLEARANCES FROM THE MANHOLE WALL AND TO MAXIMIZE CLEAR SPACE FOR MAINTENANCE PERSONNEL. THE OUTLET ELBOW AND PIPING SHALL BE ROTATED AWAY FROM THE MANHOLE STEPS.

2. THE VALVE SHALL BE AN AQUESTIA A.R.I. D-025 SERIES MODEL OR AN APPROVED EQUAL: EACH VALVE SHALL BE INSTALLED WITH A COMPATABLE BACKWASH KIT WITH QUICK-DISCONNECT COUPLINGS.

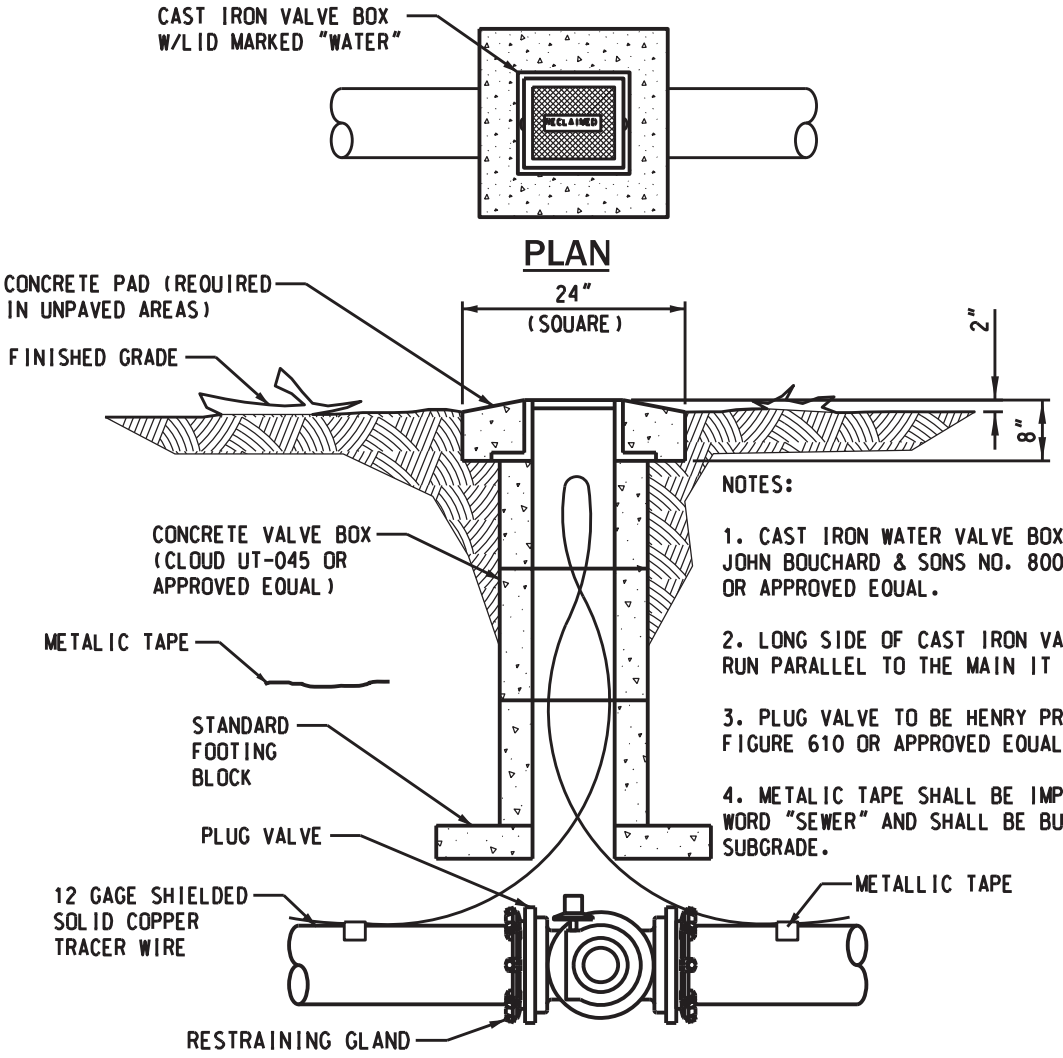
3. EACH MANHOLE SHALL BE INSTALLED WITH AN OPEN-BOTTOM AND A TOP-SLAB AND SHALL BE CLOUD MH-124 OR APPROVED EQUAL.

4. MANHOLE FRAME SHALL BE JOHN BOUCHARD & SONS NO. 1150 OR APPROVED EQUAL.

5. ALL PRECAST MANHOLE COMPONENTS SHALL COMPLY WITH ASTM C-478 AND SHALL BE ASSEMBLED WITH BUTYL MASTIC SEALANT BETWEEN TONGUE & GROOVES AND AN A WRAP OVER THE EXTERIOR JOINTS.

6. MANHOLE STEPS SHALL BE M.A. INDUSTRIES OR APPROVED EQUAL.

1" - 3" WASTEWATER AIR VALVE DETAIL (2 OF 2)



NOTES:

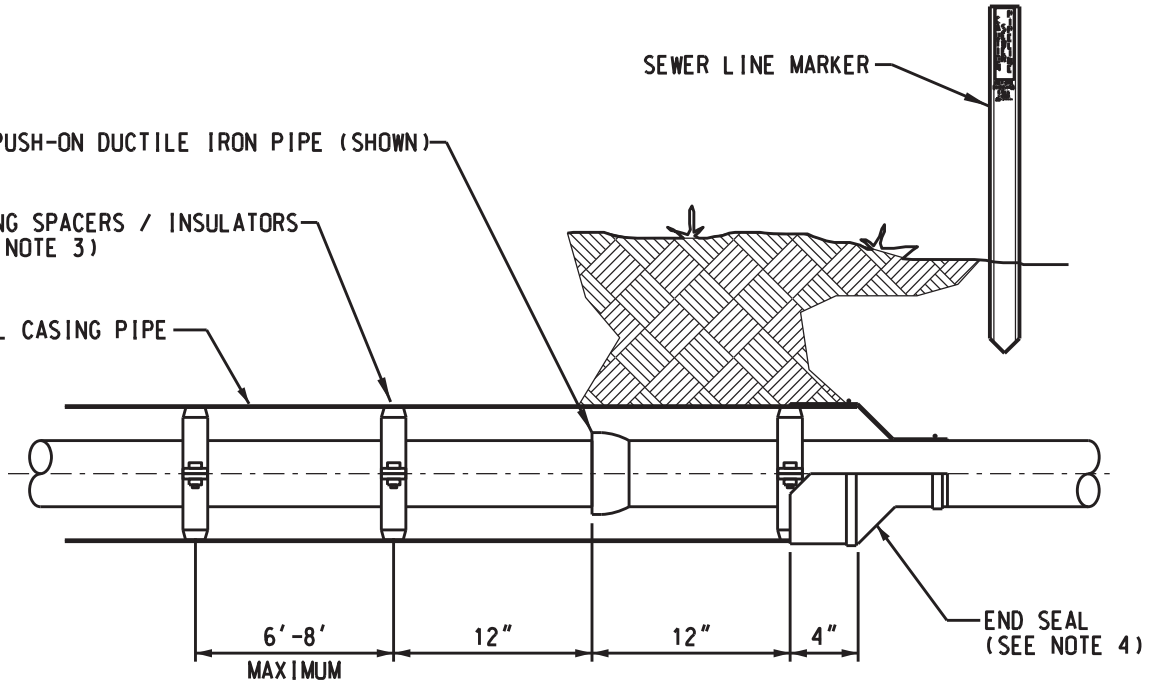
1. CAST IRON WATER VALVE BOXES TO BE JOHN BOUCHARD & SONS NO. 8006 OR APPROVED EQUAL.

2. LONG SIDE OF CAST IRON VALVE BOX SHALL RUN PARALLEL TO THE MAIN IT IS CONTROLLING.

3. PLUG VALVE TO BE HENRY PRATT BALLCENTRIC FIGURE 610 OR APPROVED EQUAL.

4. METALIC TAPE SHALL BE IMPRINTED WITH THE WORD "SEWER" AND SHALL BE BURIED 12" BELOW SUBGRADE.

TYPICAL PLUG VALVE SETTING DETAIL



SECTION VIEW

NOTES:

1. ALL STEEL CASING PIPE SHALL BE ASTM A252, GRADE B.

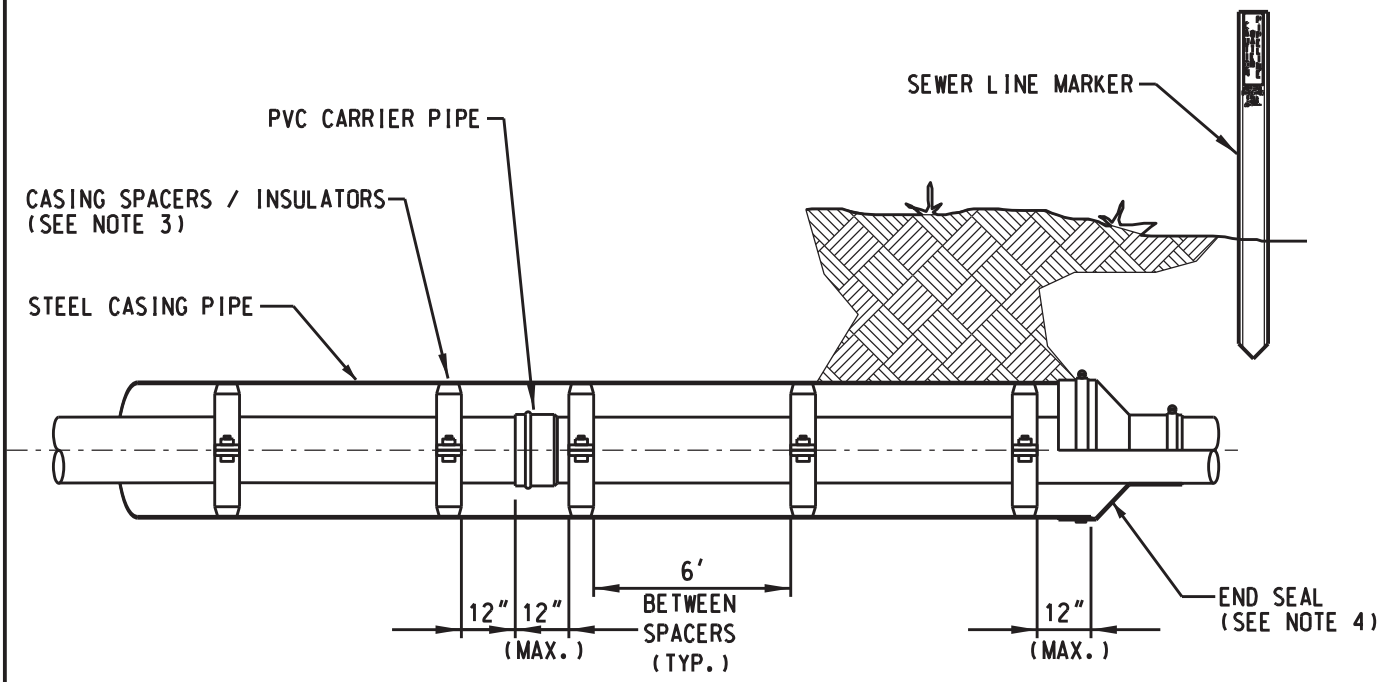
2. ALL CASING PIPE LOCATIONS AND THEIR ALIGNMENTS SHALL BE IDENTIFIED WITH SEWER LINE MARKERS. TWO MARKERS SHALL BE INSTALLED WITH EACH CASING PIPE-ONE AT EACH END. THE MARKERS SHALL BE INSTALLED IN-LINE WITH THE CASING PIPE IN UNOBSTRUCTIVE AND UNINTRUSIVE LOCATIONS.

3. STAINLESS STEEL SPACERS / INSULATORS SHALL BE INSTALLED WITH DUCTILE IRON CARRIER PIPE. POLYETHYLENE SPACER / INSULATOR SHALL BE INSTALL WITH PVC CARRIERS PIPE. SPACER / INSULATORS SHALL BE ADVANCE PRODUCTS & SYSTEMS, INC.

4. PULL-ON END SEALS SHALL BE INSTALLED AT EACH END OF EACH STEEL CASING PIPE. END SEALS SHALL BE ADVANCE PRODUCTS & SYSTEMS MODEL AC OR APPROVED EQUAL.

5. CARRIER PIPE INSIDE THE CASING PIPE SHALL BE INSTALLED WITH RESTRAINING GASKETS OR BELL RESTRAINT HARNESS.

CASING PIPE W/ DIP CARRIER PIPE DETAIL



SECTION VIEW

NOTES:

1. ALL STEEL CASING PIPE SHALL BE ASTM A139, GRADE B.

2. ALL CASING PIPE LOCATIONS AND THEIR ALIGNMENTS SHALL BE IDENTIFIED WITH SEWER LINE MARKERS. TWO MARKERS SHALL BE INSTALLED WITH EACH CASING PIPE-ONE AT EACH END. THE MARKERS SHALL BE INSTALLED IN-LINE WITH THE CASING PIPE IN UNOBSTRUCTIVE AND UNINTRUSIVE LOCATIONS.

3. POLYETHYLENE SPACER / INSULATORS SHALL BE INSTALL WITH PVC CARRIERS PIPE. SPACER / INSULATORS SHALL BE ADVANCE PRODUCTS & SYSTEMS, INC.

4. PULL-ON END SEALS SHALL BE INSTALLED AT EACH END OF EACH STEEL CASING PIPE. END SEALS SHALL BE ADVANCE PRODUCTS & SYSTEMS MODEL AC OR APPROVED EQUAL.

5. CARRIER PIPE JOINTS INSIDE THE CASING PIPE SHALL BE INSTALLED WITH RESTRAINING GASKETS OR BELL RETRAINT HARNESS.

CASING PIPE W/ PVC CARRIER PIPE DETAIL

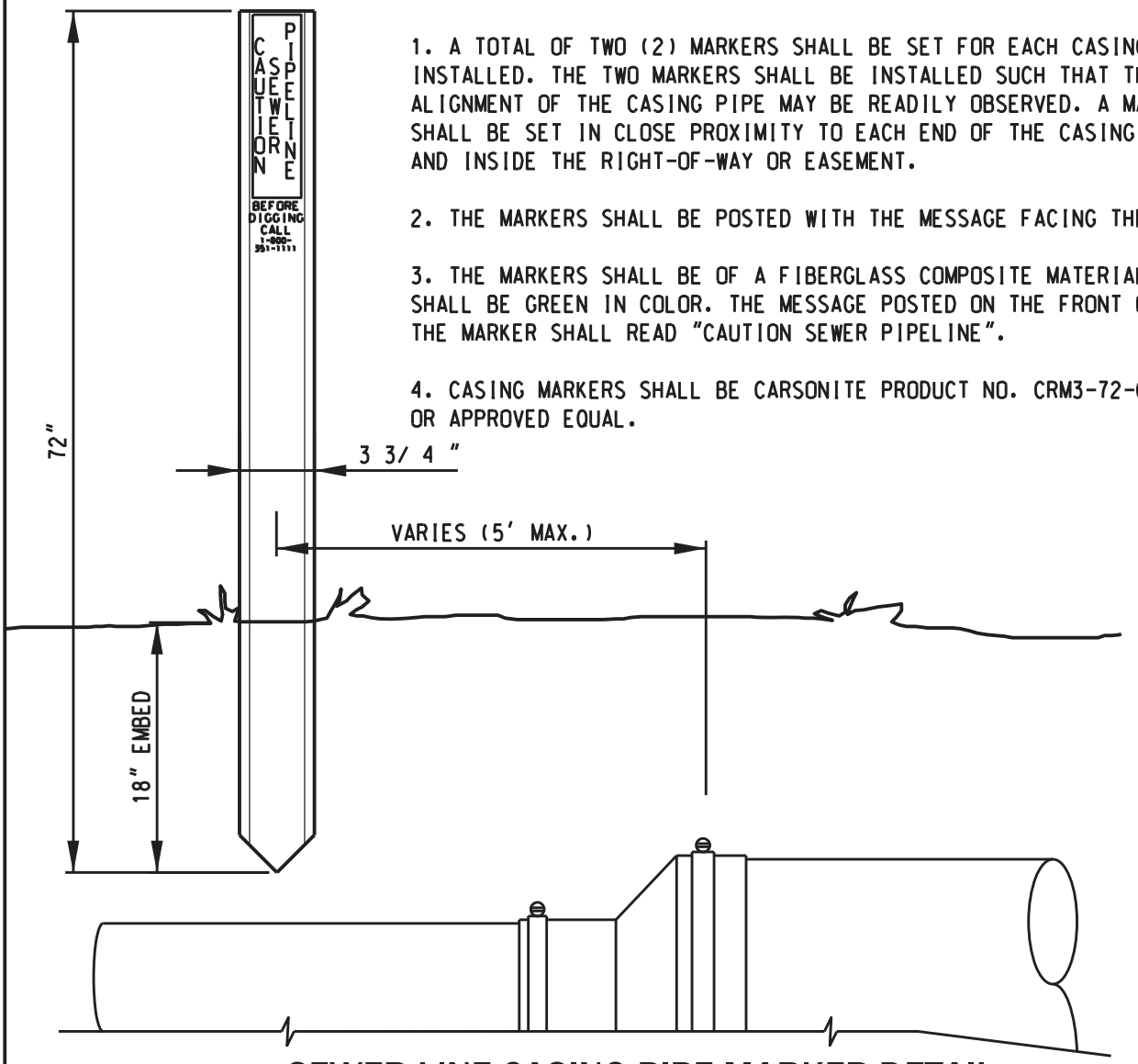
NOTES:

1. A TOTAL OF TWO (2) MARKERS SHALL BE SET FOR EACH CASING PIPE INSTALLED. THE TWO MARKERS SHALL BE INSTALLED SUCH THAT THE ALIGNMENT OF THE CASING PIPE MAY BE READILY OBSERVED. A MARKER SHALL BE SET IN CLOSE PROXIMITY TO EACH END OF THE CASING PIPE AND INSIDE THE RIGHT-OF-WAY OR EASEMENT.

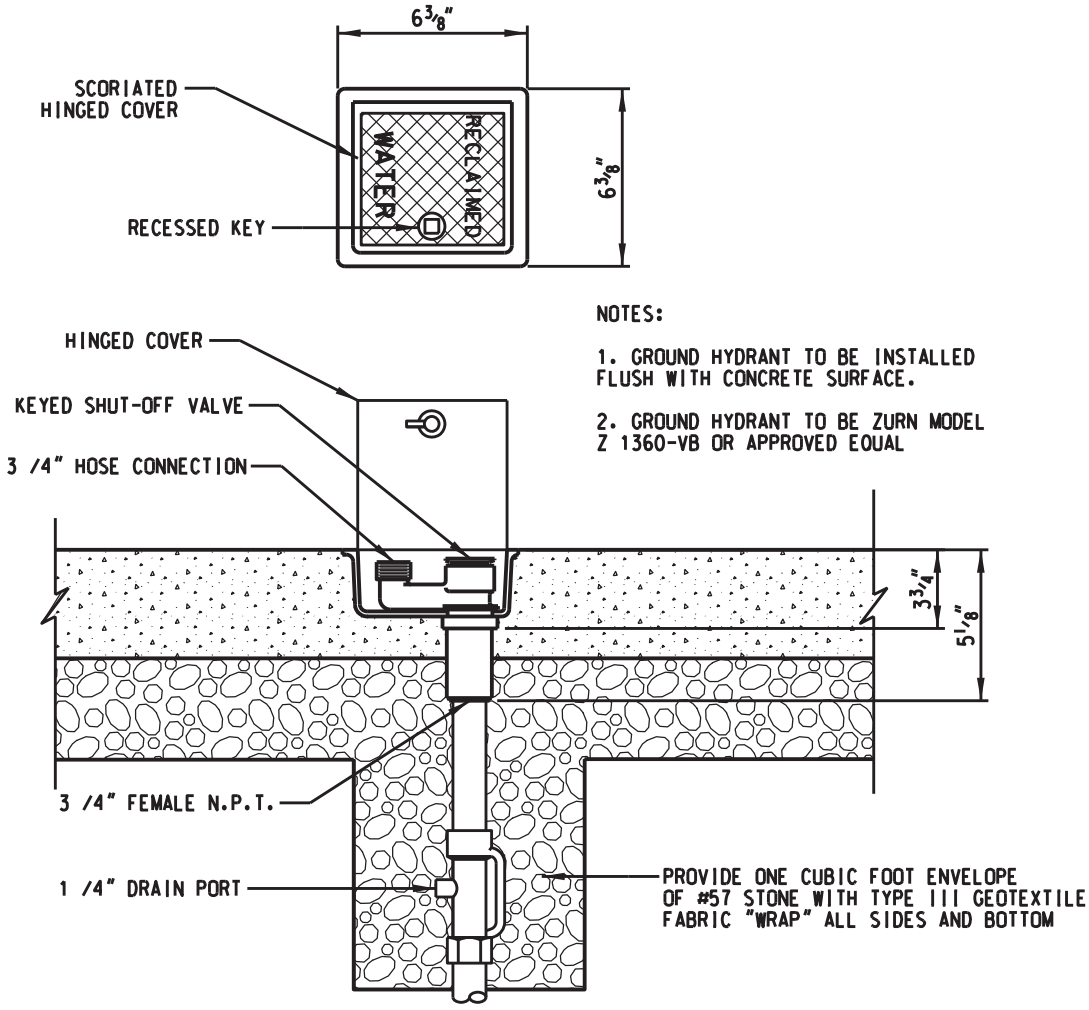
2. THE MARKERS SHALL BE POSTED WITH THE MESSAGE FACING THE ROAD.

3. THE MARKERS SHALL BE OF A FIBERGLASS COMPOSITE MATERIAL AND SHALL BE GREEN IN COLOR. THE MESSAGE POSTED ON THE FRONT OF THE MARKER SHALL READ "CAUTION SEWER PIPELINE".

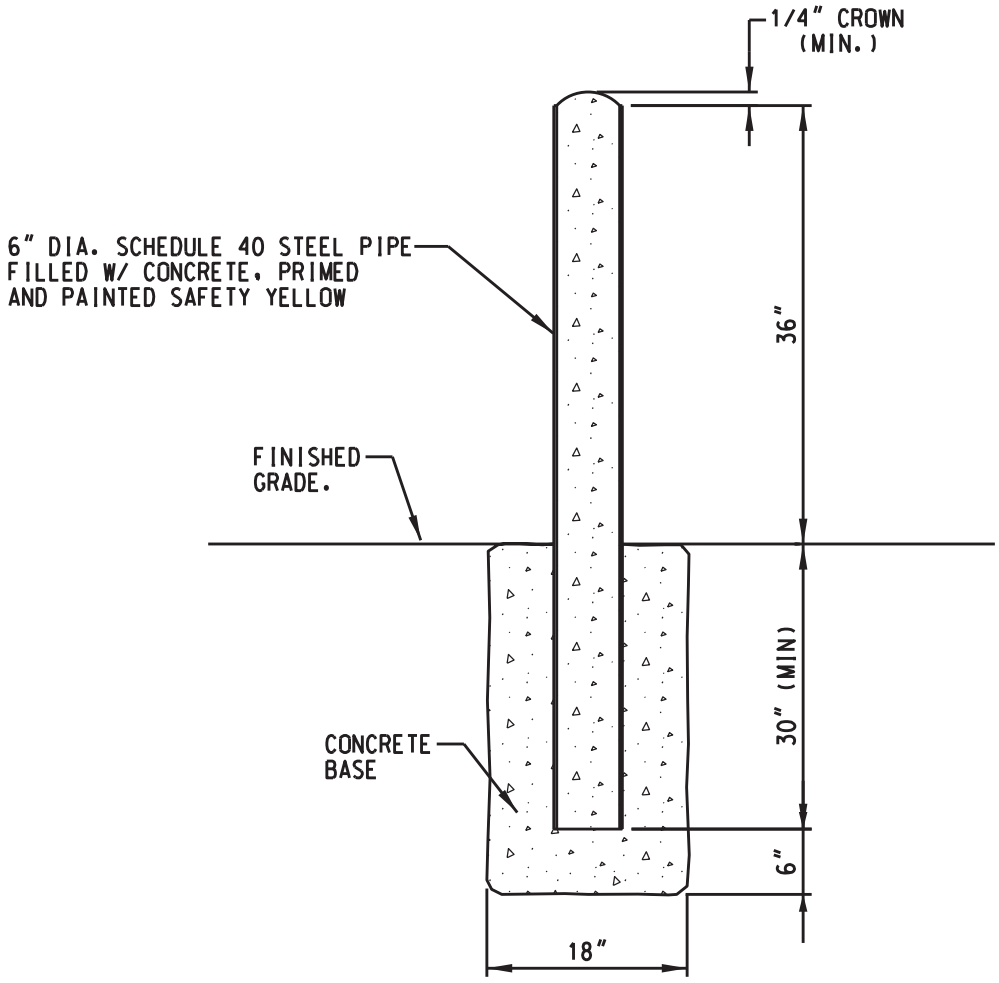
4. CASING MARKERS SHALL BE CARSONITE PRODUCT NO. CRM3-72-07 OR APPROVED EQUAL.



SEWER LINE CASING PIPE MARKER DETAIL

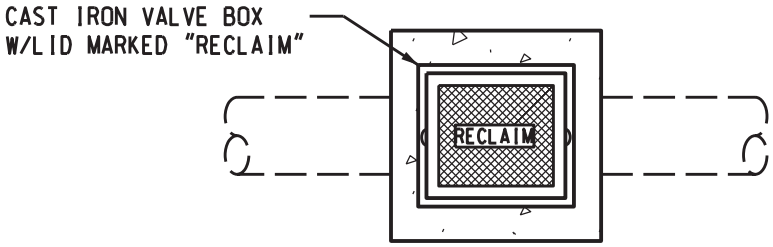


NON-FREEZE GROUND HYDRANT DETAIL

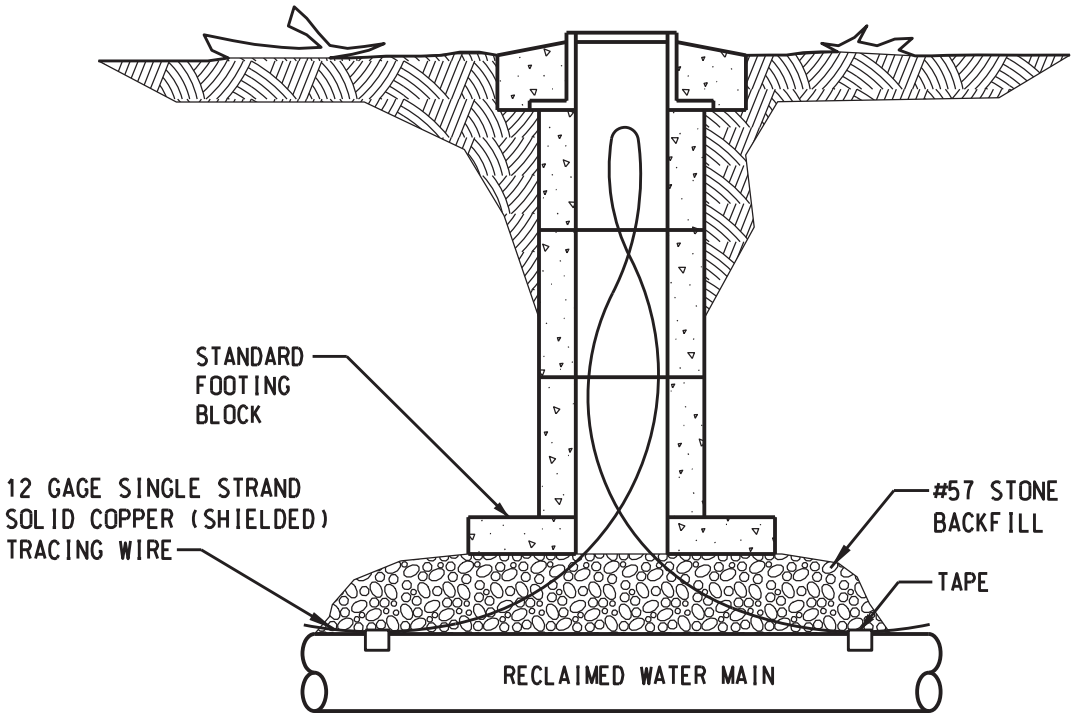


PIPE BOLLARD DETAIL

SD-1.6

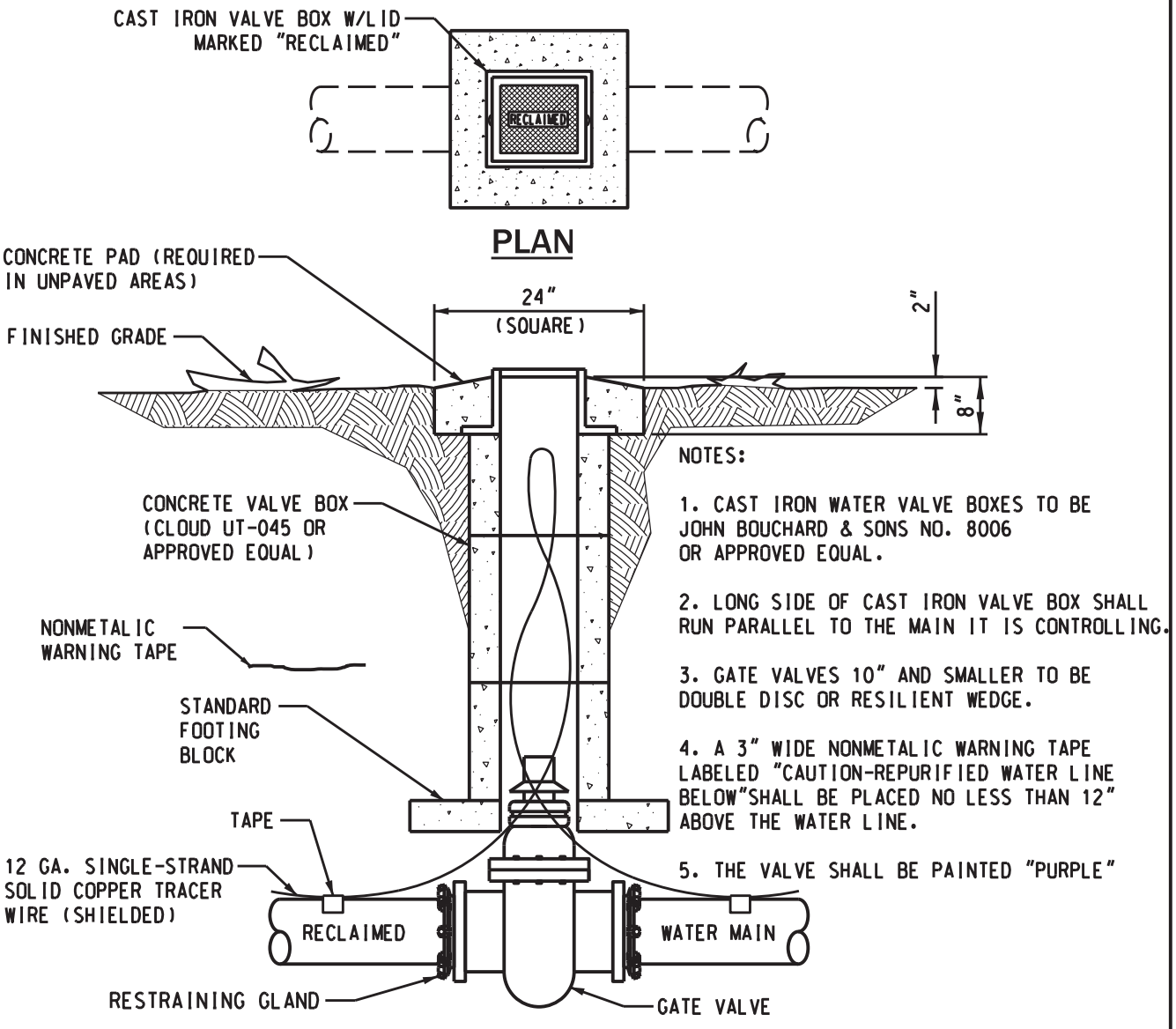


PLAN



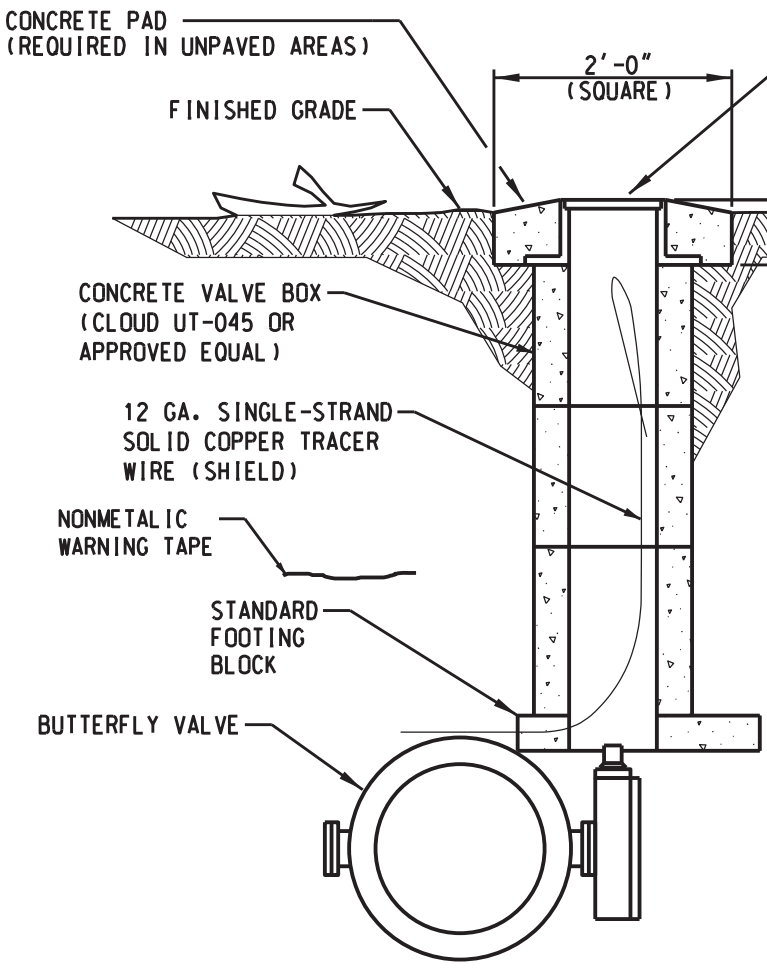
RECLAIMED WATER MAIN

TRACER WIRE DETECTION BOX DETAIL



TYPICAL GATE VALVE ASSEMBLY DETAIL (RECLAIMED WATER)

RW-1.0



NOTES:

1. CAST IRON WATER VALVE BOXES TO BE JOHN BOUCHARD & SONS NO. 8006 OR APPROVED EQUAL.

2. BUTTERFLY VALVE SHALL BE HENRY PRATT "GROUNDHOG" OR APPROVED EQUAL.

3. LONG SIDE OF CAST IRON VALVE BOX SHALL RUN PARALLEL TO THE MAIN IT IS CONTROLLING.

4. METALIC TAPE SHALL BE IMPRINTED WITH THE WORD "WATER" AND SHALL BE BURIED 12" BELOW SUBGRADE.

5. A 3" WIDE NONMETALIC WARNING TAPE LABELED "CAUTION-REPURIFIED WATER LINE BELOW" SHALL BE PLACED NO LESS THAN 12" ABOVE THE WATER LINE.

6. THE VALVE SHALL BE PAINTED "PURPLE"

BUTTERFLY VALVE ASSEMBLY DETAIL (RECLAIMED WATER)

NOTES:

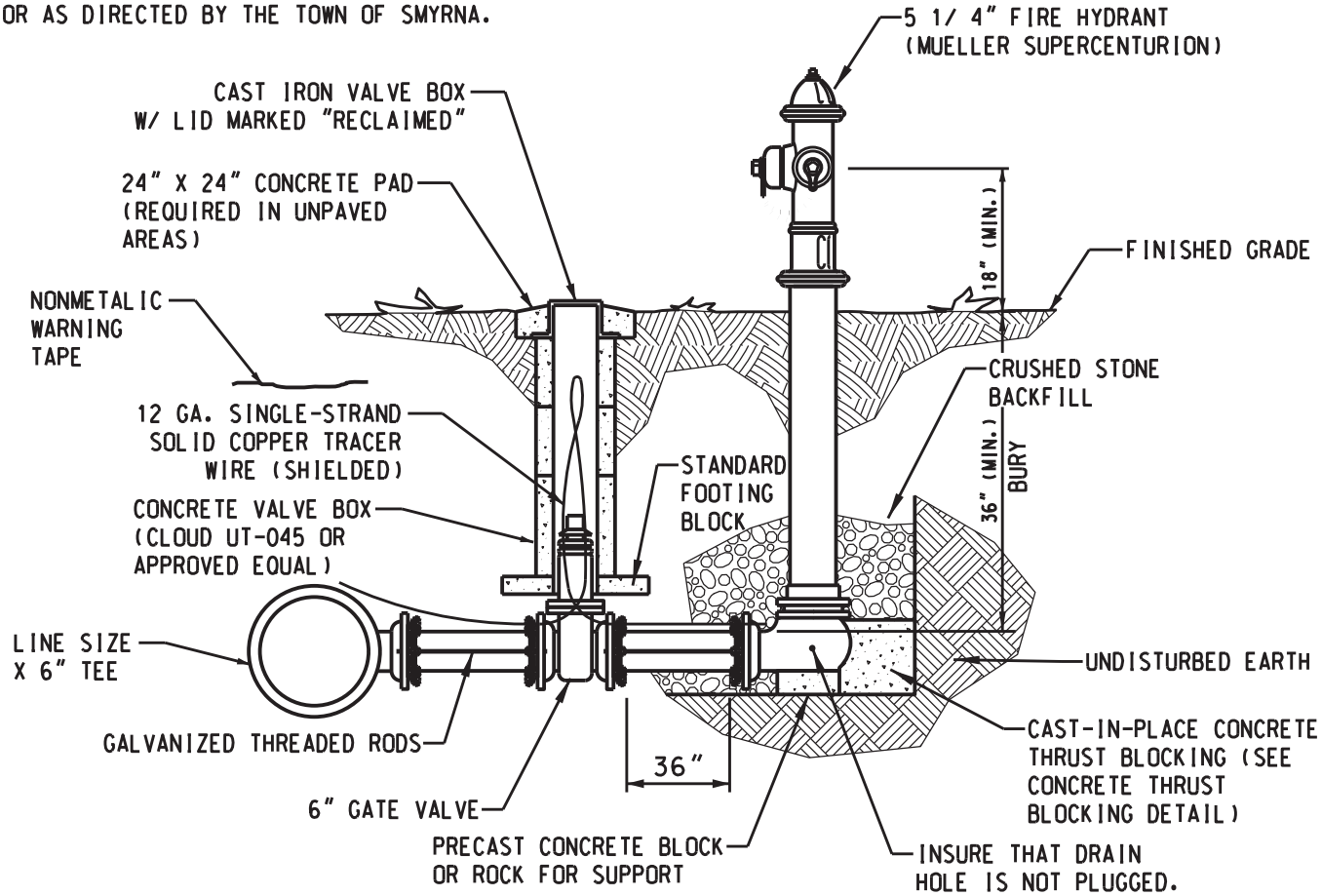
1. OPERATING NUT, OPENING DIRECTION, NOZZLE CAP NUTS, THREAD AND CONNECTIONS SHALL CONFORM TO TOWN OF SMYRNA STANDARDS.

2. CAST IRON WATER VALVE BOXES TO BE JOHN BOUCHARD & SONS NO. 8006 OR APPROVED EQUAL

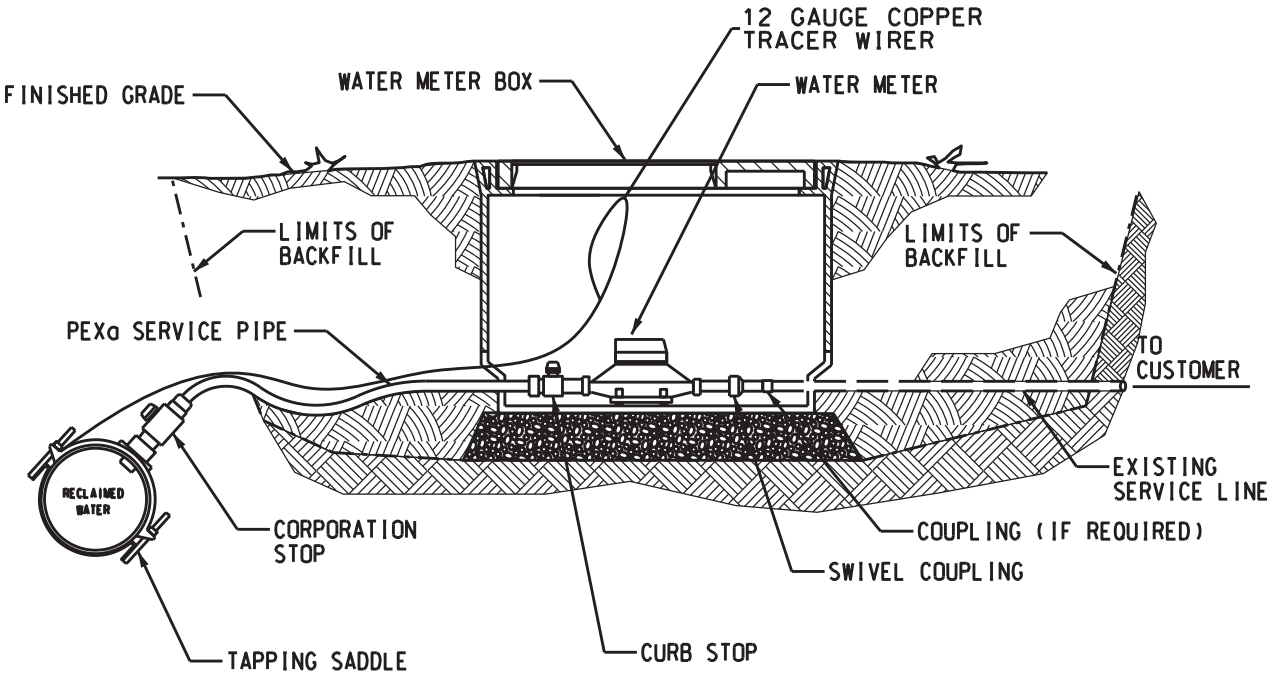
3. THE 5 1/ 4" PUMPER CONNECTION SHALL FACE STREET OR AS DIRECTED BY THE TOWN OF SMYRNA.

4. A 3" WIDE NONMETALIC WARNING TAPE LABELED "CAUTION-REPURIFIED WATER LINE BELOW" SHALL BE PLACED NO LESS THAN 12" ABOVE THE WATER LINE.

5. THE VALVE AND HYDRANT SHALL BE PAINTED "PURPLE"



FIRE HYDRANT ASSEMBLY DETAIL (RECLAIMED WATER)



NOTES:

1. FINAL GRADE SHALL SLOPE AWAY FROM THE TOP OF THE METER BOX IN ORDER TO SHED WATER.

2. THE GROUND SHALL BE EXCAVATED NO LESS THAN TWO FEET BEYOND THE METER BOX ON ALL SIDES AND TO THE FULL DEPTH OF THE METER BOX AND BASE STONE. BACKFILL MATERIAL SHALL BE ROCK-FREE SOIL.

3. METER BOX SHALL BE SIGMA RMB-132418-SW.

4. METER BOX LIDS SHALL BE SIGMA RMB-1324-L-RT.

5. "RECLAIMED WATER" SHALL BE IMPRINTED ON THE LID OF THE METER BOX.

6. 12 GAUGE COPPER TRACER WIRE SHALL BE TAPED TO THE RECLAIMED WATER SERVICE LINE. THE CONNECTION BETWEEN THE RECLAIMED WATER MAIN WIRE AND RECLAIMED WATER SERVICE SHALL BE CONNECTED WITH A WATER TIGHT WIRE NUT FASTENERS (EXAMMPLE; DRYCONN) AND WRAPPED. THE ENDS OF WIRE SHALL TERMINATE FROM THE MAIN TO THE METER. THE WIRE SHALL HAVE A MINIMUM OF 24" INSIDE THE METER BOX. THE WIRE SHALL BE THE COLOR PURPLE.

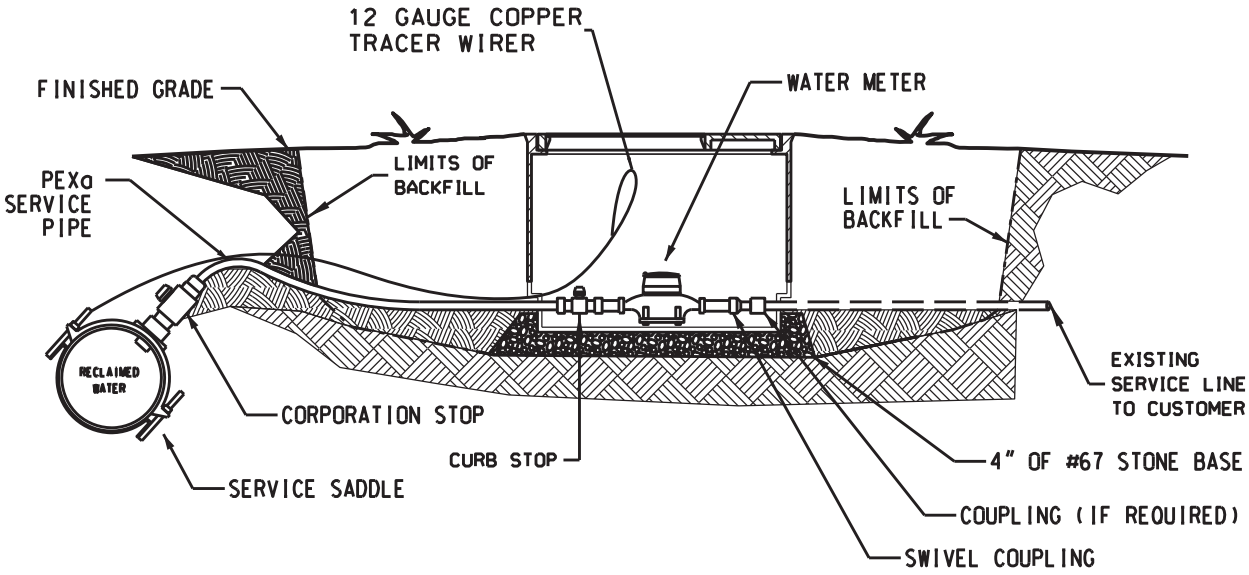
7. ALL RECLAIMED WATER SERVICE LINES SHALL BE BACKFILLED WITH QUARTER DOWN (DUST) WITH 6" ON BOTTOM AND SIDES AND 12" ON TOP. THIS SHALL BE DONE FROM THE MAIN TO THE METER.

3/4" SERVICE ASSEMBLY DETAIL (1 OF 2)

3/4" WATER METER

ITEM	MANUFACTURER	MODEL / PART NO.	COMMENTS
TAPPING SADDLE - ¾" FOR C900	SMITH - BLAIR	315-00090507-00	SS STRAP
CORPORATION STOP - ¾" TAPER X ¾" CTS	FORD METER	FB1000-3-Q-NL	-
CURB STOP - ¾" W/ 360° LOCKING WINGNUT	MUELLER	B43-232-W-R-Q-NL	-
METER - ¾" W/ ITRON CONNECTOR	BADGER	M25	-
SWIVEL COUPLING ⅝" X ¾" X ¾" X 2.5" LONG	FORD METER	C38-23-2.25-NL	-
WASHER, ¾" X ⅛" BLACK RUBBER	ANY	-	-
PIPE- ¾" PEX SERVICE PIPE	ANY	-	SDR 9
METER BOX	SIGMA	RMB-132418-SW	-
LID: READ DOOR & RECESS TOUCH READ HOLE	SIGMA	RMB-1324-L-RT	-

3/4" SERVICE ASSEMBLY DETAIL (2 OF 2)



SECTION

NOTES:

1. THE WATER METER BOX INSTALLATION FOR BOTH THE 1" METERS SHALL UTILIZE ONE METER BOX TO ACHIEVE A 18" DEPTH. FINAL GRADE SHALL SLOPE AWAY FROM THE TOP OF THE METER BOX IN ORDER TO SHED WATER.

2. THE GROUND SHALL BE EXCAVATED NO LESS THAN TWO FEET BEYOND THE METER BOX ON ALL SIDES AND TO THE FULL DEPTH OF THE METER BOX AND BASE STONE. BACKFILL MATERIAL SHALL BE ROCK-FREE SOIL.

3. METER BOXES SHALL BE: SIGMA RMB-173018-SW

4. METER BOX LID SHALL BE: SIGMA RMB-1730-L-RT

5. "RECLAIMED WATER" SHALL BE IMPRINTED ON THE LID OF THE METER BOX.

6. 12 GAUGE COPPER TRACER WIRE SHALL BE TAPED TO THE RECLAIMED WATER SERVICE LINE. THE CONNECTION BETWEEN THE RECLAIMED WATER MAIN WIRE AND RECLAIMED WATER SERVICE SHALL BE CONNECTED WITH A WATER TIGHT WIRE NUT FASTENERS (EXAMMPLE: DRYCONN) AND WRAPPED. THE ENDS OF WIRE SHALL TERMINATE FROM THE MAIN TO THE METER. THE WIRE SHALL HAVE A MINIMUM OF 24" INSIDE THE METER BOX. THE WIRE SHALL BE THE COLOR PURPLE.

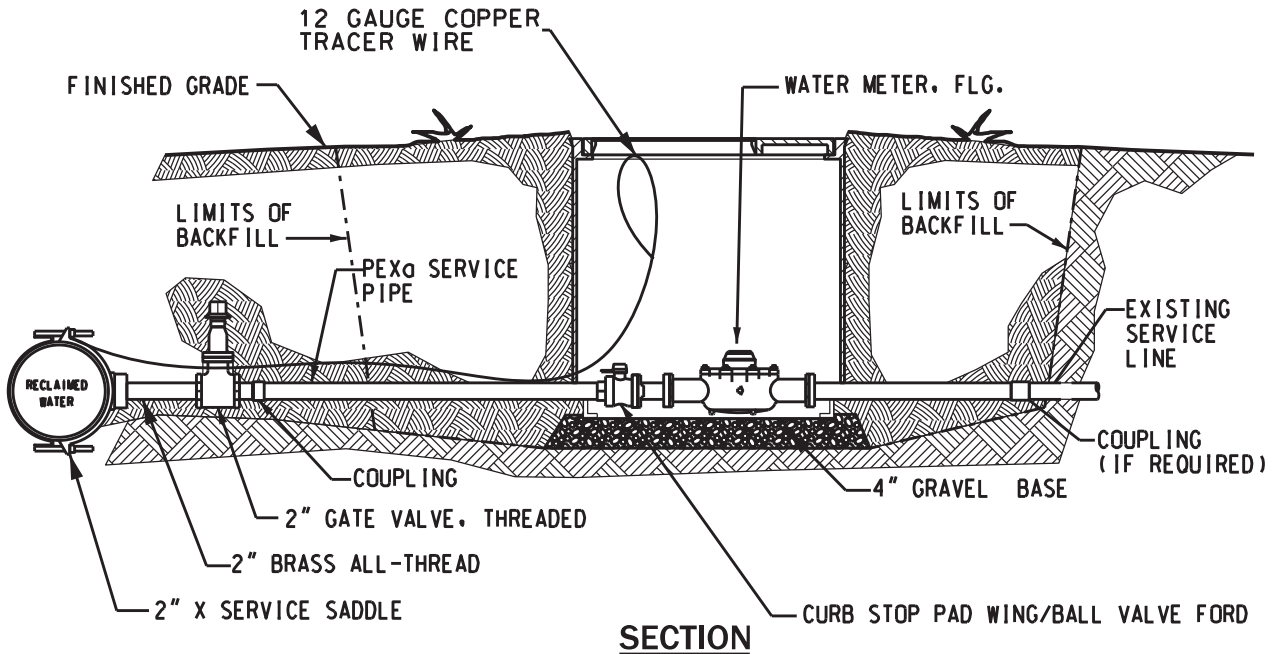
7. ALL RECLAIMED WATER SERVICE LINES SHALL BE BACKFILLED WITH QUARTER DOWN (DUST) WITH 6" ON BOTTOM AND SIDES AND 12" ON TOP. THIS SHALL BE DONE FROM THE MAIN TO THE METER.

1" WATER METER ASSEMBLY DETAIL (1 OF 2)

1" WATER METER

ITEM	MANUFACTURER	MODEL / PART NO.	COMMENTS
TAPPING SADDLE - 1" FOR C900	SMITH - BLAIR	315-00101009-000	DOUBLE STRAP
CORPORATION STOP - 1" TAPER CC X 1" CTS	FORD METER	FB1000-4-0-NL	-
CURB STOP - 1" W/ 360° LOCKING WINGNUT	MEULLER	B43-344WR-0-NL	-
METER - 1" W/ITRON CONNECTOR	BADGER	M70	-
SWIVEL COUPLING - 1" STRAIGHT	FORD METER	C38-44-2-625-NL	-
WASHER - 1" X 1/8" BLACK RUBBER	ANY	-	-
PIPE- 1" PEX∅ SERVICE PIPE	ANY	-	SDR 9
METER BOX	SIGMA	RMB-173018-SW	-
LID: READER DOOR & RECESS TOUCH READ HOLE	SIGMA	RMB-1730-L-RT	-

1" WATER METER ASSEMBLY DETAIL (2 OF 2)



SECTION

NOTES:

1. THE WATER METER BOX INSTALLATION FOR BOTH THE 1 1/ 2" AND 2" METERS SHALL UTILIZE ONE METER BOX TO ACHIEVE A 18" DEPTH. FINAL GRADE SHALL SLOPE AWAY FROM THE TOP OF THE METER BOX IN ORDER TO SHED WATER.

2. THE GROUND SHALL BE EXCAVATED NO LESS THAN TWO FEET BEYOND THE METER BOX ON ALL SIDES AND TO THE FULL DEPTH OF THE METER BOX AND BASE STONE. BACKFILL MATERIAL SHALL BE ROCK-FREE SOIL.

3. METER BOXES SHALL BE: SIGMA RMB-173018-SW

4. METER BOX LID SHALL BE: SIGMA RMB-1730-L-RT

5. "RECLAIMED WATER" SHALL BE IMPRINTED ON LID OF THE METER BOX.

6. 12 GAUGE COPPER TRACER WIRE SHALL BE TAPED TO THE RECLAIMED WATER SERVICE LINE. THE CONNECTION BETWEEN THE RECLAIMED WATER MAIN WIRE AND RECLAIMED WATER SERVICE SHALL BE CONNECTED WITH A WATER TIGHT WIRE NUT FASTENERS (EXAMMPLE: DRYCONN) AND WRAPPED. THE ENDS OF WIRE SHALL TERMINATE FROM THE MAIN TO THE METER. THE WIRE SHALL HAVE A MINIMUM OF 24" INSIDE THE METER BOX. THE WIRE SHALL BE THE COLOR PURPLE.

7. ALL RECLAIMED WATER SERVICE LINES SHALL BE BACKFILLED WITH QUARTER DOWN (DUST) WITH 6" ON BOTTOM AND SIDES AND 12" ON TOP. THIS SHALL BE DONE FROM THE MAIN TO THE METER.

1 - 1/2" AND 2" WATER METER ASSEMBLY DETAIL (1 OF 2)

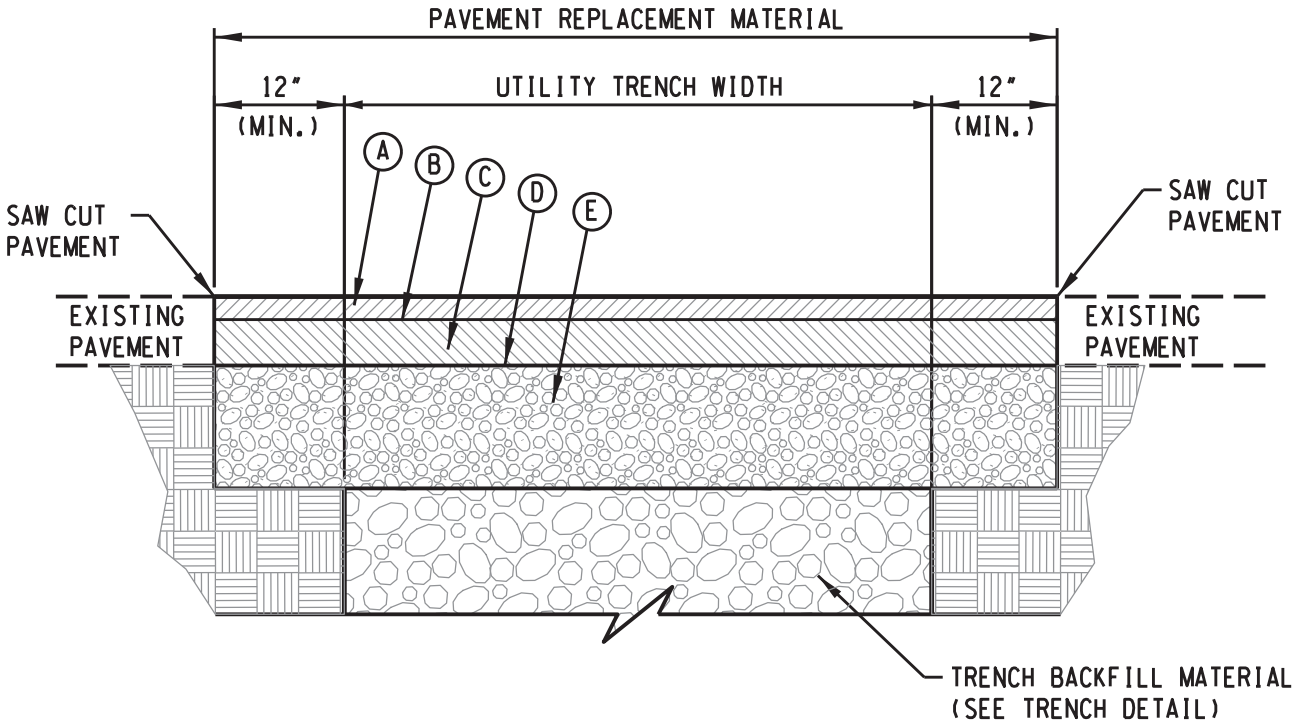
1 1/2" WATER METER

ITEM	MANUFACTURER	MODEL / PART NO.	COMMENTS
TAPPING SADDLE-2" FOR C900	SMITH-BLAIR	315-00090514-000	SS STRAP
BRASS-2" ALL-THREAD	MATCO - NORCA	NBR08CL	NO-LEAD BRASS
GATE VALVE-2"	KENNEDY VALVE	228D2X	THREADED W/ 2" NUT
COUPLING-2" SOLDER TO MALE	ANY	-	ASTM B16
CURB STOP-2" CTS X 1½"	FORD METER	BF13-777W-NL	W/ 2" FLANGE
METER W/ ITRON CONNECTOR	BADGER	M120	FLANGED
METER BRASS FLANGE PAK - 1½"	ANY	-	NO-LEAD BRASS
COUPLING - 2" SOLDER	ANY	-	ASTM B16
COUPLING - 2"- 45° SOLDER	ANY	-	ASTM B16
COUPLING - 2" - 90°, SOLDER	ANY	-	ASTM B16
PIPE-PEXa SERVICE PIPE	ANY	2K60	SDR 9
METER BOX	SIGMA	RMB-173018-SW	-
LID: READER DOOR & RECESS TOUCH READ HOLE	SIGMA	RMB-1730-L-RT	-

2" WATER METER

ITEM	MANUFACTURER	MODEL / PART NO.	COMMENTS
TAPPING SADDLE - 2" FOR C900	SMITH-BLAIR	315-00090514-00	DOUBLE STRAP
BRASS - 2" ALL-THREAD	MATCO - NORCA	NBR08CL	NO-LEAD BRASS
GATE VALVE - 2"	KENNEDY VALVE	228D2X	THREADED W/ 2" NUT
COUPLING-2" SOLDER TO MALE	ANY	-	ASTM B16
CURB STOP - 2" CTS X 1½"	FORD METER	BF13-777W-O-NL	W/ 2" FLANGE
METER W/ ITRON CONNECTOR	BADGER	M170	FLANGED
METER BRASS FLANGE PAK - 2"	ANY	-	NO-LEAD BRASS
COUPLING - 2" SOLDER	ANY	-	ASTM B16
COUPLING - 2" - 45° SOLDER	ANY	-	ASTM B16
COUPLING - 2" - 90° SOLDER	ANY	-	ASTM B16
PIPE-PEXa SERVICE PIPE	ANY	-	SDR 9
METER BOX	SIGMA	RMB-173018-SW	-
LID: READER DOOR & RECESS TOUCH READ HOLE	SIGMA	RMB-1730-L-RT	-

1 - 1/2" AND 2" WATER METER ASSEMBLY DETAIL (2 OF 2)



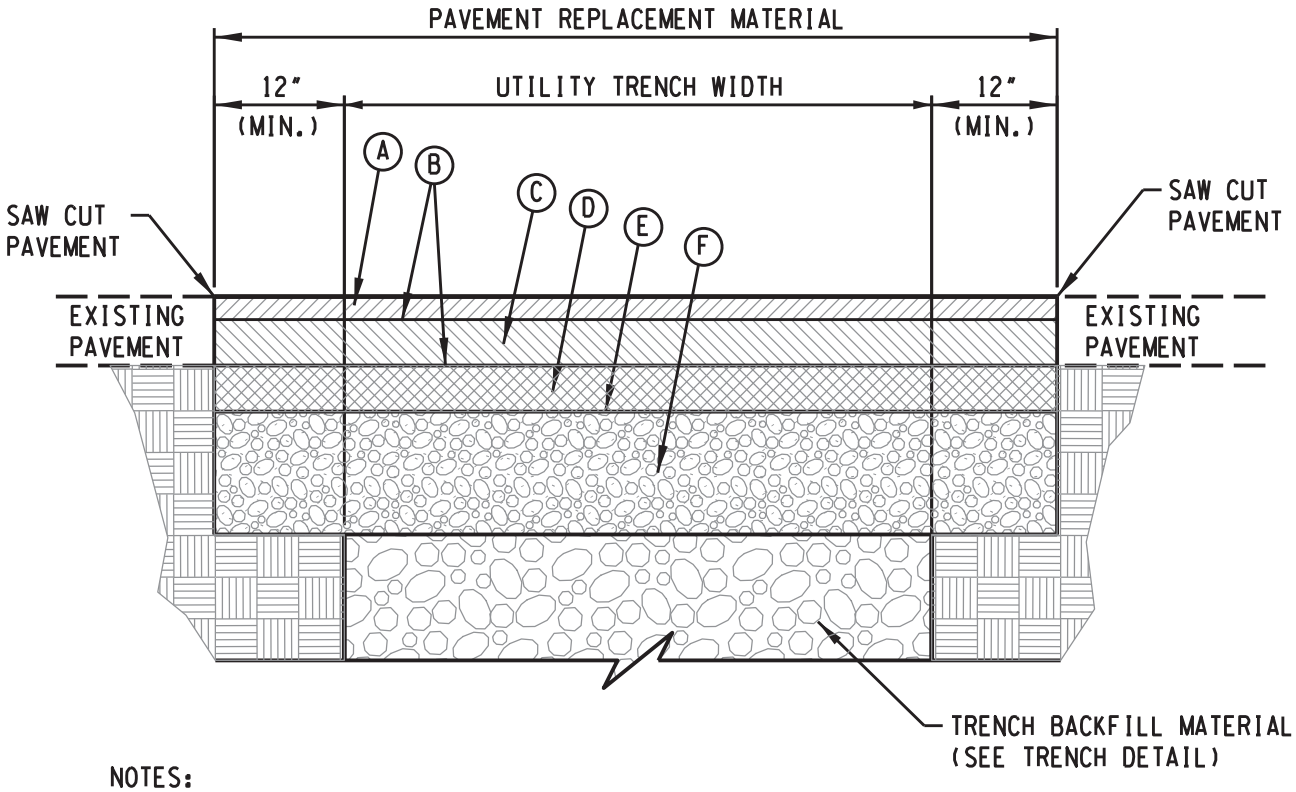
NOTES:

1. THIS DETAIL APPLIES TO ALL TOWN STREETS DESIGNATED AS RESIDENTIAL MINOR, RESIDENTIAL COLLECTOR, NON-RESIDENTIAL MINOR AND NON-RESIDENTIAL COLLECTOR.

2. PAVEMENT SCHEDULE:

A 1 1/ 2" THICK (APPROX. 165 LBS./S.Y.) ASPHALTIC CONCRETE SURFACE (307-CW).
B. BITUMINOUS MATERIAL FOR TACK COAT (403-01) @ 0.10 GAL./S.Y.
C. 3" THICK (APPROX. 339 LBS./S.Y) ASPHALTIC CONCRETE BASE (307-B MODIFIED).
D. BITUMINOUS MATERIAL FOR PRIME COAT (402-01) @ 0.30 GAL./S.Y.
E. 8" THICK 303-01 MINERAL AGGREGATE TYPE "A", GRADING "D" COMPACTED TO 97% STANDARD PROCTOR DENSITY.

PAVEMENT REPLACEMENT DETAIL (TOWN STREETS)



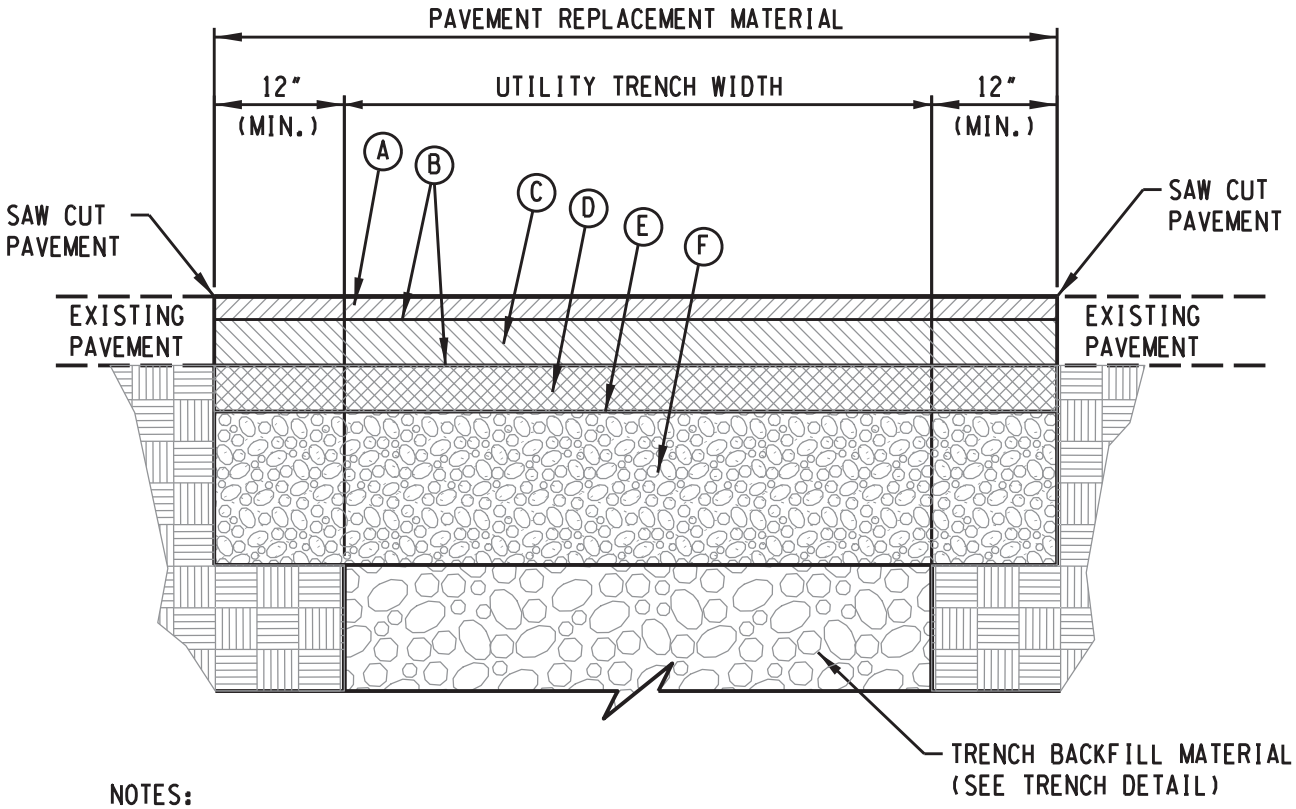
NOTES:

1. THIS DETAIL APPLIES TO ALL TOWN STREETS DESIGNATED AS RESIDENTIAL ARTERIAL.

2. PAVEMENT SCHEDULE:

A 1 1/ 2" THICK (APPROX. 165 LBS./S.Y.) ASPHALTIC CONCRETE SURFACE (307-CW).
B. BITUMINOUS MATERIAL FOR TACK COAT (403-01) @ 0.10 GAL./S.Y.
C. 3" THICK (APPROX. 339 LBS./S.Y) ASPHALTIC CONCRETE BASE (307-B MODIFIED).
B. BITUMINOUS MATERIAL FOR TACK COAT (403-01) @ 0.10 GAL./S.Y.
D. 3" THICK (APPROX. 345 LBS./S.Y) ASPHALTIC CONCRETE BASE (307-A MIX).
E. BITUMINOUS MATERIAL FOR PRIME COAT (402-01) @ 0.30 GAL./S.Y.
F. 8" THICK 303-01 MINERAL AGGREGATE TYPE "A", GRADING "D" COMPACTED TO 97% STANDARD PROCTOR DENSITY.

PAVEMENT REPLACEMENT DETAIL (RESIDENTIAL ARTERIAL)



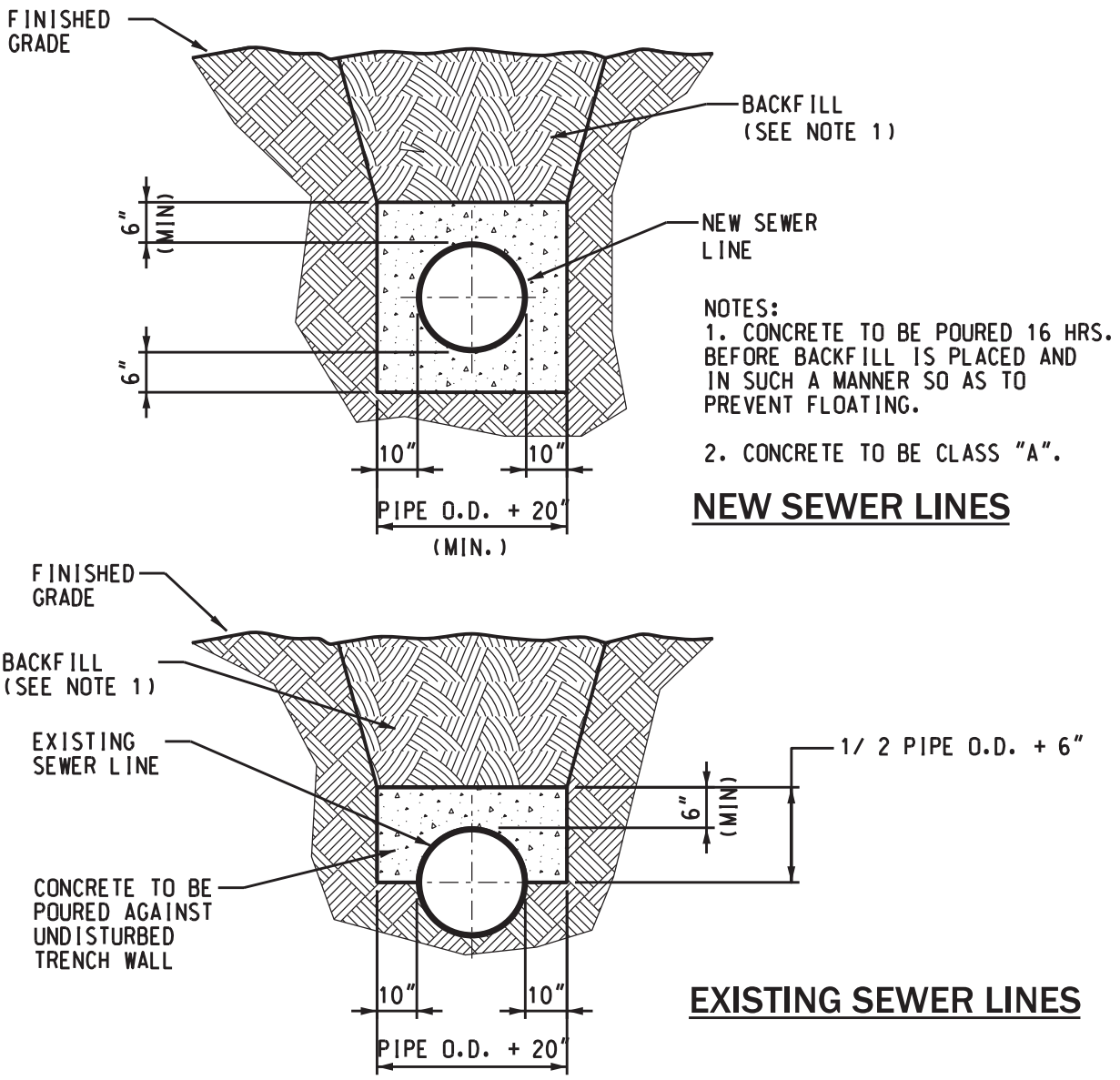
NOTES:

1. THIS DETAIL APPLIES TO ALL TOWN STREETS DESIGNATED AS NON-RESIDENTIAL ARTERIAL.

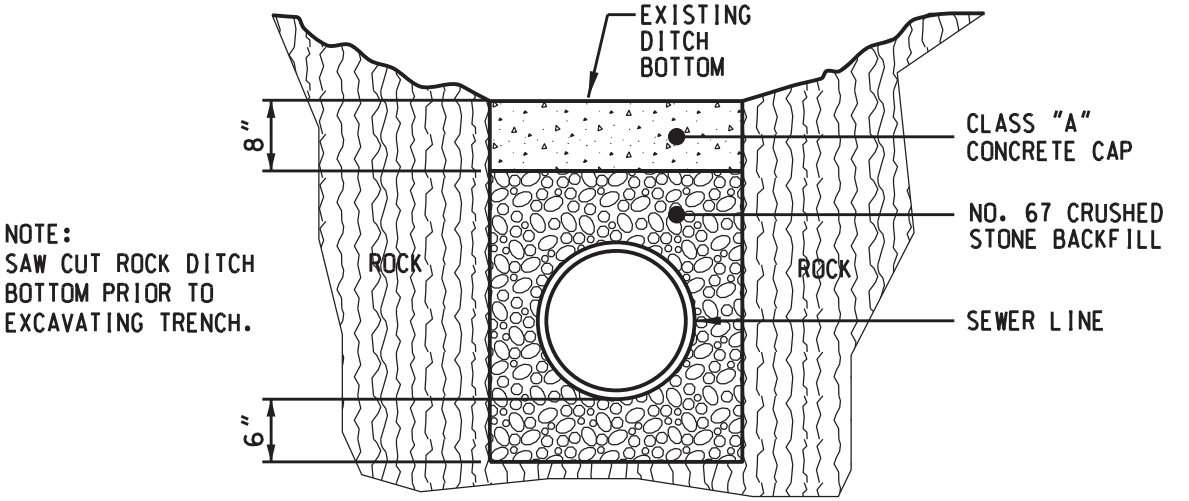
2. PAVEMENT SCHEDULE:

A 1 1/ 2" THICK (APPROX. 165 LBS./S.Y.) ASPHALTIC CONCRETE SURFACE (307-CW).
B. BITUMINOUS MATERIAL FOR TACK COAT (403-01) @ 0.10 GAL./S.Y.
C. 3" THICK (APPROX. 339 LBS./S.Y) ASPHALTIC CONCRETE BASE (307-B MODIFIED).
B. BITUMINOUS MATERIAL FOR TACK COAT (403-01) @ 0.10 GAL./S.Y.
D. 3" THICK (APPROX. 345 LBS./S.Y) ASPHALTIC CONCRETE BASE (307-A MIX).
E. BITUMINOUS MATERIAL FOR PRIME COAT (402-01) @ 0.30 GAL./S.Y.
F. 10" THICK 303-01 MINERAL AGGREGATE TYPE "A", GRADING "D" COMPACTED TO 97% STANDARD PROCTOR DENSITY.

PAVEMENT REPLACEMENT DETAIL (NON-RESIDENTIAL ARTERIAL)

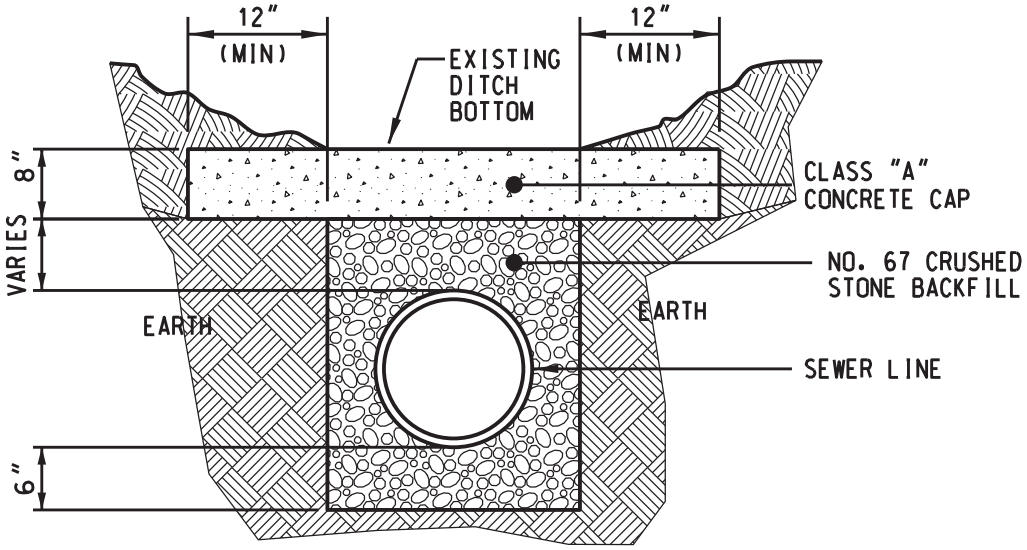


CONCRETE ENCASEMENT FOR SEWER LINES



NOTE:
SAW CUT ROCK DITCH BOTTOM PRIOR TO EXCAVATING TRENCH.

ROCK EXCAVATION



EARTH EXCAVATION

CONCRETE CAP DETAIL

PRE-CONSTRUCTION MEETING CHECKLIST

Development:_____
Location:_____
Contractor:_____

____ 1. Water and Sewer Specification books are available to view or download at www.townofsmyrna.org. Under the departments tab, click on Utilities. For subdivision, click on Planning & Zoning.

____ 2. Contractor must have state approved plans for water and sewer on the job site at all times. The operation hours for all construction projects shall be Monday through Friday from 7am to 6pm, Saturdays from 8am to 6pm, and no work shall be done on Sundays.

____ 3. The Contractor shall provide proof of contacting property owners around their site on about the pending construction (an email confirmation to Smyrna staff is acceptable).

____ 4. Square Valve boxes only are permitted, instead of round.

____ 5. The Town of Smyrna uses MJ tapping sleeves only (Mueller H-615 or approved equal). All tapping sleeves shall be hydrostatically tested at 200 psi for two (2) hours.

____ 6. Fire hydrants shall be Mueller Super Centurion 250 or M&H Valve Model 129.

____ 7. Fireline backflows shall be a Wilkins Regulator Model reduced pressure backflow preventer (or an approved equal) with a $^{3}/_{4}$" Badger water meter bypass with an Itron connection. All backflows are required to be placed outside in a hot box.

____ 8. The sewer cleanout shall be 6" SDR-26 or approved equal. In non-traffic areas, the cleanout shall be in 36H concrete box with a cast iron lid marked "SEWER" for a 36H box or approved equal. In traffic rated areas, a square JBS 8006 casting marked "SEWER" with a minimum 4" square concrete riser is to be installed.

____ 9. For sewer lines, PVC pipe will be SDR-26 for gravity lines and SDR-21 Class 200 for force mains; ductile iron pipes (DIP) will be Class 350 with Protecto 401/Ceramapure PL90 ceramic lining. For water lines, (4"-10") plastic PVC will be minimum AWWA C-900 (DR14) with a minimum pressure class of 200 psi. 12" and above water mains shall be Class 350 ductile iron pipe (DIP).

____10. 12 AWG gauge solid copper tracer wire is to be laid above the water line. Wire must be taped to the top of the water line and inside valve boxes. It is not to be wrapped around water valves in any way. Tracer shall be from the main to the meter (w/ 24" inside the box). 12 AWG gauge solid copper tracer wire is to be taped to the top of the sewer force main with metallic tape.

____11. Contractor will make water taps and verify the outer diameter of the existing main.

____12. Bedding of gravel (crushed stone No. 67) on water and sewer shall be as follows: 6" on bottom and sides and 12" on top. All gravel envelopes for water & sewer main shall have its respective utilities tape laid on top. All water pipes shall have 30" of cover. All water service lines shall have the bedding of quarter down (dust). The water service line envelope shall be as follows: 6" on bottom and sides and 12" on top.

____ 13. Ends of all pipes are to be covered when on the jobsite at the end of day. Stored pipes must be protected from heat and sun. All faded or damaged pipes will not be used for installation.

____ 14. In public roadways, the backfill shall consist entirely of crushed stone No. 67 TDOT approved. If in a new subdivision, revised regulations of Planning & Zoning dated July 2nd 2015 will be permitted.

____ 15. All manholes must have Xypex (C-500 NF Red) admix. Each barrel section is to be wrapped with mastic tape at each joint. No hydraulic cement or mortar shall be used to alter the inside of the manhole in any way. Mortar is only to be used around the sewer pipe when it is placed into the invert of the manhole through the boot.

____ 16. Manholes to be covered with a steel plate or casting with lid when set.

____ 17. Contractor must install check dams upstream of the downstream manhole after the sewer line crosses under the storm drain and/or a drain area.

____ 18. Contractor must call 24 hours minimum in advance to set up time and date with the Inspector for testing water and/or sewer. On all aspects of inspecting sewer and/or water lines, the Contractor must give the Inspector ample notice and time for all inspections (including testing, laying of lines, backfilling, etc.)

____ 19. Casting and Manhole will be vacuum tested as one unit. If the casting has been removed from the concrete manhole in any manner the casting and manhole will be vacuum tested again.

_____ 20. A camera inspection at contractor expense of the sewer mains and laterals must be done. In paved areas, after proof roll test & 30-days of the ground settling have been completed. In non-paved areas, after 30-days of the ground settling have been completed.

____ 21. Smyrna Inspector shall issue a sewer line strainer with serialized ID tag. Contractor shall submit all test plugs for inspection. Each test plug shall be issued a serialized ID tag by Smyrna Inspector. After testing all ID tags will be returned to the Smyrna Inspector. If a test plug or strainer is lost, the Contractor is responsible for all costs associated within the recovery.

____ 22. After final inspection, the Contractor will submit an Engineer stamped set of as-builts along with digital copies (.dwg-AutoCAD and .pdf) and a Letter of Completion requesting that the one year warranty period begins. For residential projects, THIS IS TO BE DONE BEFOR BUILDING PERMITS CAN BE ISSUED. For commercial projects, THIS IS TO BE DONE BEFORE A CERTIFICATE OF OCCUPANCY CAN BE ISSUED.

____ 23. The Town of Smyrna will not pay for testing equipment or construction incidentals.

____ 24. Town of Smyrna reserves the right to change the wording and the enforcement of any water or sewer specification without notification to the contractor.

_____

Town of Smyrna Representative Date

_____

Contractor Representative Date

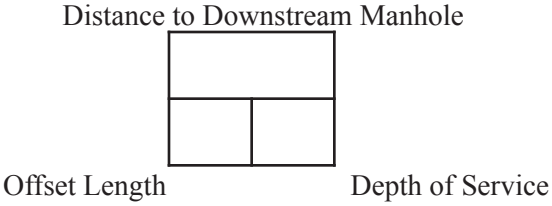
As-Built Checklist

On Plans:

1. Contact information
2. Subdivision name and section number
3. Plat Book and Page numbers
4. Lot numbers
5. (2) Dimensions to the following:
   a. Water meters
   b. Water valves
   c. Fire hydrants
   d. Storm drain features
   e. Sanitary cleanouts
   f. Above ground electrical or cable boxes
6. Stationing to the following:
   a. Manholes
   b. Sanitary tap locations from downstream manhole
   c. Offset length of sewer service
   d. Depth at end of sewer service

Items b, c, and d should be as illustrated in Figure 1.

Fig. 1.



7. Elevations to the following:
   a. Manholes
      1) Top-of-cast
      2) Invert to bottom, center
   b. Storm drain inlets top, center
   c. Plan and Profile are required for sanitary sewer, retention and detention areas

In Field:

1. Blue paint on the water valve and at 90 degrees to the valve on the curb.
2. Dimensions should be kept as close to or under 100 ft. as much as possible. Dimension ties must be made to a semi-immovable item. Examples of semi-immovable items are manholes, power (light) poles, and storm drain headwalls. Where the determination is made that there is not an acceptable feature to dimension to, drill holes can be made and painted in the top-of-curb and measured to the feature.