

CLEVELAND UTILITIES
WATER AND WASTEWATER DIVISIONS
CONTRACT DOCUMENTS, SPECIFICATIONS AND
CONSTRUCTION DETAIL DRAWINGS

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**CLEVELAND UTILITIES WATER AND WASTEWATER DIVISION
DESIGN STANDARDS AND SPECIFICATIONS**

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PROCUREMENT AND CONTRACTING REQUIREMENTS

SECTION 1

INFORMATION FOR BIDDERS

1. RECEIPT AND OPENING OF BIDS

Cleveland Utilities (herein called the "Owner"), invites Bids as shown on the attached Bid Schedule. Bids will be received by the Owner at Cleveland Utilities Water Division Auditorium, 2435 Guthrie Avenue, N.W., P.O. Box 2730, Cleveland, Tennessee, 37320-2730, Attention: Mr. Philip Luce, until ____p.m. local time, on _____, _____, 20____ and then at said place publicly opened and read aloud.

The Owner may consider informal any Bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject the above schedule time for the opening of Bids or authorized postponement thereof. Any Bid received after the time and date specified shall not be considered. No Bidder may withdraw a Bid within 60 days after the actual date of the opening thereof.

2. PREPARATION OF BID

Each Bid must be submitted on the Bid Schedule for each project. All blank spaces for Bid prices must be filled in, in ink or typewritten. Blank spaces not filled in with ink or typewritten will be considered zero. The total Bid Price must be also be written in words as well as figures. (In case of discrepancy, the amount shown in words will govern.) Any required certificates must be fully completed and executed when submitted.

All Bidders must be licensed Contractors. In compliance with all the requirements of Chapter No. 135, Public Acts of 1945 of the General Assembly of the State of Tennessee, And House Bill No. 2180 (Public Chapter No. 882) known as the Contractor's Licensing Act of 1976 (and all amendments thereto), the sealed envelope addressed to the Owner in which the Bid is contained must also bear on the outside the following:

1. Name of Bidder;
2. Address of Bidder;
3. Name of Project for which Bid is submitted;
4. Bidder's License Number and State of Registration;
5. Bidder's License Date of Registration;
6. Bidder's License Category or Classification; and
7. Bidder's License Expiration Date.

If the Bid is forwarded by mail, the sealed envelope containing a Bid must be enclosed in another envelope addressed to the Owner at 2435 Guthrie Drive, N.W., Cleveland, Tennessee 37320, Attention: Mr. Philip Luce.

Any and all Bids not meeting the aforementioned criteria for Bid submittal, will be declared nonresponsive, will not be opened, and will be returned to the Bidders unopened.

3. SUBCONTRACTS

The Bidder is specifically advised that any person, firm, or other party to whom it is proposed to award a subcontract under this Bid must be acceptable to the Owner.

4. METHOD OF BIDDING

The owner invites the following Bid(s):

Furnish all materials, labor, tools, equipment, and appliances necessary for the construction of _____ as shown on the project plans. The unit or lump sum price for each of the several items in the proposal of each bidder shall include its pro rata share of overhead and profit so that the sum of the products obtained by multiplying the quantity shown for each item by the unit price represents the total bid. Any bid not conforming to this requirement may be rejected as informal. The special attention of all bidders is called to this provision, for should conditions make it necessary to revise the quantities, no limit will be fixed for such increased or decreased quantities nor extra compensation allowed, provided the net monetary value of all such addition or subtraction in quantities of such items of work (i.e., difference in cost) shall not increase or decrease the total original contract price by more than twenty-five (25) percent.

5. QUALIFICATIONS OF BIDDERS

The Owner may make such investigations as he deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that the Bidder is properly qualified to carry out the obligations of the Bid and to complete the work contemplated therein. Conditional Bids will not be accepted.

6. ADDENDA AND INTERPRETATIONS

No interpretation of the meaning of the Drawings, Specifications, or other prebid documents will be made to any Bidder orally. Every request for such interpretation should be in writing addressed to Cleveland Utilities, at 2435 Guthrie Ave., Cleveland, TN 37320, and to be given consideration must be received at least five(5) days prior to the date fixed for the opening of Bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Specifications which, if issued, will be mailed by certified mail with return receipt requested to all prospective Bidders (at the respective addresses furnished for such purposes), not later than three(3) days prior to the date fixed for the opening of Bids. Failure of any Bidder to receive any such addendum or interpretation shall not relieve such Bidder from any obligation under his Bid as submitted. All addenda so issued shall become a part of the Contract Documents.

7. LAWS AND REGULATIONS

The Bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Bidder throughout the entire Project. Contractor shall purchase all applicable permits, such as, building, plumbing and electrical permits and include the cost in the Bid.

8. OBLIGATION OF BIDDER

At the time of the opening of the Bids each Bidder will be presumed to have inspected the entire site and to have read and to be thoroughly familiar with the Drawings and Specifications. The failure or omission of any Bidder to examine any form, instrument, or document shall in no way relieve any Bidder from any obligation in respect of his Bid.

9. METHOD OF AWARD - LOWEST QUALIFIED BIDDER

The Contract will be awarded to the responsive, responsible Bidder submitting the lowest base bid complying with the conditions as stated in the Bid Schedule. Award will be made on the basis of the prices given in the base bid. The Bidder to whom the award is made will be notified at the earliest possible date. The Owner reserves the right to reject any and all bids and to waive any informality in bids received whenever such rejection or waiver is in its interest.

A responsive Bidder shall be one who submits his bid in the proper form without qualification or intent other than as called for in the specifications and on the detail drawings and who binds himself on behalf of his bid to the Owner, and who properly completes all forms required to be completed and submitted at the time of the bidding.

A responsible Bidder shall be one who can fulfill the following requirements:

(a)The Bidder shall maintain a permanent place of business. This requirement applies to the Bidder where the Bidder is a division of a corporation, or where the Bidder is 50 percent or more owned by a person, corporation, or firm.

(b)The Bidder shall demonstrate that he has adequate construction management experience and sufficient equipment resources to properly perform the work under and in conformance with these Contract Documents. This evaluation will be based upon a list of completed or active projects and a list of construction equipment available to the Bidder to perform the work.

(c)The Bidder shall demonstrate that he is familiar with the work under these Contract Documents. This evaluation will be based upon a list of major equipment items the Bidder proposes to furnish and a list of subcontractors the Bidder proposes to use in prosecuting the work.

(d)The Bidder shall demonstrate that he has financial resources of sufficient strength to meet the obligations incident to the performance of the work covered by these Contract Documents. The ability to obtain the required Performance and Payment Bonds will not alone demonstrate adequate financial capability.

(e)The Bidder may demonstrate financial capability by submitting a suitable financial statement of an Equity Partner, provided an agreement is executed binding the Bidder and said Equity Partner, jointly and severally, to fulfill all duties, obligations, and responsibilities of the Contractor under these contract Documents if the Contract is awarded to the Bidder. The agreement shall be submitted with the Bid and shall be satisfactory to the Owner's Attorney or the bid may be declared nonresponsive.

(f)The Bidder shall furnish all data required by these Contract documents. Failure to do so may result in the Bid being declared nonresponsive. Acceptance of the Bidder's documentation and substantiation or Contract Award by the Owner does not relieve the Bidder of liability for non-performance as covered in the Contract Documents, nor will the Bidder be exempted from any other legal recourse the Owner may elect to pursue.

10. EMPLOYMENT OF LOCAL LABOR

Preference in employment on the Project shall, insofar as practicable, be given to qualified local labor.

** END OF SECTION **

SECTION 5

STANDARD AGREEMENT BETWEEN OWNER AND CONTRACTOR

THIS AGREEMENT is dated as of the day of _____ in the year 20_____
by and between

Cleveland Utilities (hereinafter called OWNER) and

_____ (hereinafter called CONTRACTOR)

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

Article 1. WORK.

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The work is generally described as follows:

Article 2. ENGINEER.

The Project has been designed by Cleveland Utilities Water Division.

who is hereinafter called ENGINEER and who will assume all duties and responsibilities and will have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

Article 3. CONTRACT TIME.

3.1 The Work will be substantially completed within _____ days after the date when the Contract Time commences to run as provided in paragraph 2.3 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.13 of the General Conditions within _____ days after the date when the Contract Time commences to run.

3.2 *Liquidated Damages* OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not substantially complete within the time specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by OWNER if the Work is not substantially complete on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as penalty) CONTRACTOR shall pay OWNER _____ dollars (\$ _____) for each day that expires after the time specified in paragraph 3.1 for substantial completion until the Work is substantially complete.

Article 4. CONTRACT PRICE.

4.1 OWNER shall pay CONTRACTOR for performance of the Work in accordance with the Contract Documents in current funds as follows:

Unit prices as shown on the Contract Bid Schedule

Article 5. PAYMENT PROCEDURES.

CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

5.1 *Progress Payments.* OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment as recommended by ENGINEER, on or about the _____ day of each month during construction as provided below. All progress payments will be on the basis of the progress of the Work measured by the schedule of values provided for in paragraph 14.1 of the General Conditions.

5.1.1. Prior to Substantial Completion progress payments will be in an amount equal to:

_____ % of the Work completed, and

_____ % of materials and equipment not incorporated in the Work but delivered and suitably stored, less in each case the aggregate of payments previously made.

5.1.2. Upon Substantial Completion, OWNER shall pay an amount sufficient to increase total payments to _____ CONTRACTOR as _____ % of the Contract Price, less such amounts as ENGINEER shall determine in accordance with paragraph 14.7 of the General Conditions.

5.2 *Final Payment.* Upon final completion and acceptance of the Work in accordance with paragraph 14.13 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said paragraph 14.13.

Article 6. INTEREST.

All moneys not paid when due hereunder shall bear interest at the maximum rate allowed by law at the place of the Project.

Article 7. CONTRACTOR'S REPRESENTATIONS.

In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations:

- 7.1 CONTRACTOR has familiarized himself with the nature and extent of the Contract Documents, Work, locality and with all local conditions and federal, state and local laws, ordinances, rules and regulations that in any manner may affect cost, progress or performance of the Work.
- 7.2 CONTRACTOR has studied carefully all reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which were relied upon by ENGINEER in the preparation of the Drawings and Specifications and which have been identified in the Supplementary Conditions.
- 7.3 CONTRACTOR has made or caused to be made examinations, investigations and tests and studies for such reports and related data in addition to those referred to in paragraph 7.2 as he deems necessary for the performance of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents; and no additional examinations, investigations, tests, reports or similar data are or will be required by CONTRACTOR for such purposes.
- 7.4 CONTRACTOR has correlated the results of all such observations, examinations, investigations, tests, reports and data with the terms and conditions of the Contract Documents.
- 7.5 CONTRACTOR has given ENGINEER written notice of all conflicts, errors or discrepancies that he has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

Article 8. CONTRACT DOCUMENTS.

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR are attached to this Agreement, made a part hereof and consists of the following:

- 8.1 This Agreement (pages 1 to _____, inclusive).
- 8.2 Performance and other Bonds, identified as exhibits _____ and consisting of _____ pages.
- 8.3 Notice of Award.
- 8.4 Specifications bearing the title _____ and consisting of _____ sections as listed in table of contents thereof and including Sections 8.5, 8.6, 8.7 below.

- 8.5 General Conditions (pages _____ to _____ , inclusive).
- 8.6 Supplementary General Conditions (pages _____ to _____ , inclusive).
- 8.7 Special Conditions (pages _____ to _____ , inclusive).
- 8.8 Drawings, consisting of a cover sheet and sheets numbered _____ through _____ inclusive with each sheet bearing the following general title:
- 8.9 Addenda numbers _____ as _____ , inclusive.
- 8.10 CONTRACTOR's Bid (pages _____ to _____ , inclusive) marked exhibit _____ (Attach Bid Form only in special circumstances).
- 8.11 Documentation submitted by CONTRACTOR prior to Notice of Award (pages _____ to _____ , inclusive).
- 8.12 Any Modification, including Change Orders, duly delivered after execution of Agreement.

There are no Contract Documents other than those listed above in this Article 8. The Contract Documents may only be altered, amended or repealed by a Modification (as defined in Section 1 of the General Conditions).

Article 9. MISCELLANEOUS

- 9.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions shall have the meanings indicated in the General Conditions.
- 9.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.
- 9.3 OWNER and CONTRACTOR each binds himself, his partners, successors, assigns and legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.

Article 10. OTHER PROVISIONS.

IN WITNESS WHEREOF, the parties hereto have signed this Agreement in triplicate. One counterpart each has been delivered to OWNER, CONTRACTOR and ENGINEER. All portions of the Contract Documents have been signed or identified by OWNER and CONTRACTOR or by ENGINEER on their behalf.

This Agreement will be effective on _____, 19_____

OWNER: CLEVELAND UTILITIES_____ CONTRACTOR _____

By _____ By _____

(CORPORATE SEAL) (CORPORATE SEAL)
Attest _____ Attest _____

Address for giving notices Address for giving notices

(If OWNER is a public body attach evidence of authority to sign and resolution or other document authorizing execution of Agreement.)

License No _____
Agent for service of process: _____

**** END OF SECTION ****

SECTION 6
GENERAL CONDITIONS

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GENERAL CONDITIONS

ARTICLE 1-DEFINITIONS

Whenever used in these General Conditions or in the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

Addenda-Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the bidding documents or the Contract Documents.

Agreement-The written agreement between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

Application for Payment-The form accepted by ENGINEER which is to be used by CONTRACTOR in requesting progress or final payment and which is to include such supporting documentation as is required by the Contract Documents.

Bid-The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

Bonds-Bid, performance and payment bonds and other instruments of security.

Change Order-A written order to CONTRACTOR signed by OWNER authorizing an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time issued after the effective date of the Agreement.

Contract Documents-The Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post-Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Bonds, these General Conditions, the supplementary Conditions, the Specifications, the Drawings as the same are more specifically identified in the Agreement, together with all Modifications issued after the execution of the Agreement.

Contract Price-The moneys payable by OWNER to CONTRACTOR under the Contract Documents as stated in the Agreement.

Contract Time-The number of days (computed as provided in paragraph 17.2) or the date stated in the Agreement for the completion of the Work.

CONTRACTOR-The person, firm or corporation with whom OWNER has entered into the Agreement.

day-A calendar day of twenty-four hours measured from midnight to the next midnight.

defective-An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents or does not meet the requirements of any inspection, test or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER's recommendation of final payment.

Drawings-The drawings which show the character and scope of the Work to be performed and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents.

effective date of the Agreement-The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

ENGINEER-The person, firm or corporation named as such in the Agreement.

Field Order-A written order issued by ENGINEER which orders minor changes in the Work in accordance with paragraph 10.2 but which does not involve a change in the Contract Price or the Contract Time.

General Requirements-Sections of Division 1 of the Specifications.

Modification-(a) A written amendment of the Contract Documents signed by both parties, (b) a Change Order, or (c) a Field Order. A modification may only be issued after the effective date of the Agreement.

Notice of Award-The written notice by OWNER to the apparent successful Bidder stating that upon compliance by the apparent successful Bidder with the conditions precedent enumerated therein, within the time specified, OWNER will sign and deliver the Agreement.

Notice to Proceed-A written notice given by OWNER to CONTRACTOR (with a copy to ENGINEER) fixing the date on which the Contract Time will commence to run and on which CONTRACTOR shall start to perform his obligation under the Contract Documents.

OWNER-The public body or authority, corporation, association, partnership, or individual with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be provided.

Project-The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

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

Shop Drawings-All drawings, illustrations, schedules and other data which are specifically prepared by CONTRACTOR, a Subcontractor, manufacturer, fabricator, supplier or distributor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a manufacturer, fabricator, supplier or distributor and submitted by CONTRACTOR, to illustrate material or equipment for some portion of the Work.

Specifications-Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

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

Substantial Completion-The Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER as evidenced by his definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it was intended; or if there be no such certificate issued, when final payment is due in accordance with paragraph 14.13. The terms "substantially complete" and "substantially completed" as applied to any Work refer to Substantial Completion thereof.

Work-The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

ARTICLE 2-PRELIMINARY MATTERS

Delivery of Bonds:

2.1. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish in accordance with paragraph 5.1.

Copies of Documents:

2.2. OWNER shall furnish to CONTRACTOR up to ten copies (unless otherwise specified in the General Requirements) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

Commencement of Contract Time; Notice to Proceed:

2.3. The Contract Time will commence to run on the thirtieth day after the effective date of the Agreement, or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed; but in no event shall the Contract Time commence to run later than the ninetieth day after the day of Bid opening or the thirtieth day after the effective date of the Agreement. A Notice to Proceed may be given at any time within thirty days after the effective date of the Agreement.

Starting the Project:

2.4. CONTRACTOR shall start to perform the Work on the date when the Contract Time commences to run, but no Work shall be done at the site prior to the date on which the Contract Time commences to run.

Before Starting Construction:

2.5. Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error or discrepancy which CONTRACTOR may discover; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error or discrepancy in the Drawings or Specifications, unless CONTRACTOR had actual knowledge thereof or should reasonably have known thereof.

2.6. Within ten days after the effective date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for review and acceptance an estimated progress schedule indicating the starting and completion dates of the various stages of the Work, a preliminary schedule of Shop Drawing submissions, and a preliminary schedule of values of the Work.

2.7. Before any Work at the site is started, CONTRACTOR shall deliver to OWNER, with a copy to ENGINEER, certificates (and other evidence of insurance requested by OWNER) which CONTRACTOR is required to purchase and maintain in accordance with paragraphs 5.3 and 5.4, and OWNER shall deliver to CONTRACTOR certificates (and other evidence of insurance requested by CONTRACTOR) which OWNER is required to purchase and maintain in accordance with paragraphs 5.6 and 5.7.

Preconstruction Conference:

2.8. Within twenty days after the effective date of the Agreement, but before CONTRACTOR starts the Work at the site, a conference will be held for review and acceptance of the schedules referred to in Paragraph 2.6, to establish procedures for handling Shop Drawings and other submittals and for processing Applications for Payment, and to establish a working understanding among the parties as to the Work.

ARTICLE 3-CONTRACT DOCUMENTS: INTENT AND REUSE

Intent:

3.1. The Contract Documents comprise the entire Agreement between OWNER and CONTRACTOR concerning the Work. They may be altered only by a Modification.

3.2. The Contract Documents are complementary; what is called for by one is binding as if called for by all. If, during the performance of the Work, CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents, he shall report it to ENGINEER in writing at once and before proceeding with the Work affected thereby; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error or discrepancy in the Specifications or Drawings unless CONTRACTOR had actual knowledge thereof or should reasonably have known thereof.

3.3. It is the intent of the Specifications and Drawings to describe a complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work that may reasonably be inferred from the Specifications or Drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for. When words which have a well-known technical or trade meaning are used to describe Work, materials or equipment such words shall be interpreted in accordance with such meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the code of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual or code in effect at the time of opening of Bids (or, on the effective date of the Agreement if there were no Bids), except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manuals or code (whether or not specifically incorporated by reference in the Contract Documents) shall change the duties and responsibilities of OWNER, CONTRACTOR or ENGINEER, or any of their agents or employees from those set forth in the Contract Documents. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided for in paragraph 9.3.

3.4. The Contract Documents will be governed by the law of the place of the Project.

Reuse of Documents:

3.5. Neither CONTRACTOR nor any Subcontractor, manufacturer, fabricator, supplier or distributor shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER; and they shall not reuse any of them on extensions of the project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaptation by ENGINEER.

ARTICLE 4-AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; REFERENCE POINTS

Availability of Lands:

4.1. OWNER shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way for access thereto, and such other lands which are designated for the use of CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise provided in the Contract Documents. If CONTRACTOR believes that any delay in OWNER's furnishing these lands or easements entitles him to an extension of the Contract Time, CONTRACTOR may make a claim therefore as provided in Article 12. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

Physical Conditions-Investigations and Reports:

4.2. Reference is made to the Supplementary Conditions for identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which have been relied upon by ENGINEER in preparation of the Drawings and Specifications. Such reports are not guaranteed as to accuracy or completeness and are not part of the Contract Documents.

Unforeseen Physical Conditions:

4.3. CONTRACTOR shall promptly notify OWNER and ENGINEER in writing of any subsurface or latent physical conditions at the site or in an existing structure differing materially from those indicated or referred to in the Contract Documents. ENGINEER will promptly review those conditions and advise OWNER in writing if further investigation or tests are necessary additional investigations and tests and furnish copies to ENGINEER and CONTRACTOR. If ENGINEER finds that the subsurface or latent physical conditions which differ materially from those intended in the Contract Documents, and which could not reasonably have been anticipated by CONTRACTOR, a Change Order shall be issued incorporating the necessary revisions.

Reference Points:

4.4. OWNER shall provide engineering surveys for construction to establish reference points which in his judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work (unless otherwise specified in the General Requirements), shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for replacement or relocation of such reference points by professionally qualified personnel.

ARTICLE 5-BONDS AND INSURANCE

Performance and Other Bonds:

5.1. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date of final payment, except as otherwise provided by law. CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the forms prescribed by the bidding documents or Supplementary Conditions and be executed by such Sureties as (i) are licensed to conduct business in the state where the Project is located, and (ii) are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of the authority to act.

5.2. If the Surety on any Bond furnished by CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of clauses (i) and (ii) of paragraph 5.1, CONTRACTOR shall within five days thereafter substitute another Bond and Surety, both of which shall be acceptable to OWNER.

Contractor's Liability Insurance:

5.3. CONTRACTOR shall purchase and maintain such comprehensive general liability and other insurance as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR's performance of the Work and CONTRACTOR's other obligations under the Contract Documents, whether such performance is by CONTRACTOR, by any Subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

5.3.1. Claims under workers' or workmen's compensation, disability benefits and other similar employee benefit acts;

5.3.2. Claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

5.3.3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees;

5.3.4. Claims for damages insured by personal injury liability coverage which are sustained (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;

5.3.5. Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom; and

5.3.6. Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

The insurance required by this paragraph 5.3 shall include the specific coverages provided in the Supplementary Conditions, or required by law, whichever is greater. The comprehensive general liability insurance shall include completed operations insurance. All such insurance shall contain a provision that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days' prior written notice has been given to

OWNER and ENGINEER. All such insurance shall remain in effect until final payment and at all times thereafter when CONTRACTOR may be correcting, removing or replacing defective Work in accordance with paragraph 13.12. In addition, CONTRACTOR shall maintain such completed operations insurance for at least two years after final payment and furnish OWNER with evidence of continuation of such insurance at final payment and one year thereafter.

Contractual Liability Insurance:

5.4. The comprehensive general liability insurance required by paragraph 5.3 will include contractual liability insurance applicable to CONTRACTOR's obligations under paragraphs 6.30 and 6.31.

Owner's Liability Insurance:

5.5. OWNER shall be responsible for purchasing and maintaining his own liability insurance and, at his option, may purchase and maintain such insurance as will protect OWNER against claims which may arise from operations under the Contract Documents.

Property Insurance:

5.6. Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property insurance upon the Work at the site to the full insurable value thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by law). This insurance shall include the interest of OWNER, CONTRACTOR and Subcontractors in the Work, shall insure against the perils of fire and extended coverage and shall include "all risk" insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and such other perils as may be provided in the Supplementary Conditions, and shall include damages, losses and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including fees and charges of engineers, architects, attorneys and other professionals). If not covered under the "all risk" insurance or otherwise provided in the Supplementary Conditions, CONTRACTOR shall purchase and maintain similar property insurance on portions of the Work stored on and off the site or in transit when such portions of the Work are to be included in an Application for Payment. The policies of insurance required to be purchased and maintained by OWNER in accordance with paragraphs 5.6 and 5.7 shall contain a provision that the coverage afforded will not be canceled or materially changed until at least thirty days' prior written notice has been given to CONTRACTOR.

5.7. OWNER shall purchase and maintain such boiler and machinery insurance as may be required by the Supplementary Conditions or by law. This insurance shall include the interests of OWNER, CONTRACTOR and Subcontractors in the Work.

5.8. OWNER shall not be responsible for purchasing and maintaining any property insurance to protect the interests of CONTRACTOR or Subcontractors in the Work to the extent of any deductible amounts that are provided in the Supplementary Conditions. If CONTRACTOR wishes property insurance coverage within the limits of such amounts, CONTRACTOR may purchase and maintain it at his own expense.

5.9. If CONTRACTOR requests in writing that other special insurance be included in the property insurance policy, OWNER shall, if possible, include such insurance, and the cost thereof shall be charged to CONTRACTOR by appropriate Change Order. Prior to commencement of the work at the site, OWNER will in writing advise CONTRACTOR whether or not such other insurance has been procured by OWNER.

Waiver of Rights:

5.10. OWNER and CONTRACTOR waive all rights against each other and the Subcontractors and their agents and employees and against ENGINEER and separate contractors (if any) and their subcontractors' agents and employees, for damages caused by fire or other perils to the extent covered by insurance provided under paragraphs 5.6 and 5.7, inclusive, or any other property insurance applicable to the Work, except such rights as they may have to the proceeds of such insurance held by OWNER as trustee. OWNER shall require similar written waivers by ENGINEER and from each separate contractor, and CONTRACTOR shall require similar written waivers from each Subcontractor (in accordance with paragraph 6.11 as applicable); each such waiver will be in favor of all other parties enumerated in this paragraph 5.10.

Receipt and Application of Proceeds:

5.11. Any insured loss under the policies of insurance required by paragraphs 5.6 and 5.7 shall be adjusted with OWNER and made payable to OWNER as trustee for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.12. OWNER shall deposit in a separate account any money so received, and he shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof and the Work and the cost thereof covered by an appropriate Change Order.

5.12. OWNER as trustee shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen days after the occurrence of loss to OWNER's exercise of his power. If such objection be made, OWNER as trustee shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If required in writing by any party in interest, OWNER as trustee shall upon the occurrence of an insured loss, give bond for the proper performance of his duties.

Acceptance of Insurance:

5.13. If OWNER has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance with paragraphs 5.3 and 5.4 on the basis of its not complying with the Contract Documents, OWNER will notify CONTRACTOR in writing thereof within ten days of the date of delivery of such certificates to OWNER in accordance with paragraph 2.7. If CONTRACTOR has any objection to the coverage afforded by or other provisions of the policies of insurance required to be purchased and maintained by OWNER in accordance with paragraphs 5.6 and 5.7 on the basis of their not complying with the Contract Documents, CONTRACTOR will notify OWNER in writing thereof within ten days of the date of delivery of such certificates to CONTRACTOR in accordance with paragraph 2.7. OWNER and CONTRACTOR will each provide to the other such additional information in respect of insurance provided by him as the other may reasonably request. Failure by OWNER or CONTRACTOR to give any such notice of objection within the time provided shall constitute acceptance of such insurance purchased by the other as complying with the Contract Documents.

Partial Utilization-Property Insurance:

5.14. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with paragraph 14.10; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected the changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or lapse on account of any such partial use or occupancy.

ARTICLE 6-CONTRACTOR'S RESPONSIBILITIES

Supervision and Superintendence:

6.1. CONTRACTOR shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but CONTRACTOR shall not be solely responsible for the negligence of others in the design or selection of a specific means, method, techniques, sequence or procedure of construction which is indicated in and required by the Contract Documents. CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract Documents.

6.2. CONTRACTOR shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications given to the superintendent shall be as binding as if given to CONTRACTOR.

Labor, Materials and Equipment:

6.3. CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Supplementary Conditions, all Work at the site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without OWNER's written consent given after prior written notice to ENGINEER.

6.4. CONTRACTOR shall furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water and sanitary facilities and all other facilities and incidentals necessary for the execution, testing, initial operation and completion of the Work.

6.5. All materials and equipment shall be good quality and new, except as otherwise provided in the Contract Documents. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind of quality of materials and equipment.

6.6. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier or distributor, except as otherwise provided in the Contract Documents.

Equivalent Materials and Equipment:

6.7. Whenever materials or equipment are specified or described in the Drawings or Specifications by using the name of a proprietary item or the name of a particular manufacturer, fabricator, supplier or distributor, the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other manufacturers, fabricators, suppliers or distributors may be accepted by ENGINEER if sufficient information is submitted by CONTRACTOR to allow ENGINEER to determine that the material or equipment proposed is equivalent to that named. The procedure for review by ENGINEER will be as set forth in paragraphs 6.7.1 and 6.7.2 below as supplemented in the General Requirements.

6.7.1. Requests for review of substitute items of material and equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment CONTRACTOR shall make written application to ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions called for by the general design, be similar and of equal substance to that specified and be suited to the same use and capable of performing the same function as that specified. The application will state whether or not acceptance of the substitute for use in the Work will require a change in the Drawings or Specifications to adapt the design to the substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified shall be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which shall be considered by ENGINEER in evaluating the proposed substitute. ENGINEER may require CONTRACTOR to furnish at CONTRACTOR's expense additional data about the proposed substitute. ENGINEER will be the sole judge of acceptability, and no substitute will be ordered or installed without ENGINEER's prior written acceptance. OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.

6.7.2. ENGINEER will record time required by ENGINEER and ENGINEER's consultants in evaluating substitutions proposed by CONTRACTOR and in making changes in the Drawings of Specifications occasioned thereby. Whether or not ENGINEER accepts a proposed substitute, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's consultants for evaluating any proposed substitute.

Concerning Subcontractors:

6.8. CONTRACTOR shall not employ any Subcontractor or other person or organization (including those who are to furnish the principal items of materials or equipment), whether initially or as a substitute, against whom OWNER or ENGINEER may have reasonable objection. A Subcontractor or other person or organization identified in writing to OWNER and ENGINEER by CONTRACTOR prior to the Notice of Award and not objected to in writing by OWNER or ENGINEER prior to the Notice of Award will be deemed acceptable to OWNER and ENGINEER. Acceptance of any Subcontractor, other person or organization by OWNER or ENGINEER shall not constitute a waiver of any right of OWNER or ENGINEER to reject defective Work. If OWNER or ENGINEER after due investigation has reasonable objection to any Subcontractor, other person or organization proposed by CONTRACTOR after the Notice of Award, CONTRACTOR shall submit an acceptable substitute and the Contract Price shall be increased or decreased by the difference in cost occasioned by such substitution, and an appropriate Change Order shall be issued. CONTRACTOR shall not be required to employ any Subcontractor, other person or organization against whom CONTRACTOR has reasonable objection.

6.9. CONTRACTOR shall be fully responsible for all acts and omissions of his Subcontractors and of persons and organizations directly or indirectly employed by them and of persons and organizations for whose acts any of them may be liable to the same extent that CONTRACTOR is responsible for the acts and omissions of persons directly employed by CONTRACTOR. Nothing in the Contract Documents shall create any contractual relationship between OWNER or ENGINEER and any Subcontractor or other person or organization having a direct contact with CONTRACTOR, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any Subcontractor or other person or organization, except as may otherwise be required by law. OWNER or ENGINEER may furnish to any Subcontractor or other person or organization, to the extent practicable, evidence of amounts paid to CONTRACTOR on account of specific Work done.

6.10. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or delineating the Work to be performed by any specific trade.

6.11. All Work performed for CONTRACTOR by a Subcontractor will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor which specifically binds the subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER and contains waiver provisions as required by paragraph 5.10. CONTRACTOR shall pay each Subcontractor a just share of any insurance moneys received by CONTRACTOR on account of losses under policies issued pursuant to paragraphs 5.6 through 5.8.

Patent Fees and Royalties:

6.12. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorneys' fees) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

Permits:

6.13. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids. CONTRACTOR shall pay all charges of utility service companies for connections to the Work, and OWNER shall pay all charges of such companies for capital costs related thereto.

Laws and Regulations:

6.14. CONTRACTOR shall give all notices and comply with all laws, ordinances, rules and regulations applicable to the Work. If CONTRACTOR observes that the Specifications or Drawings are at variance therewith, CONTRACTOR shall give ENGINEER prompt written notice thereof, and any necessary changes shall be adjusted by an appropriate Modification. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to such laws, ordinances, rules and regulations, and without such notice to ENGINEER, CONTRACTOR shall bear all costs arising therefrom: however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with such laws, ordinances, rules and regulations.

Taxes:

6.15. CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by him in accordance with the law of the place of the Project.

Use of Premises:

6.16. CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workmen to areas permitted by law, ordinances, permits or the requirements of the Contract Documents, and shall not unreasonably encumber the premises with construction equipment.

6.17. During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work CONTRACTOR shall remove all waste materials, rubbish, and debris from and about the premises as well as all tools, appliances, construction equipment and machinery, and surplus materials, and shall leave the site clean and ready for occupancy by OWNER. CONTRACTOR shall restore to their original condition those portions of the site not designated for alteration by the Contract Documents.

6.18. CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

Record Documents:

6.19. CONTRACTOR shall keep one record copy of all Specifications, Drawings, Addenda, Modifications, Shop Drawings, and samples at the site, in good order and annotated to show all changes made during the construction process. These shall be available to ENGINEER for examination and shall be delivered to ENGINEER for OWNER upon completion of the Work.

Safety and Protection:

6.20. CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.20.1. all employees on the Work and other persons who may be affected thereby,

6.20.2. all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and

6.20.3. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and utilities when prosecution of the Work may affect them. All damage, injury or loss to any property referred to in paragraph 6.20.2. or 6.20.3 caused, directly or indirectly, in whole or in part, by

CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or 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 CONTRACTOR). CONTRACTOR's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.13 that the Work is acceptable.

6.21. CONTRACTOR shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be CONTRACTOR's superintendent unless otherwise designated in writing by CONTRACTOR to OWNER.

Emergencies:

6.22. In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from ENGINEER or OWNER, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give ENGINEER prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby.

Shop Drawings and Samples:

6.23. After checking and verifying all field measurements, CONTRACTOR shall submit to ENGINEER for review and approval, in accordance with the accepted schedule of Shop Drawing submissions (see paragraph 2.8), live copies (unless otherwise specified in the General Requirements) of all Shop Drawings, which shall have been checked by and stamped with the approval of CONTRACTOR and identified as ENGINEER may require. The data shown on the Shop Drawings will be complete with respect to dimensions, design criteria, materials of construction and like information to enable ENGINEER to review the information as required.

6.24. CONTRACTOR shall also submit to ENGINEER for review and approval with such promptness as to cause no delay in Work, all samples required by Contract Documents. All samples will have been checked by and stamped with the approval of CONTRACTOR, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.

6.25. At the time of each submission, CONTRACTOR shall in writing call ENGINEER's attention to any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents.

6.26. ENGINEER will review and approve with reasonable promptness Shop Drawings and samples, but ENGINEER's review and approval shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make any corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and resubmit new samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals. CONTRACTOR's stamp of approval on any Shop Drawing or sample shall constitute a representation to OWNER and ENGINEER that CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that CONTRACTOR has reviewed or coordinated each Shop Drawing or sample with the requirements of the Work and the Contract Documents.

6.27. Where a Shop Drawing or sample is required by the Specifications, no related Work shall be commenced until the submittal has been reviewed and approved by ENGINEER.

6.28. ENGINEER's review and approval of Shop Drawings or samples shall not relieve CONTRACTOR from responsibility for any deviations from the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to such deviation at the time of submission and ENGINEER has given written concurrence and approval to the specific deviation, nor shall any concurrence or approval by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in the Shop Drawings.

Continuing the Work:

6.29. CONTRACTOR shall carry out on the Work and maintain the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as CONTRACTOR and OWNER may otherwise agree in writing.

Indemnification:

6.30. To the fullest extent permitted by law, CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER and their agents and employees from and against all claims, damages, losses and expenses including but not limited to attorney's fees and all costs arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (a) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom and (b) is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused by a party indemnified hereunder.

6.31. In any and all claims against OWNER or ENGINEER or any of their agents or employees by any employee of CONTRACTOR, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.30 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

6.32. The obligations of CONTRACTOR under paragraph 6.30 shall not extend to the liability of ENGINEER, his agents or employees arising out of the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications.

ARTICLE 7-WORK BY OTHERS

7.1. OWNER may perform additional work related to the Project by himself, or have additional work performed by utility service companies, or let other direct contracts therefore which shall contain General Conditions similar to these. CONTRACTOR shall afford the utility service companies and the other contractors who are parties to such direct contracts (or OWNER, if OWNER is performing the additional work with OWNER's employees) 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.

7.2. If any part of CONTRACTOR's Work depends for proper execution or results upon the work of any such other contractor or utility service company (or OWNER), CONTRACTOR shall inspect and promptly report to ENGINEER in writing any patent or apparent defects or deficiencies in such work that render it unsuitable for such proper execution and results. CONTRACTOR's failure so to report shall constitute an acceptance of the other work as fit and proper for integration with CONTRACTOR's Work except for latent or non-apparent defects and deficiencies in the other work.

7.3. CONTRACTOR shall do all cutting, fitting, and patching of his Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected.

7.4. If the performance of additional work by other contractors or utility service companies or OWNER was not noted in the Contract Documents, written notice thereof shall be given to CONTRACTOR prior to starting any such additional work. If CONTRACTOR believes that the performance of such additional work by OWNER or others involves additional expense to CONTRACTOR or required an extension of the Contract Time, CONTRACTOR may make a claim therefore as provided in Articles 11 and 12.

ARTICLE 8-OWNER'S RESPONSIBILITIES

8.1. OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.2. In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer against whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER. Any dispute in connection with such appointment shall be subject to arbitration.

8.3. OWNER shall furnish the data required of OWNER under the Contract Documents promptly and shall make payments to CONTRACTOR promptly after they are due as provided in paragraphs 14.4 and 14.13.

8.4. OWNER's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting performance of the Work which have been relied upon by ENGINEER in preparing the Drawings and Specifications.

8.5. OWNER's responsibilities in respect of purchasing and maintaining liability and property insurance are set forth in paragraphs 5.5 through 5.7.

8.6. In connection with OWNER's rights to request changes in the Work in accordance with Article 10, OWNER (especially in certain instances as provided in paragraph 10.4) is obligated to execute Change Orders.

8.7. OWNER's responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 13.4.

8.8. In connection with OWNER's right to stop Work or suspend Work, see paragraphs 13.10 and 15.1. Paragraph 15.2 deals with OWNER's right to terminate services of CONTRACTOR under certain circumstances.

ARTICLE 9-ENGINEER'S STATUS DURING CONSTRUCTION

Owner's Representative:

9.1. ENGINEER will be OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER's representative during construction are set forth in the Contract Documents and shall not be extended without written consent of OWNER and ENGINEER.

Visits to Site:

9.2. ENGINEER will make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform to the Contract Documents. On the basis of such visits and on-site observations as an experienced and qualified design professional, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defects and deficiencies in the Work.

Clarifications and Interpretations:

9.3. ENGINEER will issue with reasonable promptness such written clarification or interpretations of the Contract Documents (in the form of Drawings or otherwise) as ENGINEER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If CONTRACTOR believes that a written clarification or interpretation justifies an increase in the Contract Price or Contract Time, CONTRACTOR may make a claim therefore as provided in Article 11 or Article 12.

Rejecting Defective Work:

9.4. ENGINEER will have authority to disapprove or reject Work which is defective, and will also have authority to require special inspection or testing of the Work as provided in paragraph 13.9, whether or not the Work is fabricated, installed or completed.

Shop Drawings, Change Orders and Payments:

9.5. In connection with ENGINEER's responsibility for Shop Drawings and samples, see paragraphs 6.23 through 6.29 inclusive.

9.6. In connection with ENGINEER's responsibilities as to Change Orders, see Articles 10, 11, and 12.

9.7. In connection with ENGINEER's responsibilities in respect of Applications for Payment, etc., see Article 14.

Project Representation:

9.8. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in observing the performance of the Work. The duties, responsibilities and limitations of authority of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions. If OWNER designates another agent to represent him at the site who is not ENGINEER's agent or employee, the duties, responsibilities and limitations of authority of such other person will be as provided in the Supplementary Conditions.

Decisions on Disagreements:

9.9. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the execution and progress of the Work shall be referred initially to ENGINEER in writing with a request for a formal decision in accordance with this paragraph, which ENGINEER will render in writing within a reasonable time. Written notice of each such claim, dispute and other matter shall be delivered by the claimant to ENGINEER and the other party to the Agreement within fifteen days of the occurrence of the event giving rise thereto, and written supporting data will be submitted to ENGINEER and the other party within forty-five days of such occurrence unless ENGINEER allows an additional period of time to ascertain more accurate data. In his capacity as interpreter and judge ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.10. The rendering of a decision by ENGINEER pursuant to paragraph 9.9 with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.16) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or at law in respect of any such claim, dispute or other matter.

Limitations on ENGINEER's Responsibilities:

9.11. Neither ENGINEER's authority to act under this Article 9 or elsewhere in the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of ENGINEER to CONTRACTOR, any Subcontractor, any manufacturer, fabricator, supplier or distributor, or any of their agents or employees or any other person performing any of the Work.

9.12. Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed", or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper" or "satisfactory" or adjectives of like effect or import are used, to describe requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the Work for compliance with the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective never indicates that ENGINEER shall have authority to supervise or direct performance of the Work or authority to undertake responsibility contrary to the provisions of paragraphs 9.13 or 9.14.

9.13. Neither ENGINEER nor OWNER will be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and ENGINEER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

9.14. Neither ENGINEER nor OWNER will be responsible for the acts or omissions of CONTRACTOR or of any Subcontractors, or of the agents or employees of any CONTRACTOR or Subcontractor, or of any other persons at the site or otherwise performing any of the Work.

ARTICLE 10-CHANGES IN THE WORK

10.1. Without invalidating the Agreement, OWNER may, at any time or from time to time, order additions, deletions or revisions in the Work; these will be authorized by Change Orders. Upon receipt of a Change Order, CONTRACTOR shall proceed with the Work involved. All such Work shall be executed under the applicable conditions of the Contract Documents. If any Change Order causes an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, an equitable adjustment will be made as provided in Article 11 or Article 12 on the basis of a claim made by either party.

10.2. ENGINEER may authorize minor changes in the Work not involving an adjustment in the Contract Price or the Contract Time, which are consistent with overall intent of the Contract Documents. These may be accomplished by a Field Order and shall be binding on OWNER, and also on CONTRACTOR who shall perform the change promptly. If CONTRACTOR believes that a Field Order justifies an increase in the Contract Price or Contract Time, CONTRACTOR may make a claim therefore as provided in Article 11 or Article 12.

10.3. Additional Work performed without authorization of a Change Order will not entitle CONTRACTOR to an increase in the Contract Price or an extension of the Contract Time, except in the case of an emergency as provided in paragraph 6.22 and except as provided in paragraphs 10.2 and 13.9.

10.4. OWNER shall execute appropriate Change Orders prepared by ENGINEER covering changes in the Work which are required by OWNER, or required because of unforeseen physical conditions or emergencies, or because of uncovering Work found not to be defective, or as provided in paragraphs 11.9 or 11.10, or because of any other claim of CONTRACTOR for a change in the Contract Time or the Contract Price which is recommended by ENGINEER.

10.5 If notice of any changes affecting the general scope of the Work or change in the Contract Price is required by the provisions of any Bond to be given to the Surety, it will be CONTRACTOR's responsibility to so notify the Surety, and the amount of each applicable Bond shall be adjusted accordingly. CONTRACTOR shall furnish proof of such adjustment to OWNER.

ARTICLE 11-CHANGE OF CONTRACT PRICE

11.1. The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at his expense without change in the Contract Price.

11.2. The Contract Price may only be changed by a Change Order. Any claim for an increase in the Contract Price shall be based on written notice delivered to OWNER and ENGINEER within fifteen days of the occurrence of the event giving rise to the claim. Notice of the amount of the claim with supporting data shall be delivered within forty-five days of such occurrence unless ENGINEER allows an additional period of time to ascertain accurate cost data. All claims for adjustment in the Contract Price shall be determined by ENGINEER if OWNER and CONTRACTOR cannot otherwise agree on the amount involved. Any change in the Contract Price resulting from any such claim shall be incorporated in a Change Order.

11.3. The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

11.3.1. Where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to quantities of the items involved (subject to the provisions of paragraph 11.9).

11.3.2. By mutual acceptance of a lump sum.

11.3.3. On the basis of the Cost of the Work (determined as provided in paragraphs 11.4 and 11.5) plus a Contractor's Fee for overhead and profit (determined as provided in paragraph 11.6).

Cost of the Work:

11.4. The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.5:

11.4.1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' or workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. Such employees shall include superintendents and foremen at the site. The expenses of performing Work after regular working hours, on Sunday or legal holidays, shall be included in the above to the extent authorized by OWNER.

11.4.2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and manufacturers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds, and all returns from sale of surplus materials and equipment shall accrue to OWNER and CONTRACTOR shall make provisions so that they may be obtained.

11.4.3. Payments made by CONTRACTOR to the Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to CONTRACTOR and shall deliver such bids to OWNER who will then determine, with the advice of ENGINEER, which bids will be accepted. If a subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a Fee, the Subcontractor's Cost of the Work shall be determined in the same manner as CONTRACTOR's Cost of the Work. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

11.4.4. Costs of special consultants (including, but not limited to, engineers, architects, testing laboratories, surveyors, lawyers and accountants) employed for services specifically related to the Work.

11.4.5. Supplemental costs including the following:

11.4.5.1 The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

11.4.5.2. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workmen, which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of CONTRACTOR.

11.4.5.3. Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, installation, dismantling and removal thereof-all in accordance with terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

11.4.5.4. Sales, use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by any governmental authority.

11.4.5.5. Deposits lost for causes other than CONTRACTOR's negligence, royalty payments and fees for permits and licenses.

11.4.5.6. Losses and damages (and related expenses), not compensated by insurance or otherwise, to the Work or otherwise sustained by CONTRACTOR in connection with the execution of the Work, provided they have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's Fee. If, however, any such loss or damage required reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for services a fee proportionate to that stated in paragraph 11.6.2.

11.4.5.7. The cost of utilities, fuel and sanitary facilities at the site.

11.4.5.8. Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

11.4.5.9. Cost of premiums for additional Bonds and insurance required because of changes in the Work.

11.5. The term Cost of the Work shall not include any of the following:

11.5.1. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, lawyers, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in his principal or a branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in subparagraph 11.4.1-all of which are to be considered administrative costs covered by the Contractor's Fee.

11.5.2. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the site.

11.5.3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.

11.5.4. Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same (except for additional Bonds and insurance required because of changes in the Work).

11.5.5. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.

11.5.6. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.4.

Contractor's Fee:

11.6. The Contractor's Fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

11.6.1. a mutually acceptable fixed fee; or if none can be agreed upon,

11.6.2. a fee based on the following percentages of the various portions of the Cost of the Work:

11.6.2.1. for costs incurred under paragraphs 11.4.1 and 11.4.2, the Contractor's Fee shall be ten percent,

11.6.2.2. for costs incurred under paragraph 11.4.3, the Contractor's Fee shall be five percent; and if a subcontractor is on the basis of Cost of the Work Plus a Fee, the maximum allowable to the Subcontractor as a fee for overhead and profit shall be ten percent, and

11.6.2.3. no fee shall be payable on the basis of costs itemized under paragraphs 11.4.4, 11.4.5, and 11.5.

11.7. The amount of credit to be allowed by CONTRACTOR to OWNER for any such change which results in a net decrease. When both additions and credits are involved in any one change, the combined overhead and profit shall be figured on the basis of the net increase, if any.

Adjustment of Unit Prices:

11.8. Whenever the cost of any Work is to be determined pursuant to paragraphs 11.4 and 11.5, CONTRACTOR will submit in form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

11.9. Where the quantity of Work with respect to any item that is covered by a unit price differs materially and significantly from the quantity of such Work indicated in the Contract Documents, an appropriate Change Order shall be issued on recommendation of ENGINEER to adjust the unit price.

Cash Allowances:

11.10. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be done by such Subcontractors, manufacturers, fabricators, suppliers or distributors and for such sums within the limit of the allowances as may be acceptable to ENGINEER. Upon final payment, the Contract Price shall be adjusted as required and an appropriate Change Order issued. CONTRACTOR agrees that the original Contract Price includes such sums as CONTRACTOR deems proper for costs and profit on account of cash allowances. No demand for additional cost or profit in connection therewith will be valid.

ARTICLE 12-CHANGE OF THE CONTRACT TIME

12.1. The Contract Time may only be changed by a Change Order. Any claim for an extension in the Contract Time shall be based on written notice delivered to OWNER and ENGINEER within fifteen days of the occurrence of the event giving rise to the claim. Notice of the extent of the claim supporting data shall be delivered within forty-five days of such occurrence unless ENGINEER allows an additional period of time to ascertain more accurate data. All claims for adjustment in the Contract Time resulting from any such claim shall be incorporated in a Change Order.

12.2. The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of CONTRACTOR if a claim is made therefore as provided in paragraph 12.1. Such delays shall include, but not to be limited to, acts or neglect by OWNER or others performing additional Work as contemplated by Article 7, or to fires, floods, labor disputes, epidemics, abnormal weather conditions, or acts of God.

12.3. All time limits stated in the Contract Documents are of the essence of the Agreement. The provisions of this Article 12 shall not exclude recovery for damages (including compensation for additional professional service) for delay by either party.

ARTICLE 13-WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

Warranty and Guarantee:

13.1. CONTRACTOR warrants and guarantees to OWNER and ENGINEER that all Work will be in accordance with the Contract Documents and will not be defective. Prompt notice of all defects shall be given to CONTRACTOR. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in the Article 13.

Access to Work:

13.2. ENGINEER and ENGINEER's representatives, other representatives of OWNER, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspection and testing. CONTRACTOR shall provide proper and safe conditions for such access.

Tests and Inspections:

13.3. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals.

13.4. If any law, ordinance, rule, regulation, code, or order of any public body having jurisdiction requires any Work (or part thereof) to specifically be inspected, tested or approved, CONTRACTOR shall assume full responsibility therefore, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval. CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with OWNER's or ENGINEER's acceptance of a manufacturer, fabricator, supplier or distributor of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work. The cost of all other inspections, tests and approvals required by the Contract Documents shall be paid by OWNER (unless otherwise specified).

13.5. All inspections, tests or approvals other than those required by law, ordinance, rule, regulation, code or order of any public body having jurisdiction shall be performed by organizations acceptable to OWNER and CONTRACTOR (or by ENGINEER is so specified).

13.6. If any Work that is to be inspected, tested or approved is covered without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation. Such uncovering shall be at CONTRACTOR's expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR's intention to cover such Work and ENGINEER has not acted with reasonable promptness in response to such notice.

13.7 Neither observations by ENGINEER nor inspections, tests or approvals by others shall relieve CONTRACTOR from his obligations to perform the Work in accordance with the Contract Documents.

Uncovering Work:

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

13.9. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER's request, shall uncover, expose or otherwise make available for observation, inspection or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment. If it is found that such Work is defective, CONTRACTOR shall bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, including compensation for additional professional services, and an appropriate deductive Change Order shall be issued. If, however, such Work is not found to be defective, CONTRACTOR shall 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 if he makes a claim therefore as provided in Articles 11 and 12.

Owner May Stop the Work:

13.10. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workmen or suitable materials or equipment, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any other party.

Correction or Removal of Defective Work:

13.11. If required by ENGINEER, CONTRACTOR shall promptly, without cost to OWNER and as specified by ENGINEER, either correct any defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by ENGINEER, remove it from the site and replace it with non defective Work.

One Year Correction Period:

13.12. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions, either correct such defective Work, or, if, it has been rejected by OWNER, remove it from the site and replace it with non defective Work. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by CONTRACTOR.

Acceptance of Defective Work:

13.13. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER's recommendation of final payment, also ENGINEER) prefers to accept it, OWNER may do so. In such case, if acceptance occurs prior to ENGINEER's recommendation of final payment, a Change Order shall be issued incorporating the necessary revisions in the Contract Documents, including appropriate reduction in the Contract Price; or, if the acceptance occurs after such recommendation, an appropriate amount shall be paid by CONTRACTOR to OWNER.

Owner May Correct Defective Work:

13.14. If CONTRACTOR fails within a reasonable time after written notice of ENGINEER to proceed to correct and to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.11, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents (including any requirements of the progress schedule), OWNER may, after seven days' written notice to CONTRACTOR, correct and remedy any such deficiency. In exercising his rights under this paragraph OWNER shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees such access to the site as may be necessary to enable OWNER to exercise his rights under this paragraph. All direct and indirect costs of OWNER in exercising such rights shall be charged against CONTRACTOR in an amount verified by ENGINEER, and a Change Order shall be issued incorporating the necessary revisions in the Contract Documents and a reduction in the Contract Price. Such direct and indirect costs shall include, in particular but without limitation, compensation for additional professional services required and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR's defective Work. CONTRACTOR shall not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by OWNER of OWNER's rights hereunder.

ARTICLE 14-PAYMENTS TO CONTRACTOR AND COMPLETION

Schedules:

14.1. At least ten days prior to submitting the first Application for a progress payment, CONTRACTOR shall (except as otherwise specified in the General Requirements) submit to ENGINEER a progress schedule, a final schedule of Shop Drawing submission and where applicable a schedule of values of the Work. These schedules shall be satisfactory in form and substance to ENGINEER. The schedule of values shall include quantities and unit prices aggregating the Contract Price, and shall subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Upon acceptance of the schedule of values by ENGINEER, it will be incorporated into a form of Application for Payment acceptable to ENGINEER.

Application for Progress Payment:

14.2. At least ten days before each progress payment falls due (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents and also as 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 the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by such data, satisfactory to OWNER, as will establish OWNER's title to the material and equipment and protect OWNER's interest therein, including applicable insurance. Each subsequent Application for Payment shall include an affidavit of CONTRACTOR stating that all previous progress payments received on account of the Work have been applied to discharge in full all of CONTRACTOR's obligations reflected in prior Applications for Payment. The amount of Retainage with respect to progress payments will be as stipulated in the Agreement.

CONTRACTOR's Warranty of Title:

14.3. CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER at the time of payment free and clear of all liens, claims, security interests and encumbrances (hereafter in these General Conditions referred to as "Liens").

Review of Applications for Progress Payment:

14.4. ENGINEER will, within ten days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER, or return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application. OWNER shall, within ten days of presentation to him of the Application for Payment with ENGINEER's recommendation pay CONTRACTOR the amount recommended.

14.5. ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER's on-site observations of the Work in progress as an experienced and qualified design professional and on ENGINEER's review of the Application for Payment and the accompanying data and schedules that the Work has progressed to the point indicated; that, to the best of ENGINEER's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning Project upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents and any qualifications stated in the recommendation: and that CONTRACTOR is entitled to payment of the amount recommended. However, by recommending any such payment ENGINEER will not thereby be deemed to have represented that exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work, or that the means, methods, techniques, sequences, and procedures of construction have been reviewed or that any examination has been made to ascertain how or for what purpose CONTRACTOR has used the moneys paid or to be paid to CONTRACTOR on account of the Contract Price, or that title to any Work, materials or equipment has passed to OWNER free and clear of any Liens.

14.6. ENGINEER's recommendation of final payment will constitute an additional representation by ENGINEER to OWNER that the conditions precedent to CONTRACTOR's being entitled to final payment as set forth in paragraph 14.13 have been fulfilled.

14.7. ENGINEER may refuse to recommend the whole or any part of any payment if, in his opinion, it would be incorrect to make such representations to OWNER. He may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify and such payment previously recommended to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:

14.7.1. the Work is defective, or completed Work has been damaged requiring correction or replacement,

14.7.2. written claims have been made against OWNER or Liens have been filed in connection with the Work,

14.7.3. the Contract Price has been reduced because of Modifications,

14.7.4. OWNER has been required to correct defective Work or complete the Work in accordance with paragraph 13.14,

14.7.5. of CONTRACTOR's unsatisfactory prosecution of the Work in accordance with the Contract Documents, or

14.7.6. CONTRACTOR's failure to make payment to Subcontractors, or for labor, materials or equipment.

Substantial Completion:

14.8. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall, in writing to OWNER and ENGINEER, certify that the entire Work is substantially complete and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, CONTRACTOR and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving his reasons therefore. If ENGINEER considers the Work substantially complete. ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which he may make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within fourteen days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating his reasons therefore. If, after consideration of OWNER's objections, ENGINEER considers the Work substantially complete, ENGINEER will within said fourteen days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as he believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Complete ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities and insurance. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER prior to his issuing the definitive certificate of Substantial Completion ENGINEER's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

14.9. OWNER shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

Partial Utilization:

14.10. Use by OWNER of completed portions of the Work may be accomplished prior to Substantial Completion of all the Work subject to the following:

14.10.1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any part of the Work which OWNER believes to be substantially complete and which may be so used without significant interference with construction of the other parts of the Work. If CONTRACTOR agrees, CONTRACTOR will certify to OWNER and ENGINEER that said part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time thereafter OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving his reasons therefore. If ENGINEER considers that part of the Work to be substantially complete, ENGINEER will execute and deliver to OWNER and CONTRACTOR a certificate to that effect, fixing the date of Substantial Completion as to that part of the Work, attaching thereto a tentative list of items to be completed or corrected before final payment. Prior to issuing a certificate of Substantial Completion as to part of the Work ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to the division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, utilities and insurance for that part of the Work which shall become binding upon OWNER and CONTRACTOR at the time of issuing the

definitive certificate of Substantial Completion as to that part of the Work unless OWNER and CONTRACTOR shall have otherwise agreed in writing and so informed ENGINEER. OWNER shall have the right to exclude CONTRACTOR from any part of the Work which ENGINEER has so certified to be substantially complete, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.10.2. In lieu of the issuance of a certificate of Substantial Completion as to part of the Work, OWNER may take over operation of a facility constituting part of the Work whether or not it is substantially complete if such facility is functionally and separately usable; provided that prior to any such takeover, OWNER and CONTRACTOR have agreed as to the division of responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, correction period, heat, utilities and insurance with respect to such facility.

14.10.3. No occupancy of part of the Work or taking over of operations of a facility will be accomplished prior to compliance with the requirements of paragraph 5.14 in respect of property insurance.

Final Inspection:

14.11. Upon written notice from CONTRACTOR that the Work is complete, ENGINEER will make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to remedy such deficiencies.

Final Application for Payment:

14.12. After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, marked up record documents and other documents-all as required by the Contract Documents, and after ENGINEER has indicated that the Work is acceptable (subject to the provisions of paragraph 14.16). CONTRACTOR may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents and such other data and schedules as ENGINEER may reasonably require, together with complete and legally effective releases or waivers (satisfactory to OWNER) of all Liens arising out or filed in connection with the Work. In lieu thereof and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full; an affidavit of CONTRACTOR that the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or his property might in any way be responsible, have been paid or otherwise satisfied; and consent of the Surety, if any, to final payment. If any Subcontractor, manufacturer, fabricator, supplier or distributor fails to furnish a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

Final Payment and Acceptance:

14.13. If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation-all as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR has fulfilled all of his obligations under the Contract Documents, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing his recommendation of payment and present the Application to OWNER for payment. Thereupon ENGINEER will give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.16. Otherwise, ENGINEER will return the Application to CONTRACTOR shall make the necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, OWNER shall, within thirty days after receipt thereof pay CONTRACTOR the amount recommended by ENGINEER.

14.14. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed thereof and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been

furnished as required in paragraph 5.1, the written consent of the Surety to the payment of the balance due for that portion of the Work fully completed accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

Contractor's Continuing Obligation:

14.15. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by ENGINEER, nor the issuance of a certificate of Substantial Completion, nor any payment by OWNER to CONTRACTOR under the Contract Documents, nor any use or occupancy of the Work or any act of acceptance by OWNER nor any failure to do so, nor the issuance of a notice of acceptability by ENGINEER pursuant to paragraph 14.13, nor any correction of defective Work by OWNER shall constitute an acceptance of Work not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents.

Waiver of Claims:

14.16. The making and acceptance of final payment shall constitute:

14.16.1. a waiver of all claims by OWNER against CONTRACTOR, except claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.11 or from failure to comply with the Contract Documents or the terms of any special guarantees specified therein; however, it shall not constitute a waiver by OWNER of any rights in respect of CONTRACTOR's continuing obligations under the Contract Documents; and

14.16.2. a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

ARTICLE 15-SUSPENSION OF WORK AND TERMINATION

Owner May Suspend Work:

15.1. OWNER may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to CONTRACTOR and ENGINEER which shall fix the date on which Work shall be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if he makes a claim thereof as provided in Articles 11 and 12.

Owner May Terminate:

15.2. Upon the occurrence of any one or more of the following events:

15.2.1. if CONTRACTOR is adjudged a bankrupt or insolvent,

15.2.2. if CONTRACTOR makes a general assignment for the benefit of creditors,

15.2.3. if a trustee or receiver is appointed for CONTRACTOR or for any of CONTRACTOR's property,

15.2.4. if CONTRACTOR files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or similar laws,

15.2.5. if CONTRACTOR repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment,

15.2.6. if CONTRACTOR repeatedly fails to make prompt payments to Subcontractors of for labor, materials or equipment,

15.2.7. if CONTRACTOR disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction,

15.2.8. if CONTRACTOR disregards the authority of ENGINEER, or

15.2.9. if CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents,

OWNER may after giving CONTRACTOR and his Surety seven days' written notice, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Work, including compensation for additional professional services, such excess shall be paid to CONTRACTOR. If such costs exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such costs incurred by OWNER shall be verified by ENGINEER and incorporated in a Change Order, but in finishing the Work OWNER shall not be required to obtain the lowest figure for the Work performed.

15.3. Where CONTRACTOR's services have been so terminated by OWNER, the termination shall not affect any rights of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.4. Upon seven days' written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Agreement. In such case, CONTRACTOR shall be paid for all Work executed and any expense sustained plus reasonable termination expenses.

Contractor May Stop Work or Terminate:

15.5. If, through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within thirty days after it is submitted, or OWNER fails for thirty days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days' written notice to OWNER and ENGINEER, terminate the Agreement and recover from OWNER payment for all Work executed and any expense sustained plus reasonable termination expenses. In addition and in lieu of terminating the Agreement, if ENGINEER has failed to act on an Application for Payment or OWNER has failed to make any payment as aforesaid, CONTRACTOR may upon seven days' notice to OWNER and ENGINEER stop the Work until payment of all amounts then due. The provisions of this paragraph shall not relieve CONTRACTOR of his obligations under paragraph 6.29 to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with OWNER.

ARTICLE 16-ARBITRATION

16.1. All claims, disputes and other matters in question between OWNER and CONTRACTOR arising out of, or relating to the Contract Documents or the breach thereof except for claims which have been waived by the making or acceptance of final payment as provided by paragraph 14.16, shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then obtaining subject to the limitations of this Article 16. This agreement so to arbitrate and any other agreement or consent to arbitrate entered into in accordance herewith as provided in the Article 16 will be specifically enforceable under the prevailing arbitration law of any court having jurisdiction.

16.2. No demand for arbitration of any claim, dispute or other matter that is required to be referred to ENGINEER initially for decision in accordance with paragraph 9.9 shall be made until the earlier of (a) the date on which ENGINEER has rendered a decision or (b) the tenth day after the parties have presented their evidence to ENGINEER if a written decision has not been rendered by ENGINEER before that date. No demand for arbitration of any such claim, dispute or other matter shall be made later than thirty days after the date on which ENGINEER has rendered a written decision in respect thereof in accordance with paragraph 9.9; and the failure to demand arbitration within said thirty days' period shall result in ENGINEER's decision being final and binding upon OWNER and CONTRACTOR. If ENGINEER renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence but shall not supersede the arbitration proceedings, except where the decision is acceptable to the parties concerned.

16.3. Notice of the demand for arbitration shall be filed in writing with the other party to the Agreement and with the American Arbitration Association, and a copy shall be sent to ENGINEER for information. The demand for arbitration shall be made within the thirty-day period specified in paragraph 16.2 where applicable, and in all other cases within a reasonable time after the claim, dispute or other matter in question has arisen, and in no event shall any such demand be made after institution of legal or equitable proceedings based on such claim, dispute or other matter in question would be barred by the applicable statute of limitations.

16.4. No arbitration arising out of or relating to the Contract Documents shall include by consolidation, joinder or in any other manner any other person or entity (including ENGINEER, his agents, employees or consultants) who is not a party to this Agreement unless:

16.4.1. the inclusion of such other person or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration,

16.4.2. such other person or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings, and

16.4.3. the written consent of the other person or entity sought to be included and of OWNER and CONTRACTOR has been obtained for such inclusion, which consent shall make specific reference to this paragraph; but no such consent shall constitute consent to arbitration of any dispute not specifically described in such consent or to arbitration with any party not specifically identified in such consent.

16.5. The award rendered by the arbitrators will be final, judgment may be entered upon it in any court having jurisdiction thereof, and will not be subject to modification or appeal except to the extent permitted by Sections 10 and 11 of the Federal Arbitration Act (9 U.S.C. 10,11)

ARTICLE 17-MISCELLANEOUS

Giving Notice:

17.1. Whenever any provision of the Contract Documents require the giving of written notice it shall be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

Computation of Time:

17.2. When any period of time is referred to in the Contract Documents by days, it shall be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day shall be omitted from the computation.

General:

17.3. Should OWNER or CONTRACTOR suffer injury or damage to his person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim shall be made in writing to the other party within a reasonable time of the first observance of such injury or damage.

17.4. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligation imposed upon CONTRACTOR by paragraphs 6.30, 13.1, 13.11, 13.14, 14.3, and 15.2 and all of the rights and remedies available to OWNER and ENGINEER thereunder, shall be in addition to, and shall not be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by law or contract, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph shall be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply. All representations, warranties and guarantees made in the Contract Documents shall survive final payment and termination or completion of this Agreement.

****END OF SECTION****

SECTION 7

SUPPLEMENTAL GENERAL CONDITIONS

1. SURVEYS

- A. The owner shall furnish all boundary surveys and establish all base lines for locating the principle component parts of the work together with suitable number of bench marks 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.
- B. The contractor shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

2. INSURANCE

- A. Each insurance policy shall be renewed 10 days before the expiration date thereof.
- B. Insurances must be carried by a recognized insurance company licensed to do business in the state in which the project is constructed and approved by the Owner's Attorney.
- C. The contractor's and his subcontractor's Insurance Coverage shall provide protection in the amounts as specified in the Special Conditions against the following special hazards:

Blasting:

Damage to existing structures

Damage to private driveways, sidewalks, shrubbery, plantings, trees, etc.

Damage to public utilities, i.e. electric, water, sanitary sewer, storm sewer, telephone, gas, telecable, etc.

Damage to U.S. Government markers.

The insurance certificates themselves must contain the naming of the aforesated special hazards.

- D. The contractor shall not commence work under this Contract until he has obtained all the insurance required and such insurance has been approved by the Owner, nor shall the contractor allow any subcontractor to commence work on his subcontract until the insurance required of the subcontractor has been obtained and approved.
- E. In the event any insurance coverage should be canceled or allowed to lapse, the contractor will not be permitted to work until adequate and satisfactory insurance is in effect. Failure to keep insurance policies in effect WILL NOT be cause for any claims for extension of the time under this Contract.
- F. Section 5.3.4 - Contractor's Personal Injury Liability Insurance as contained under Article 5 - "Bonds and Insurance" of the General Conditions shall include the following definition:

"Personal injury" means injury, other than "bodily injury", arising out of one or more of the following offenses:

- a. False arrest, detention or imprisonment;
- b. Malicious prosecution;
- c. The wrongful eviction from, wrongful entry into, or invasion of the right of private occupancy of a room, dwelling or premises that a person occupies by or on behalf of its owner, landlord or lessor;
- d. Oral or written publication of material that slanders or libels a person or organization or disparages a person's or organization's goods, products, or services; or
- e. Oral or written publication of material that violates a person's right of privacy.

3. SEWAGE, SURFACE AND FLOOD FLOWS

- A. The Contractor shall furnish all the necessary equipment, shall take all necessary precautions and shall assume the entire cost of handling any sewage, seepage, storm, surface, and flood flows which may be encountered at any time during the construction of the Work. The manner of providing for these flows shall meet the approval of the Engineer, and the entire cost of said work shall be included in prices bid for the various items of the Work to be done under this Contract.
- B. The Contractor shall minimize siltation and bank erosion during construction.

- C. During the period of construction the Contractor shall cooperate with the Owner's employees in maintaining all existing treatment facilities in operation. The cost of any temporary connections or bypasses shall be included in the price bid for other items of work under this Contract, as no separate payment will be made.
- D. No wastewater will be bypassed during construction unless a schedule has been approved by the applicable State Department of Public Health and the U.S. Environmental Protection Agency if required pursuant to terms of NPDES Permit.

4. BID SECURITY

A bid security will be required as called for in Item 6, Bid Security, of Section 1 "Information For Bidders" and as described in the "Invitation For Bids" letter. There may be occasion where no bid security will be required. This will be stated in the "Invitation For Bids" letter.

5. RECORD DRAWINGS

The Contractor shall provide to Cleveland Utilities, within thirty (30) calendar days after acceptance of the work, record drawings in accordance with the appropriate sections of these specifications.

** END OF SECTION **

SECTION 8

SPECIAL CONDITIONS

1. INSURANCE COVERAGE (Refers to Article 5, General Conditions, and Paragraph 2, Supplemental General Conditions)

A. The limits of liability for the insurance required by Article 5, General Conditions, shall provide coverage for not less than the following amounts or greater where required by law:

- 1. Worker's Compensation, etc.
 - a. State Statutory
 - b. Applicable Federal Statutory
 - c. Employer's Liability \$100,000 per occurrence/
\$500,000 policy limit

- 2. Comprehensive General Liability
 - \$1,000,000 per occurrence/ \$1,000,000 aggregate
 - \$1,000,000 products/completed operations aggregate

- 3. Comprehensive Automobile Liability
 - \$1,000,000 per accident

B. Owner's Liability Insurance

Delete Paragraph 5.5 of Article 5, General Conditions, and add the following:

The contractor shall be responsible for purchasing and maintaining liability insurance as will protect the Owner against claims which may arise from operations under the Contract. The Engineer shall be endorsed as additional insured on this policy. The insurance shall be in the amount of not less than \$1,000,000.

** END OF SECTION **

GENERAL REQUIREMENTS

SECTION 11

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 SCOPE

This section describes the methods by which measurement will be made of the quantities for which payment will be made for the project.

It is the intention of this Specification that payment will be made for those items listed in the Bid Form only. All items of work not specifically listed in the Bid Form shall be considered incidental to the construction, and the cost of all such work and material shall be included in the prices bid for the various items listed.

PART 2 - PRODUCTS

2.01 MEASUREMENT AND PAYMENT

Partial payment shall be made for approved materials stored at the project site at the presentation of material invoices in the proper manner. For ongoing construction contracts, stored materials will be addressed as a part of the monthly partial payment request.

PART 3 - EXECUTION

3.01 OTHER SECTIONS

No separate payment shall be made for work included in the following Sections. The cost of this work shall be included in the unit prices and/or lump sum prices bid for other items of work.

SECTION 1	INFORMATION FOR BIDDERS
SECTION 5	STANDARD AGREEMENT BETWEEN OWNER AND CONTRACTOR
SECTION 6	GENERAL CONDITIONS
SECTION 7	SUPPLEMENTARY GENERAL CONDITIONS
SECTION 8	SPECIAL CONDITIONS
SECTION 11	MEASUREMENT AND PAYMENT
SECTION 13	GUARANTEES AND WARRANTIES

SECTION 15	PROJECT RECORD DOCUMENTS
SECTION 40	CONCRETE REINFORCEMENT
SECTION 110	SEEDING
SECTION 130	STERILIZATION
SECTION 150	SLOPE PROTECTION AND EROSION CONTROL
SECTION 200	CONSTRUCTION DETAIL DOCUMENTS

3.02 SECTION 20 - EARTHWORK

A. Measurement and Payment

1. Excavation

- a. No separate measurement or payment will be made for trench earth excavation for sewers and other pipelines, nor for any other appurtenant facilities such as manholes, inlets, outlets, headwalls, collars, saddles, piers, and pipe protection or encasement. Payment for all such excavation shall be included in the unit price bid per linear foot of the varies sizes of pipe laid for the respective trench depths as provided for in the contract Bid Schedule. Trench depths shall be the vertical distance between the ground surface and the invert elevation of the pipe. Where special bedding or cradles are shown on the Drawings or required by the Engineer, no allowance shall be made for extending earth excavation in the trenches to the bottom of such bedding or cradles; such costs shall be included in the unit price bid for bedding materials or cradles.
- b. The removing of all pavements, pavement foundations, sidewalks, driveways, etc., will be included in the trench excavation for which payment will be made as provided for in paragraph a. above. No separate payment will be made for these items.
- c. No separate payment shall be made for pumping, bailing, draining, clearing, grubbing, backfilling, borrow excavation, removing vegetable growth, debris, buildings, or waste material nor for the disposal of any materials or similar work. Where sewers or structures are located in, near or across stream beds or drainage ditches no separate payment shall be made for diverting the stream flow or drainage and dewatering each section as the work progresses.

2. Sheeting and Shoring

No measurement or payment will be made for sheeting and shoring left in place in trenches in accordance with these Specifications unless the upper portion is likewise ordered to be left in place under written instructions from the Engineer, in which case, sheeting so ordered to be left in place shall be measured by nominal thousand feet board measure of timber. Payment shall be made for the quantities determined as specified above at the unit price bid per MFBM. No allowance shall be made for spikes, screens, hardware, etc., the cost of which shall be included in the unit price bid per MFBM of sheeting and shoring left in place.

3. Bedding Material

Bedding material for trench stabilization, rock trench bedding, or other use as required by these Specifications and/or shown on the Drawings shall be measured by the cubic yard of bedding required for the specified trench width only. Payment for crushed stone or gravel placed as required by the Drawings or Specifications or as directed by the Engineer shall be made for the quantities determined in the manner specified above at the unit price bid per cubic yard of crushed rock bedding material in the Contract Bid Schedule and shall include the cost of removing all subgrade materials regardless of classification to the required or specified bottom of the crushed stone bedding. No separate payment shall be made for bedding, but payment shall be included in the unit prices for pipe.

4. Rock Excavation

a. Definition

- (1) Sound, solid rock in its original position in ledges, bedded deposits, or masses of such hardness and texture that, in the opinion of the Engineer, cannot be loosened or broken down and removed by use of heavy construction equipment such as power shovels, bulldozers, heavy-duty rooters, etc., without drilling and blasting, shall be classified as rock excavation.
- (2) Boulders, stones, or pieces of masonry that are one-half cubic yard or larger in volume shall be considered rock excavation.
- (3) Hard pan, small boulders less than one-half cubic yard in volume, chert, clay, soft shale, soft and disintegrated rock, and similar material shall not be considered as rock even though the Contractor elects to excavate same by drilling and blasting methods.

b. Determination of Pay Quantities

- (1) The volumes of rock excavation for which payment will be allowed shall be expressed in cubic yards as computed from cut measurements.
- (2) For pipeline excavation, the allowable volume of rock excavation shall be based on the maximum allowable width of trench as shown on the plans and specified herein, and on the centerline depth of rock from the top of rock to the specified bottom of the trench plus whatever depth is required by the plans and Specifications for bedding if rock extends to such depth, or to the bottom of the rock if above these depths. No allowance shall be made for excavating to extra widths for construction of pipeline appurtenances, or for any other reason, and costs of such additional rock excavation shall be included in the unit price bid for this item.
- (3) Rock excavation shall be computed by the average-end-area method. All measurements shall be taken to the nearest 1/10 foot.

c. Payment

1. Payment for rock excavation performed under these Specifications shall be made for the quantities determined in the manner specified above at the applicable contract unit price per cubic yard as listed in the Bid Schedule.
2. These amounts, so paid, shall cover the cost of furnishing all labor, materials, tools, plant, and other expense in connection with or incidental to rock excavation.

3.03 SECTION 30, CAST-IN-PLACE CONCRETE

A. Measurement and Payment

1. Except for concrete sidewalks, paving, concrete for manholes, railroad and highway crossings, etc., payment for which is provided elsewhere. Payment for Class A and Class B concrete shall be made for the quantities placed at the unit prices bid per cubic yard in the Bid Schedule. These equipment, tools, plant services, and other expenses in connection with or incidental to the concrete work.

2. The volumes of each class of concrete for which payment will be allowed shall be expressed in cubic yards as computed from the dimensions of the neat lines shown on the Drawings. Where concrete masonry for which specific dimensions are not given on the Drawings has been placed under the direction of the Engineer, the volume shall be determined by the Engineer from field measurements.
3. The volume allowed for payment shall include only the items of concrete placed in accordance with these Specifications and accepted by the Engineer. No deductions will be made for pipe or conduit runs 3 inches or under or for individual cavities or embedded pieces less than 1 cubic foot each or for reinforcement.

3.04 SECTION 50, DUCTILE IRON PIPE, DUCTILE IRON AND CAST IRON FITTINGS; SECTION 60 POLYVINYL CHLORIDE (PVC) WATER PRESSURE PIPE

A. Measurement

1. Polyvinyl chloride pipe and ductile iron pipe installed underground shall be measured in linear feet along the centerline of the installed pipe with no deduction for fittings, valves, etc., within the limits of the installation work performed under these Contracts.
2. Payment for ductile iron fittings made under this section shall be the number and type of fittings furnished and placed, jointed and tested, in accordance with these Specifications. No separate payment will be allowed for jointing compound, bolts, nuts, washers, or gaskets which shall be considered an incidental part of the fitting and included in the unit price bid per type of fittings.
3. Any necessary repairs to existing mains and service lines damaged during performance of work under these Contracts shall be made at the Contractor's expense and no reimbursement will be made for any labor, material, equipment, or other costs involved in such repairs. Materials furnished by the Owner shall not be used for such repairs unless approved by the Owner and the Contractor compensates the Owner for the cost of such materials so used.

4. Where connections are shown or required to be made between new and existing water mains, the cost of all such work, services, and equipment, including excavation, cutting pipe, pumping, etc., as required to complete such connections shall be included in the unit prices bid in the Bid Schedule and no separate payment therefor will be made. Payment for furnishing and installing any new pipe and fittings and furnishing and installing accessory items such as valves, etc., required for such connections shall be made at the applicable unit prices bid.
5. Concrete for pipe protection and encasement and concrete thrust blocking at bends and other fittings, when and as authorized by the Engineer, shall be paid for at the unit price per cubic yard of Class B Concrete as set forth in the Bid Schedule.
6. Crushed rock, gravel, or other approved bedding material placed in accordance with Drawing dimensions and these Specifications shall be expressed in linear feet of bedding measured along the centerline of the trench.

B. Payment

1. Payment for furnishing, testing, sterilizing, placing in service and installing, complete in place, polyvinyl chloride pipe, ductile iron pipe, and specials, including all common excavation and backfill, shall be made per linear foot of pipe installed at the applicable contract unit prices set forth for each size and type of pipe in the Bid Schedule.
2. Payment so made shall constitute full compensation to the Contractor for material, excavation and backfill, installation, sterilization and tests, including all labor, materials, tools, equipment, and services necessary to complete the work as specified herein.

3.05 SECTION 65, WATER SERVICE LINE INSTALLATION

A. Measurement

1. The quantity of services installed for which payment will be allowed shall be the actual length and size installed by the Contractor complete and accepted by the Engineer.

2. The quantity of service line and fittings placed underground for which payment will be allowed shall be expressed in linear feet for each size of service line installed and shall be measured along the central axis of the pipe after the pipe and fittings have been installed. Measurement shall be from the corporation stop on the water main to the curb stop in a new meter box.

B. Payment

1. Payment for furnishing and installing all service line and fittings for service lines placed in underground installations shall be paid for at the applicable unit prices bid in the Bid Schedule for the actual linear feet of each size service line placed. No additional payment shall be allowed for plugs or markers used on service lines.
2. No separate payment will be made for connecting pipe on air release valves, gauges, etc., fittings, joint materials, excavation, boring, jacking, service ties, sterilizing, or testing. The cost of these items of work shall be included in the applicable unit prices bid per linear foot for each size and type of pipe.
3. Payment for furnishing all new meter services complete with meter box, saddles, corporation stops, angle valves, and all other fittings and accessories including excavation and backfill as specified and required for a proper installation shall be made at the applicable unit price bid in the Bid Schedule for each meter service installed.

3.06 SECTION 70 POLYVINYL CHLORIDE (PVC) SEWER & SERVICE PIPE

A. Measurement

1. The quantities of pipe sewers and service lines, including unclassified excavation, for which payment will be allowed shall be expressed in linear feet for each size and type of pipe and applicable depth as shown in the Bid Schedule and shall be the horizontal length of sewer installed complete in place as measured along the centerline of the sewer with no deductions made for tee connections or manholes. The applicable vertical depth shall be measured from the original ground surface to the invert of the sewer and shall be as shown on the Bid Schedule.
2. The quantities of tee connections and plugged stubs for which payment will be allowed shall be the actual number of each size and type furnished and installed by the Contractor.

3. Reinforcing steel, rock excavation, concrete, pipe protection and/or encasement, crushed rock, gravel, or other approved bedding materials, and sections of work not specifically listed in the Bid Schedule shall not be separately measured and paid for but costs for same shall be included in the unit price or lump sum price bid for other sections of work.
4. The quantities of connecting risers for which payment will be allowed shall be expressed in linear feet of pipe and bends and shall be the vertical length of riser installed in place as measured along the centerline of the riser from the centerline elevation of the sewer line to the top of the riser connection as shown on the Drawings. No separate payment will be made for bends, concrete or plastic film markers used in this construction, payment therefor being included in the linear feet of riser pipe paid for in this category.

B. Payment

1. Payment for pipe sewers, service lines, tees, risers, plugged stubs, and connections to sewer pipe constructed under these Specifications shall be made for the quantities determined in the manner specified above at the contract price per linear foot or per each, as applicable, for each of the applicable pipe and special sizes and types listed in the contract pay items in the Bid Schedule.
2. Payment for concrete and bedding materials furnished and placed under this Specification shall be made for the quantities determined in the manner specified above at the contract price per cubic yard and as listed under the applicable items of the Bid Schedule as specified.
3. No separate payment shall be made for furnishing and installing stoppers. The cost of this item shall be included in the unit prices bid for other items of work done in the Bid Schedule.
4. No separate payment shall be made for furnishing and installing adapters, bends, increasers and tees, cleanouts and other fittings and accessories in the building service lines. The cost of these shall be included in the unit prices bid for service lines in the Bid Schedule.
5. The quantities of cast iron and ductile iron pipe sewers installed in casing pipes for railroad or highway crossings for which payment will be made under this item shall be expressed in linear feet for each size and type of pipe as shown in the Bid Schedule and shall be the horizontal length of cast iron or ductile iron sewer installed complete in place as measured along the centerline of the sewer with no deductions made for manholes.

6. No separate payment shall be made for connections to existing sewers and to manholes, or inlets. The cost of this work shall be included in the unit price bid for other items of work.
7. No separate payment shall be made for any unclassified or borrow excavation, clearing, or backfill in connection with sewer line construction. The cost of these items shall be included in the unit prices bid for pipe sewers.
8. These amounts shall cover the cost of furnishing all materials, tools, labor, plant, equipment, services, and other expenses in connection with common trench excavation and furnishing and installing all items of work herein specified and when so paid, shall constitute full compensation to the Contractor.

3.07 SECTION 80, MANHOLES

A. Measurement and Payment

1. The quantities of standard manholes as shown on the Drawings for which payment shall be allowed, shall be the actual number of each type, size, and applicable depth of manhole, 6 feet deep or less, installed by the Contractor and accepted by the Engineer.
2. The depth of standard manholes will be measured from the top of the manhole frame to the invert of the lowest sewer leaving the manhole. The depth of special manholes constructed on top of concrete junction chambers, precast concrete tee manhole bases or curved manhole bases, cast in place, will be measured from the top of the manhole frame to the top of the concrete of the junction chamber, precast concrete tee base or curved manhole base, cast in place.
3. For manholes more than 6 feet in depth, payment will be allowed for extra depth per vertical foot for each foot thereof over 6 feet at the applicable unit price provided for in the Bid Schedule. Fractions of a foot of extra depth shall be accumulated until one extra foot has been constructed and then considered for payment.
4. Payment for precast concrete tee manhole bases shall be the actual number of each size furnished and installed by the Contractor and accepted by the Engineer.

5. Junction Chamber Payment for furnishing all materials, labor, etc., including unclassified excavation, concrete, reinforcing steel, toe pockets, maintenance of existing sewage flow, required adjustment of existing sewers, topsoil, and seeding, all required to complete the junction chamber as shown on the Drawings and in the applicable Specifications shall be included in the applicable lump sum price bid for junction chambers listed in the Bid Schedule. Payment for pipe sewer will not be allowed through the junction chamber.
6. All other items such as pavement replacement, plugged stubs, etc., shall be paid for under their respective items in the Bid Schedule as elsewhere provided herein.
7. Payment for all manholes as constructed under these Specifications shall be made for the quantities determined in the manner specified above as listed under the applicable pay items in the Bid Schedule. These amounts, so paid, shall constitute full compensation to the Contractor under this item and shall cover the cost of furnishing all labor, materials, tools, plant equipment, services, and other expenses in connection with the construction of manholes, complete in place, including unclassified excavation, backfill, masonry, all castings, concrete, reinforcing steel, inspection, and test, all as herein specified.
8. All drop manholes shall be measured and paid for as specified for standard manholes and, in addition, extra payment will be allowed at applicable contract unit price for each drop connection, including excavation, pipe specials, riser pipe, and concrete encasement as provided for in the Bid Schedule.
9. Payment for manhole adjusting rings furnished for future paving shall be made for the actual number furnished by the Contractor and accepted by the Engineer.
10. Payment for curved manhole bases, cast-in-place, shall be made at the applicable bid price for Class A concrete and reinforcing steel shown in the Bid Schedule. Measurements shall be made in accordance with the applicable provisions of these Specifications. No separate payment shall be made for excavation, backfill, or castings required to complete the work.

3.08 SECTION 90, VALVES

A. Measurement

Various types of valves as specified and shown on the Drawings shall be measured as a number of valves per type and size as reflected in the Bid Schedule.

B. Payment

Payment for furnishing and installing various type valves, complete in every respect as specified and shown on the Drawings shall be made at the applicable unit prices, each, bid for each size and type in the Bid Schedule or where applicable shall be included in the lump sum price bid for other items of work. The amount so paid shall cover the total cost of furnishing valve boxes, valve pits, bypass valves, common excavation, backfill, jointing materials, labor, equipment and services, all as herein specified and shown on the Drawings and payment so made shall constitute full compensation to the Contractor for the complete valve installation.

3.09 SECTION 100, FIRE HYDRANTS

Measurement and Payment

1. The quantity of fire hydrants installed for which payment will be allowed shall be the actual number of installations constructed by the Contractor complete as shown on the contract drawings and accepted by the Engineer.
2. Payment for fire hydrant installation constructed under these specifications shall be made for the quantity determined at the applicable unit price bid as contained in the Bid Schedule. Included in the unit price shall be the full compensation for common and rock excavation, D.I. pipe and fittings from the main water supply line to the fire hydrant including tee, gate valve, valve box, fire hydrant, bedding material, thrust block, backfilling, disposal of excess or unsuitable material, final clean up and completing all incidentals, and for furnishing all equipment, tools, labor, and incidentals necessary to complete the work.
3. Normal fire hydrant bury lengths for new water line installations is 3.5 feet. Where conditions or circumstances require a longer bury length, fire hydrant extensions may be ordered and installed only with the approval of the Engineer. Each extension length must be reviewed and approved by the Engineer on a case by case basis. Payment for fire hydrant extensions will be made per vertical foot as stated in the contract Bid Schedule. No payment will be made for extensions where the Contractor did not meet all water line extension requirements in these specifications or did not obtain the approval from the Engineer.

3.10 SECTION 120, NEW AND REPLACEMENT PAVEMENT CURBS, AND SIDEWALKS

A. Measurement

1. The quantities of crushed stone backfill for which payment will be made shall be expressed in linear feet of crushed stone backfill measured along the centerline of the trench and for the specified trench width for sewer lines and appurtenances placed in or across existing paved streets, driveways, and parking areas.
2.
 - a. The quantities of the various types of paving for which payment will be made shall be expressed in linear feet of street occupied by the main sewer and shall be measured along the centerline of the street from the point of entry to the exit point. When the paving is to be replaced for trench width only no separate payment will be made for replacing paving over service lines extending from the main sewer line to the edge of paving but the cost of such paving over the trenches cut for service lines shall be included in the price bid for replacing paving over the main service lines as determined above. If the street is to be repaved full street width, the Contractor shall satisfy himself as to the average width of the street. Payment will be allowed only one way through street intersection when full width of street is paved. No separate payment will be made for replacing pavement over the trenches cut for service lines.
 - b. In streets having asphaltic concrete paving over portland cement concrete base, the quantity of concrete base shall be expressed as linear feet of sewer line trench as measured along the centerline of the main sewer lines and service lateral lines.
 - c. The quantity of paving replacement in asphalt drives and parking lots for which payment will be allowed shall be expressed as linear feet of sewer trench centerline.
3. The quantity of sidewalks for which payment will be made shall be expressed in square feet and shall be obtained from surface measurements.
4. The quantity of asphaltic concrete curbs for which payment will be made shall be expressed in linear feet of asphaltic concrete curb.
5. The quantity of Portland cement concrete curbs for which payment will be made shall be expressed in cubic yards of Class A Concrete, as specified under Section 30 of these Specifications.

6. The quantities of Portland cement concrete paving in driveways for which payment will be made shall be expressed in square feet and shall be determined from surface measurements.

B. Payment

1. Payment for each type of pavement, sidewalk, asphalt curb, and crushed stone backfill furnished and installed under these Specifications shall be made for the quantities determined in the manner specified above at the applicable contract unit prices stated in the Bid Schedule. This amount, so paid, shall be compensation in full for furnishing all labor, materials, tools, plant equipment, services and other work in connection with or incidental to the construction of the roadway pavement.
2. When full width paving is required, no separate payment shall be allowed for extending paving into existing paved driveways in order to provide a smooth transition from the full width paved street to the existing driveway grade. The work shall be completed to the satisfaction for the Engineer with no separate payment being allowed.
3. No separate payment will be allowed for replacing or repairing unpaved, crushed stone, gravel or chert street surfaces, driveways or parking areas as specified in this section.
4. No separate payment will be made for placing crushed stone in the top four (4) inches of trenches as required under Section 20 of these Specifications nor for the temporary surface as required in this section. The cost of furnishing and placing this material shall be included in the price bid per linear foot of pipe under Sections 50, 60, or 70 of these Specifications.
5. Payment for concrete curbs installed under these Specifications shall be made at the applicable unit price per cubic yard of concrete under Section 30 of these Specifications.
6. No separate payment will be made for street cleanup, maintenance, or preparation for paving. The cost of this work is to be included in the unit price bid for crushed rock backfill in the Base Bid.

3.11 SECTION 140, RAILROAD AND HIGHWAY CROSSINGS (BORING METHOD)
SECTION 145, RAILROAD AND HIGHWAY CROSSINGS (TUNNEL METHOD)

A. Measurement and Payment

1. Payment for furnishing all labor, materials, equipment, and services required for the complete installation of casing pipe by boring or jacking methods, and steel liner plates by construction in tunnels including all classes of excavation, sand fill, concrete, wooden blocks, etc., all in accordance with these Specifications and details shown on the Drawings, shall be made at the applicable unit price bid in the Bid Schedule for the actual number of linear feet of casing pipe or liner plates installed. This measurement shall be made from outside end to outside end of casing pipe or liner plate and shall include the end sections that may be installed in open trench excavation.
2. Payment for furnishing all labor, materials, equipment and services required for the complete installation of casing pipe or steel liner plates by open-cut method, including all classes of excavation, sand fill, concrete, wooden blocks, removal and replacement of pavement, removal and replacement of tracks, ties, etc., backfill in accordance with instructions and details shown on the Drawings, crushed stone backfill, cement stabilizer, etc., all in accordance with the Specifications and details shown on the Drawings shall be made at the applicable unit price bid in the Bid Schedule for the actual number of linear feet of casing pipe or steel liner plates installed.
3. No separate payment shall be made for any pavement replacement for highway crossings installed by open-cut methods. The cost of this work shall be included in the unit prices bid for highway crossings installed by open-cut methods under Section 140 of the Bid Schedule.
4. Carrier pipe shall be furnished, installed and paid for under applicable provision of Section 50, Cast Iron and Ductile Iron Piping, or under Section 70, Polyvinyl Chloride (PVC) Pipe Sewers, of these specifications at the unit price bid under the respective section in the Bid Schedule.
5. Payment for sewer line construction in railroad and state highway rights-of-way shall be contingent upon approval and acceptance by the railroad or highway department.

** END OF SECTION **

SECTION 13

GUARANTEES AND WARRANTIES

PART 1 - GENERAL

1.01 GENERAL WARRANTY

- A. The Contractor shall warrant all equipment, materials, products, and workmanship provided by the Contractor under these Contract Documents for a period of twelve (12) months after the date of final acceptance of the work by the Owner.
- B. If, during the warranty period (a) any equipment, materials, or products furnished and/or installed by the Contractor are found to be defective in service by reason of the Contractor's faulty process, structural and/or mechanical design or specifications, or (b) any equipment, materials, or products furnished and/or installed by the Contractor are found to be defective by reason of defects in material or workmanship, the Contractor shall, as soon as possible after receipt of written notice from the Owner, repair or cause to be repaired such defective equipment, materials or products, or replace such defective equipment, materials or products.
- C. In the event of multiple equipment failures of major consequence prior to the expiration of the one-year warranty described above, the affected equipment shall be disassembled, inspected, and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the equipment failure shall be replaced. A new twelve (12) month warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item of equipment is reassembled and placed back into operation. As used herein, multiple equipment shall be interpreted to mean two (2) or more successive failures of the same kind in the same item of equipment or failures of the same kind in two (2) or more items of equipment. Major equipment failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts or structural members, broken or chipped gear teeth, overheating, premature bearing failure, excessive wear, or excessive leakage around seals. Equipment failures which are directly and clearly traceable to operator abuse, such as operating the equipment in conflict with published operating procedures, or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over- or under-lubrication, and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one-year warranty. Should multiple equipment failures occur in a given item or type of equipment, all equipment of the same size and type shall be disassembled, inspected, modified or replaced, as necessary, and re-warranted for one year.

- D. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability with the law of the place of construction.

1.02 START-UP OF OPERABLE COMPONENTS

- A. Because of the need to maintain operation during construction, it will be necessary to accept and start-up operable components of the project at various times prior to the completion and final acceptance of the entire project.
- B. A component of the project, as used herein, shall mean a complete process subsystem and shall include all associated structures, equipment, piping, controls, etc.
- C. When a component of the project has been completed, checked out, field tested, and made ready for operation, the Contractor shall notify the Engineer in writing that the component is substantially complete and request an inspection for substantial completion. The Engineer will schedule the inspection within 10 days of the Contractor's request. If he concurs in the Contractor's statement, the Engineer will notify the Contractor in writing that the component is accepted as substantially complete. At the same time, the Engineer will submit to the Contractor a list of items which must be completed or corrected before final acceptance can be given.
- D. If a component of the project is needed in order to maintain operation during construction and if it has been accepted as substantially complete, the Contractor shall start up the component when directed by the Engineer. Once the component has achieved stable and satisfactory operation (minimum 95 percent availability over a 7-day period), the Contractor shall request beneficial occupancy by the Owner. The Owner, if he concurs in the Contractor's statement, that stable and satisfactory operation has been achieved, will notify the Contractor in writing within 10 days that he is assuming beneficial occupancy of the component.
- E. On the date that the Owner assumes beneficial occupancy, the following shall occur:
 - 1. The one-year warranties for the component specified in Part 1.01 of this Section will begin; and
 - 2. The Owner will assume responsibility for operating and maintaining the component.

** END OF SECTION **

SECTION 15

PROJECT RECORD DOCUMENTS

1.01 GENERAL

The Contractor shall maintain accurate record documents related to furnishing and installation of equipment, materials, and products at the site of the project during the course of the work.

1.02 MAINTENANCE OF DOCUMENTS

The Contractor shall maintain at the project site two (2) copies of the approved plans. One set of approved project plans shall be stored in a file in a location satisfactory to Cleveland Utilities (CU) and shall be available at all times to CU. The plans shall be maintained in a clean, dry, legible condition and shall not be used for construction purposes. One (1) set of approved plans shall be used for Project Record Drawings.

1.03 RECORDING

The Contractor shall label one (1) set of drawings "Project Record" in one-inch high letters. Record documents shall be kept current and work shall not be permanently concealed until the required information has been recorded.

- A. Contract Drawings: The Contractor shall legibly mark to record the actual construction on the project record set of prints of the Contract Drawings, the following:
1. Any and all changes or revisions to the original drawings for both water and sewer.
 2. Plan view and profile of the sewers and any revisions.
 3. Location of all tees or wyes as measured from the nearest downstream manhole.
 4. Location of all valves and blowoffs shall be located by measurement from two separate, easily identifiable, stationary points. These points shall be manholes, power poles, electric vaults, telephone pedestals, buildings, or any other permanent type items which are not subject to change in size, shape, or location. Property pins may be used if no other reference point is available.
 5. Length of the sewer service line measured from the center of the collector line to the end of the pipe.
 6. Approximate depth of the end of each sewer service pipe.

7. Where the sewer service line is not perpendicular to the centerline of the collector line, a measurement from the downstream manhole must be made to a point located on the collector line that is perpendicular to the end of the sewer service line. The length of the sewer service from this point to end of the pipe must also be noted.
8. All bench marks used for sewer line design and construction must be shown on both construction and record drawings. Permanent bench marks shall be located adjacent to every third manhole on the project and the description and elevation noted on the construction plans.
9. Changes made by change order or field order.

After completion of the work, the Contractor shall prepare a set of project record drawings by drafting all noted changes and revisions as described in 1.03 (A) above. These changes shall be submitted on a set of reproducible mylars.

B. Specifications and Addenda

The Contractor shall legibly mark up each section to record:

1. Manufacturer, trade name, catalogue number, and supplier of each product and item of equipment actually installed;
2. Changes made by change order or field order;
3. Other matters not originally specified.

C. Manhole Location Survey

The Contractor shall perform a manhole location survey of the constructed manholes. The drawing shall be at a 1" =200' scale on a 22" x 34" border and shall include the state plane coordinates of all the constructed manholes and beginning (existing) manholes. Coordinates shall correspond to the geometric center of the manhole lid. The drawing must be stamped by a licensed surveyor in the State of Tennessee. The Contractor shall submit an electronic copy of the drawing in a format acceptable to Cleveland Utilities.

1.04 SUBMITTAL

At the completion of the work and prior to final acceptance by CU, the Contractor shall deliver the Project Record Documents to CU. The Project Record Documents shall be acceptable to CU before final payment is made. With the submittal of the Project Record Documents the Contractor shall submit a list of each document submitted and a certification that each document as submitted is complete and accurate.

** END OF SECTION **

DETAILED SPECIFICATIONS

SECTION 20

EARTHWORK

PART 1 - GENERAL

1.01 SCOPE

- A. This Specification Section includes earthwork and related operations, including, but not limited to, clearing and grubbing the construction site, dewatering, excavating all classes of material encountered, pumping, draining and handling of water encountered in the excavations, handling, storage, transportation, and disposal of all excavated and unsuitable material, construction of fills and embankments, backfilling around structures and pipe, bedding and backfilling all trenches and pits, compacting, all sheeting, shoring and bracing, preparation of subgrades, surfacing and grading, and any other similar, incidental, or appurtenant earthwork operation which may be necessary to properly complete the work.
- B. The Contractor shall provide all services, labor, materials, and equipment required for all earthwork and related operations necessary or convenient to the Contractor for furnishing a complete work as shown on the Drawings or specified in these Contract Documents.

1.02 GENERAL

- A. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonable, accurate information about the existing elevations. They are not precise, and the Contractor should satisfy himself as to the exact quantities of excavation and fill required.
- B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.
- C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material.
- D. If soil borings are available for the area of this work, they will be on file at the Owner's address where they will be made available for review. This information is made available to the Contractor for such use as he may choose to make of it in the preparation of his bid, but the Owner gives no guarantee, either expressed or implied, that it represents a true or complete cross section of all of the material to be encountered in performing the excavation and earthwork on this project.

- E. Earthwork within the rights-of-way of the State Department of Transportation, the County Road Department, and the respective cities shall be done in accordance with requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these Specifications.
- F. The Contractor shall control grading in a manner to prevent water running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains, or temporary drains. Material for backfill or for protection of excavation in public roads from surface drainage shall be neatly placed and kept shaped so as to cause the least possible interference with public travel. Free access must be provided to all fire hydrants, watergates, meters, and private drives.
- G. No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.
- H. Tests for compaction and density shall be conducted by the Engineer or by an independent testing laboratory selected by him. Costs of compaction tests performed by an independent testing laboratory shall be paid for directly by the Owner and not as a part of this Contract. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests. The cost of all retests made necessary by the failure of materials to conform to the requirements of these Contract Documents shall be paid by the Contractor.
- I. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations, and shall be conducted in a manner acceptable to the Engineer.
- J. It is understood and agreed that the Contractor has made a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and floodplains, particularly in areas where construction activities may encounter water-bearing sands and gravels or limestone solution channels. The Contractor shall be responsible for providing all services, labor, equipment, and materials necessary or convenient to him for completing the work within the time specified in these Contract Documents.

PART 2 - EXECUTION

2.01 INITIAL SITE PREPARATION

- A. Preparatory to beginning of construction operations, the Contractor shall remove from the site all vegetative growth, trees, brush, stumps, roots, debris, and any other objectionable matter, including fences, buildings, and other structures shown on the Drawings in the construction areas which are designated for removal or which, if left in place, would interfere with the proper performance or completion of the contemplated work, would impair its subsequent use, or would form obstructions therein.
- B. Stumps and roots shall be grubbed and removed to a depth not less than 5 feet below grade. All holes or cavities which extend below the subgrade elevation of the proposed work shall be filled with compacted layers of crushed rock or earth backfill conforming to the requirements specified here for backfill. Organic material from clearing operations shall not be incorporated in excavation backfill or embankment material.
- C. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, buildings, and other structures which are located in the construction area but not within designated clearing limits as shown on the Drawings or within the limits of embankments, excavations, or proposed structures. The Contractor shall be responsible for the repair and/or replacement of any of the aforementioned items damaged by his operation or construction activities.
- D. The Contractor shall remove and dispose of all excess material resulting from clearing or site preparation operations. The Contractor shall dispose of such materials in a manner acceptable to the Engineer and at an approved location where such materials can be lawfully disposed.

2.02 DEWATERING

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

- B. Unless specifically authorized by the Engineer, no concrete or mortar shall be placed in water nor shall water be allowed to rise over newly-placed concrete or mortar for at least 24 hours after placement. No concrete structure shall be exposed to unequal hydrostatic forces until the concrete has reached its specified 28-day strength. Water shall not be allowed to rise above bedding during pipe laying operations. The Contractor shall exercise care to prevent damage to pipelines or structures resulting from flotation, undermining, or scour. Dewatering operations shall commence when ground or surface water is first encountered and shall be continuous until such times as water can safely be allowed to rise in accordance with the provisions of this section. Excavations shall be protected from the entrance of surface water to the extent possible by the use of dikes and/or covers.
- C. Standby pumping equipment shall be on the jobsite. A minimum of one standby unit (a minimum of one for each ten in the event well points are used) shall be available for immediate installation should any pumping unit fail. The design and installation of well points or deep wells shall be suitable for the accomplishment of the work. Drawings or diagrams on proposed well point or deep well dewatering systems shall be submitted to the Engineer for review.
- D. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with crushed rock at no cost to the Owner.
- E. The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. Conveyance of the water shall be such as to not interfere with traffic flow or treatment facilities operation. No water shall be drained into work built or under construction without prior consent of the Engineer. The Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.
- F. Sedimentation and desilting basins shall be provided as necessary or when directed by the Engineer to prevent the entrance of excessive or injurious amounts of sand and silt from surface runoff or dewatering operations into storm drains or receiving waters. The system used for desanding or desilting the water shall be a baffled structure and shall provide not less than five minutes detention time and shall be designed to have a "flow-through" velocity not exceeding 0.2 feet per second at the anticipated peak flow. The method of desanding or desilting and the point of disposal shall be subject to the approval of the Engineer.
- G. Water shall be disposed of in such a manner as not to be a menace to the public health and in accordance with applicable Environmental Protection Agency, Corps of Engineers, and State Water Quality Control Division standards and permits.

2.03 SHEETING, SHORING, AND BRACING

- A. The sides of all excavations shall be sufficiently sheeted, shored, and braced as necessary to prevent slides, cave-ins, settlement or movement of the banks, to maintain the excavation clear of all obstructions, and to provide safe working conditions. Wood or steel sheeting of approved design and type shall be used in wet, saturated or flowing ground. All sheeting, shoring, and bracing shall have sufficient strength and rigidity to withstand the pressure exerted and to maintain shape and position under all circumstances.
- B. The responsibility for correctly assessing the need for sheeting and analyzing the stresses induced shall be the total responsibility of the Contractor. Since the Engineer does not dictate or determine the Contractor's sequence or limits of excavation, the Engineer assumes no responsibility for sheeting and shoring. The Contractor must employ or otherwise provide for adequate professional structural and geotechnical engineering supervision to assess the need for sheeting and shoring and design same. Results of sheeting and shoring analysis and design shall be submitted to the Engineer on request.
- C. Excavations adjacent to existing or proposed buildings and structures, or in paved streets or alleys shall be sheeted, shored, and braced adequately to prevent undermining beneath or subsequent settlement of such structures or pavements. Underpinning of adjacent structures shall be done when necessary to maintain structures in safe condition. Any damage to structures or pavements occurring through settlements, water or earth pressures, slides, caves, or other causes; due to failure or lack of sheeting or bracing, or due to improper bracing; or occurring through negligence or fault of the Contractor in any other manner shall be repaired by the Contractor at his own expense.
- D. Sheeting, shoring, or bracing materials shall not be left in place unless otherwise specified or shown on the Drawings or ordered by the Engineer in writing. Such materials shall be removed in such manner that no danger or damage will occur to new or existing structures or property, public or private, and so that cave-ins or slides will not take place. Trench sheeting shall be left in place until backfill has been brought to a level 12 inches above the top of the pipe. It shall then be cut off and the upper portion removed. Sheeting for structures shall be left in place until backfill has been brought to a level of 12 inches above the top of the bottom footing. It shall then be cut off and the upper portion removed.
- E. All holes and voids left in the work by the removal of sheeting, shoring, or bracing shall be filled and thoroughly compacted.

2.04 EXCAVATION

A. General

1. Excavation shall include the removal of all material from an area necessary for the construction of a pipeline, structure, basin, flume, or building. Excavations shall provide adequate working space and clearances for the work to be performed therein.
2. Except where otherwise shown on the Drawings, specified herein, or authorized by the Engineer, all material excavated below the bottom of concrete walls, footings, and foundations shall be replaced, by and at the expense of the Contractor, with Class B concrete to the lines and grades shown on the Drawings.
3. Where quicksand, soft clay, spongy, swampy or other materials unsuitable for subgrade or foundation purposes are encountered below the excavation limits, they shall be removed and disposed of to the level of suitable material. Areas so excavated shall be backfilled with Class B concrete or with compacted layers of crushed rock, sand, or other approved material conforming to the requirements specified herein for backfill to the lines and grades shown on the Drawings.
4. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until the excavations are backfilled. All excavations shall be barricaded in such a manner as to prevent persons from falling or walking into any excavation.

B. Rock Excavation

1. Rock encountered in the process of excavation for structures shall be uncovered and stripped of all loose materials over the entire limits of excavation. Rock encountered for removal in a trench section shall be uncovered for a distance of not less than 50 feet.
2. Rock and large boulders in trenches shall be excavated over the horizontal limits of excavation and to depths as shown on the Drawings.
3. The space below grade for pipe lines shall then be backfilled to the proper grade with compacted layers of crushed rock or sand conforming to the requirements specified herein for backfill. Where pipe sewers are constructed on concrete cradles, rock shall be excavated to the bottom of the cradle as shown on the Drawings.

4. Rock under structures shall be excavated to lines and grades shown on the Drawings. Unless specified otherwise, where rock excavation has been carried below grade the Contractor shall backfill to grade with Class B concrete at his own expense.
5. Where rock foundation is obtained at grade for over 50 percent of the area of any one structure, the portion of the foundation that is not rock shall be excavated below grade to reach a satisfactory foundation of rock. The portion below grade shall be backfilled with Class B concrete.
6. Where rock foundation is obtained at grade for less than 50 percent of any one structure and satisfactory rock cannot be found over the remaining area by reasonable additional excavation, the rock shall be removed for a depth of 12 inches below grade and the space below grade shall be backfilled to the proper grade with compacted layers of crushed rock conforming to the requirements specified herein for backfill.
7. Drilling and blasting operations shall be conducted with due regard for the safety of persons and property in the vicinity and in strict conformity with requirements of all ordinances, laws and regulations governing blasting and the use of explosives; see paragraph 2.12 of this section for special requirements during blasting. Rock excavation near existing pipelines or other structures shall be conducted with the utmost care to avoid damage. Injury or damage to other structures and properties shall be promptly repaired to the satisfaction of the Owner by the Contractor at his own expense.
8. Rock excavation for all structures and adjacent trenches under this Contract and any other rock excavation directed by the Engineer shall be completed before construction of any structure is started in the vicinity.

C. Borrow Excavation

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

D. Roadway Excavation

Roadway excavation shall consist of excavation for roadways and parking areas in conformity with lines, grades, cross sections, and dimensions shown on the Drawings. After shaping to line, grade, and cross section, the subgrade shall be rolled until compacted to a depth of at least 6 inches to 100 percent of the maximum density at optimum water content as determined by AASHTO T99, Method A. This operation shall include any reshaping and wetting required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.

E. Trench Excavation

1. Trench excavation shall consist of the removal of materials necessary for the construction of water, sewer, and other pipelines and all appurtenant facilities including manholes, inlets, outlets, headwalls, collars, concrete saddles, piers and pipe protection called for on the Drawings.
2. Excavation for pipelines shall be made in open cut unless shown otherwise on the Drawings. Trenches shall be cut true to the lines and grades shown on the Drawings or established by the Engineer on the ground. The banks of trenches shall be cut in vertical, parallel planes equidistant from the pipe centerline. From an elevation 12 inches above the top of the pipe to the bottom of the trench, the horizontal distance between vertical planes for different sizes of pipe shall be exceed those shown on the Drawings. When sheeting is used, the width of the trench shall be considered as the distance between the inside faces of the sheeting. The bottom of the trench shall be cut carefully to the required grade of the pipe except where bedding material or cradles are shown, in which case the excavation shall extend to the bottom of the bedding or cradles as shown on the Drawings. Minimum, pipe cover shall be as shown on the Drawings or specified in these Contract Documents.
3. The use of a motor-powered trenching machine will be permitted but full responsibility for the preservation, replacement, and/or repair of damage to any existing utility services and private property shall rest with the Contractor.
4. Bell holes for bell and spigot pipe and/or mechanical joint pipe shall be excavated at proper intervals so the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper installation of all joints in the pipe. Bell holes shall not be excavated more than 10 joints ahead of pipe laying. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.
5. Excavation for manholes, outlets, collars, saddles, piers, and other pipeline structures shall conform to the additional requirements specified herein for structural excavation.

6. Pipe trenches shall not be excavated more than 400 feet in advance of pipe laying and all work; shall be performed to cause the least possible inconvenience to the public. Adequate temporary bridges or crossings shall be constructed and maintained where required to permit uninterrupted vehicular and pedestrian traffic.
7. Unless otherwise specified herein or shown on the Drawings, wherever pipe trenches are excavated below the elevation shown on the Drawings, the Contractor, at his own expense, shall fill the void thus made to the proper grade with Class B concrete or with compacted layers of crushed rock or sand conforming to the requirements specified herein for backfill.
8. In all cases where materials are deposited along open trenches they shall be placed so that no damage will result to the work and/or adjacent property in case of rain or other surface wash.

F. Structural Excavation

1. Structural excavation shall consist of the removal of all materials necessary for the construction of structures, including tanks, foundations, footings, wetwells, dry wells, box culverts, flumes, channels, buildings, and other miscellaneous structures.
2. The bottom of structural excavations shall be true to the lines and grades shown on the Drawings. Faces of excavations shall not be undercut for extended footings. Except as provided herein for excavation of unsuitable material or rock, where the excavation is carried below the grade elevation shown on the Drawings. The Contractor shall backfill the void thus made to the proper grade with Class B concrete at his own expense.

2.05 BEDDING

A. Materials

Materials for bedding shall conform to the following requirements:

1. Crushed Rock Crushed rock conforming to Section 903.22, Size No. 7 (1/2" To No.4) and Size No. 57 (1" to N0.4) of Tennessee Department of Highway Standard Specifications for Road and Bridge Construction.

B. Bedding Trenches

1. Bedding for water and sewer and other pipeline trenches shall be as provided as shown on the Drawings to fit the depth of trench, type and size of pipe, and width of trench.

2. Bedding for PVC (Polyvinyl Chloride), flexible thermoplastic (non-pressure) and D.I. sewer pipe in non-traveled (open) areas shall be in accordance with details shown the contract Drawing. Crushed rock, No.7 (1/2 to N0.4), shall be used for bedding said pipe to a depth of 6 inches under pipe and 12 inches over top of pipe and around sides of pipe. Placement of this material shall be done carefully. Material shall be thoroughly compacted by hand.
3. Bedding for PVC (Polyvinyl Chloride), flexible thermoplastic (non-pressure) and D.I. sewer pipe in traveled areas shall be in accordance with details shown the contract Drawing. Crushed rock, No.7 (1/2 to N0.4), shall be used for bedding said pipe to a depth of 6 inches under pipe and 12 inches over top of pipe and around sides of pipe. Placement of this material shall be done carefully. Material shall be thoroughly compacted by hand.
4. Bedding for PVC pressure water pipe and D.I. water pipe in both traveled and non-traveled (open) areas shall be in accordance with details as shown on the contract Drawings. Where a suitable earth trench bed is found and upon approval by the Engineer said pipe may be laid without any special bedding. Where an unsuitable trench bed is found, the unsuitable material shall be removed to a depth of 6" below the bottom of the pipe. Crushed rock, No. 57 (1" to No. 4) or No. 7 (1/2" to No. 4), shall be placed to a depth of 6 inches after which said pipe can be laid.
5. The determination of bedding limits shall be from the actual width of trench. Pipe laying details give the 'Bd' trench width at 12" above the top of the pipe. If the contractor increases width of trench for his convenience or due to collapse of trench walls so that larger quantities of bedding material is required, the increased cost of same shall be borne by the contractor.
6. Bedding shall be in accordance with the schedule and dimensions shown on the Drawings and shall be placed where shown on the Drawings.

2.06 BACKFILLING

A. Materials

Materials for backfilling shall conform to the following requirements:

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

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| 2. Common Earth Backfill | Sound, loose earth containing optimum moisture content for compaction to 90 percent of maximum, density, free from all wood, vegetable matter, debris, and other objectionable material, and having scattered clods, stones, or broken concrete and pavement less than 6 inches in maximum dimension. |
| 3. Sand | Natural or imported sand conforming to ASTM D 1073. |
| 4. Crushed Rock | Crushed rock conforming to Section 903.22, Size 57 (1-inch to No. 4) and Size 7 (1/2-inch to No. 4) of the Tennessee Department of Highways Standard Specifications for Road and Bridge Construction. |
| 5. Class B Concrete | Class B concrete as specified in the Section entitled "Cast-in-Place Concrete" of these Specifications. |

B. General

1. Unless otherwise specified herein, earth backfill shall be compacted to not less than 90 percent of the maximum density at optimum water content as determined by AASHTO T-99, Method A. Crushed stone and sand shall be compacted or consolidated to not less than 83 percent of the solid volume density as determined from the bulk specific gravity by AASHTO T-84 and T-85 and the dry weight of the aggregate.
2. Material that is too dry for adequate compaction shall receive a prior admix of sufficient water to secure optimum moisture content. Material having excessive water content shall not be placed at any time.
3. Unless otherwise specified herein backfill material required to be compacted shall be placed in horizontal layers not to exceed 6 inches in thickness (before compaction) and compacted in place by ramming, tamping, or rolling. Compaction shall be accomplished by power driven tools and machinery wherever possible. Compaction and consolidation of sand and crushed rock backfill shall be accomplished using vibrating equipment in a manner acceptable to the Engineer.

C. Backfilling Trenches

1. The backfilling of sewer, water, and other pipeline trenches shall be started immediately after the construction of same has been inspected and approved by the Engineer. Select backfill or bedding material if specified shall be placed in the trench under and on each side of the pipe in 6-inch layers for the full width of the trench and thoroughly and uniformly compacted by ramming and/or tamping to a minimum of 90 percent of the maximum density determined as specified herein. Select earth backfilling shall start above the class of pipe bedding as specified or

shown on the Drawings. Sufficient select earth backfill shall be placed around the pipe and compacted to provide a cover of not less than 12 inches over the top of the pipe. Mechanical compactors or tampers shall not be used within 12 inches of pipe. Compaction in this area shall be accomplished by hand methods. Sand or specified crushed stone bedding material shall be substituted for select earth backfill when the pipe is bituminous coated steel pipe or wrapped steel pipe or when crushed stone trench backfill is required. Backfilling shall proceed simultaneously on both sides of the pipe to prevent lateral displacement.

2. Caution shall be used during backfill operations for PVC or other flexible thermoplastic pipe (non-pressure or sewer pipe) to prevent pipe deformation. PVC or other flexible thermoplastic pipe (sewer pipe) shall not be subjected to roller or wheel loads until a minimum of 36 inches of backfill has been placed over the top of the pipe and a hydro hammer shall NOT be used until a minimum depth of 48 inches backfill has been placed over the top of the pipe.
3. Backfilling of PVC pressure pipe or other flexible thermoplastic pipe (water pipe) shall be as described in paragraph 1 above.
4. In streets, alleys, across sidewalks and driveways, and at any other places subject to vehicular traffic or other superimposed loads, common earth backfill shall be placed and compacted in 6-inch layers from the level of 12 inches above the top of the pipe upward for the full depth of the trench, except for the top 12 inches of backfill, which shall be compacted crushed rock. Where specified or shown on the Drawings, compacted crushed rock shall be substituted for common earth backfill. Crushed rock backfill shall be either No.7 or No. 57 stone as shown on the detailed drawings or specified by the Engineer. The placement of the stone shall be to within 12" of the surface with the remaining 12" to be backfilled with crusher run stone. The crusher run stone will act as a wearing surface. When crushed rock backfill is required it shall be placed in lifts of 48 inches maximum and compacted by use of a hydro hammer or approved vibratory compactor. The subgrade shall meet the requirements of Subsection 2.07 H. of this specification.
5. Trenches under concrete slabs and footings of structures shall be completely backfilled with compacted sand or crushed rock or filled with Class B concrete as shown on the Drawings.
6. In all other areas not affected by superimposed loads, common earth backfill may be placed from a level of 12 inches above the top of pipe upward for the full depth of the trench without compaction. At these places, backfill shall be neatly rounded over the trench to sufficient height to allow for settlement to grade after consolidation.

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

D. Backfilling Around Structures

1. Backfilling around structures shall consist of common earth backfill placed in 6-inch layers and compacted by tamping to a minimum of 90 percent of the maximum density determined as specified herein for the full depth of the excavation from the bottom to the finished grade. No backfill shall be placed against concrete structures until the concrete has reached its specified 28-day compressive strength. Where practical, compaction of structural backfill shall be accomplished by power-driven tamping equipment.
2. Where crushed rock mats under slabs and foundations are called for on the Drawings, the Contractor shall excavate below grade to the depth of the crushed rock mat as shown on the Drawings and shall install a compacted crushed rock bed. This shall be finished to a true line or plane and even with the subgrade of the concrete foundations, piers, footings, or slabs. Before placing any crushed rock, all loose earth or debris shall be removed. This crushed rock mat shall extend 12 inches beyond all slabs and foundations or to edges of sheet piling.
3. Crushed rock mats, 12 inches or less in thickness, shall be constructed of compacted layers of crushed rock conforming to Section 903.23, Size 7 (1/2-inch to No. 4), of the Tennessee Department of Highways, Standard Specifications for Road and Bridge Construction.
4. Crushed rock mats of thickness greater than 12 inches shall have the top 12 inches constructed of compacted layers of crushed rock as specified above. That portion below the top 12 inches shall be constructed of compacted layers of crushed rock conforming to Section 903.05, Class A, with a modified gradation of 6 inches to dust as received from the crusher.
5. Unless otherwise shown on the Drawings, the use of earth backfill to support footings, foundations, and structures shall not be permitted.

2.07 FILLS AND EMBANKMENTS

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

- B. Materials shall be placed in the fill or embankment in successive layers 6 inches or less in thickness before compaction, each layer being approximately horizontal and extending to the full limit of the required cross section and shall be compacted at optimum water content over the entire surface to not less than 95 percent of the maximum density as determined by AASHTO T-99, Method A. The process shall be repeated for each layer of material until the fill or embankment conforms to the plan lines, grades, and cross sections. The degree of compaction and moisture content required, the method of tamping, and the equipment used shall be approved by the Engineer.
- C. The area over which the fill or embankment is to be constructed shall first be cleared of all vegetation, debris, and other objectionable material and, if the ground is in a loose, uncompacted condition, it shall be compacted to a minimum 95 percent of maximum density determined as specified herein.
- D. No material shall be placed beyond the sloping lines of embankment unless so ordered by the Engineer. Material allowed to be placed beyond the lines of embankment shown on the Drawings will be compacted as required above unless otherwise authorized by the Engineer.
- E. Material for embankments or roadway fills shall be placed in 6-inch maximum lifts and shall be compacted by rolling with power rollers weighing not less than 10 tons, with sheepsfoot rollers, with vibrating rollers, or with pneumatic tire rollers, as required to accomplish the work. While and as each layer is deposited, water shall be applied in sufficient amount to ensure optimum moisture to secure the compaction specified.
- F. The use of trucks, carryalls, scrapers, tractors, or other heavy hauling equipment shall not be considered as rolling in lieu of rollers, but the traffic of such hauling equipment shall be distributed over the fill in such a manner as to make the use of the compaction afforded thereby as an addition to compaction by the use of rollers.
- G. Wherever a trench passes through a fill or embankment, the fill or embankment material shall be placed and compacted to an elevation 12 inches above the top of the pipe before the trench is excavated.
- H. On subgrades for all roadbeds, the density for the top 12 inches of the finished subgrade shall be equal to not less than 100 percent of the maximum density as determined by AASHTO T-99, Method A. When field tests show failure to meet the density requirement, the subgrade shall be loosened by disking, harrowing or other approved methods to a depth of not less than 12 inches, then reshaped and recompacted as indicated in this paragraph.

2.08 DISPOSAL OF WASTE AND UNSUITABLE MATERIALS

- A. All materials removed by excavation, which are suitable for the purpose, shall be used to the extent possible for backfilling pipe trenches, foundations, and footings and for making embankment fills or for such other purposes as may be shown on the Drawings. All materials not used for such purposes shall be considered as waste materials and the disposal thereof shall be made by the Contractor in a manner and at locations approved by the Engineer.
- B. Waste materials shall be spread in uniform layers and neatly leveled and shaped. Spoil banks shall be provided with sufficient and adequate openings to permit surface drainage of adjacent lands.
- C. Unsuitable materials, consisting of wood, vegetable matter, debris, soft or spongy clay, peat, and other objectionable material so designated by the Engineer shall be removed from the work site and disposed of by the Contractor in a manner and at a location approved by the Engineer.
- D. No unsuitable or waste material shall be dumped on private property unless written permission is furnished by the owner of the property and unless a dumping permit is issued from the local jurisdiction.

2.09 FINAL GRADING

- A. After other earthwork operations have been completed, the sites of all structures, roads, and embankments shall be graded within the limits and to the elevations shown on the Drawings. Grading operations shall be so conducted that materials shall not be removed or loosened beyond the required limits. The finished surfaces shall be left in smooth and uniform planes such as are normally obtainable from the use of hand tools. If the Contractor is able to obtain the required degree of evenness by means of mechanical equipment he will not be required to use hand labor methods. Slopes and ditches shall be neatly trimmed and finished to slopes shown on the Drawings unless otherwise approved by the Engineer.
- B. Unless otherwise specified or shown on the Drawings, all finished ground surfaces shall be graded and dressed to present a surface varying not more than plus or minus 0.10 foot as regards local humps or depressions and shall be acceptable to the Engineer.

2.10 TOPSOIL

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

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

2.11 SETTLEMENT

- A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within one (1) year after final acceptance of the work by the Owner.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Engineer or Owner. Where hazardous conditions are determined to exist by the Owner or Engineer immediate repair work shall be completed by the Contractor.

2.12 PREVENTION OF BLASTING DAMAGE

A. General

The Contractor shall conduct all drilling and blasting operations in strict conformity with requirements of all ordinances, laws, and regulations governing blasting and the use of explosives. This shall include but is not limited to the requirements as stated in the latest revision of the Occupational Safety and Health Standards for Construction Industry Manual, Subpart U - Blasting and the Use of Explosives and the Tennessee Blasting Standards.

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

B. Preventing Damage By Fly-Rock

A qualified Explosive Engineer and experienced Powder Foreman shall be available to direct and supervise the design of the blasting work. This shall consist of selecting the correct burden, spacing and stemming dimensions for the explosives used and the rock being blasted. This includes, but is not limited to, controlling water in the blast hole and using the proper stemming. The objective is to select the optimum blast dimensions which insure that just enough explosive is available to break the rock, and that there is no excess explosive to propel the rock fragments beyond safe limits. Blasting mats and/or backfill materials shall be used for each "shot" to help confine the limits of fly-rock in populated areas. Traffic and access to blasting areas shall be closed off and blasting signals audible for 2,000 feet shall be sounded in time for all workers and nearby residents to get under cover. Also, residents immediately adjacent to a blast should be notified personally before any blast occurs.

C. Preventing Damage By Air Blast

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

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

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

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

There should be no top priming of any holes.

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

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

D. Preventing Damage By Ground Vibrations

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

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

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

Excessive subdrilling shall not be permitted.

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

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

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

Delay pattern shall be designed to provide maximum amount of free faces which reduces the amount of energy-transfer in ground vibrations. Where potential settlement of a structure is involved, a presplit line shall be required to help reduce the peak particle velocity beneath the structure to be protected.

**** END OF SECTION ****

SECTION 30

CAST-IN-PLACE-CONCRETE

PART 1 - GENERAL

1.01 SCOPE

- A. The work covered by this item shall consist of furnishing, erecting and removing concrete forms; furnishing, proportioning and mixing concrete ingredients; placing, curing and finishing plain and reinforced concrete masonry and all other work incidental thereto as required for the proper construction of the structures shown on the plans or specified herein.
- B. Steel reinforcement shall be incorporated in the concrete masonry as required on the plans but it shall be furnished, bent, set and placed in accordance with the provisions in the section entitled "Concrete Reinforcement" of these specifications.

1.02 CLASSIFICATION AND DEFINITIONS

- A. Concrete shall be either Class A or Class B, as indicated on the plans. If the class is not otherwise indicated, the Contractor shall furnish class A concrete.
- B. In general, Class A concrete shall be used for reinforced concrete masonry cast in place in forms for piers, headwalls, tanks, walls, floors, manholes, pits and similar structures. Class B concrete shall be plain concrete and shall be used for pipe cradles, pipe protection, bedding, grade correction, anchors, collars, massive sections and similar works.
- C. The purpose of this specification is to obtain a dense concrete having not only the specified strength but also a mixture that will have the following characteristics: plasticity and cohesiveness to reduce the danger of honey comb and porosity; a minimum water-cement ratio to reduce shrinkage and bleeding and for maximum water tightness and strength. The requirements herein as to aggregate grading and cement content are given as methods of obtaining the above-mentioned characteristics. However, the Contractor may submit for approval other methods of modifications of the methods set forth herein for obtaining the desired results.

1.03 COMPOSITION

Concrete shall be composed of cement, fine aggregate, coarse aggregate, approved admixtures and water, so pro portioned and mixed as to produce a plastic, workable mixture in accordance with all requirements under this item and suitable for the specific conditions of placement.

1.04 SAMPLING AND TESTING CEMENT AND AGGREGATES

- A. The Contractor shall determine the source, kind and quality of the cement and aggregates to be used in the work well in advance of the time scheduled for starting the work and shall submit such information to the Engineer for approval before starting concrete operations.
- B. The cost of testing cement and aggregates shall be borne by the Contractor. Certified test report and certificates shall be submitted in duplicate to the Engineer and to such agencies for persons as he may designate. Reports or certificates indicating compliance of any shipment of cement or aggregate shall be placed in the hands of the Engineer prior to use of such materials.
- C. Where reputable cement and aggregate suppliers maintain regular recognized testing services, certified copies of such test will be accepted by the Engineer. However, in any case of doubt as to the accuracy and/or adequacy of such test, the Engineer may require that cement and aggregates be tested by a recognized commercial testing laboratory which has been selected by the Contractor and approved by the Engineer. The testing laboratory shall then test the cement and aggregates and prepare written reports showing the results of such tests on each shipment. The laboratory shall also certify that the materials covered by the report comply in all respects with these specifications. In general, cement and aggregates shall be tested at the mill but if untested shipments require sampling and testing after arrival at the site of the work, the Contractor shall be fully responsible for delays in the progress of the work due to delays in testing and reporting.
- D. No cement or aggregate which fails to meet the requirements shall be incorporated into the work. In case of emergency the Engineer may authorize the use of specific lots of cement which have satisfactorily passed the soundness test and the 7-day strength test only.

1.05 TESTING OF CONCRETE

- A. Before any concrete is poured the Contractor shall prepare and submit preliminary mix designs for approval for each class of concrete specified. Tests shall be made in accordance with ASTM Standard Method of Tests for Compression Strength of Concrete, C 39, to determine the proper mixes of cement, sand, coarse aggregate and water-cement ratios to be used in connection with furnishing concrete for this project. Tests for the proposed mixes shall consist of making and breaking 9 standard cylinders for each mix, 3 of which shall be broken each at 7, 14, and 28-day ages. The results of these tests shall be furnished to the Engineer in triplicate and on completion of these tests, curves shall be prepared showing the strength of the concrete at the various ages. No separate payment will be made for furnishing concrete mix designs. All sampling, testing, making and breaking cylinders, etc., required for concrete mix design shall be done by the Contractor at his expense.

- B. During the progress of the work, slump tests and compression test cylinders shall be taken and the Cylinders broken in accordance with the ASTM Standard Specifications, Serial Designations C 143 and C 31, latest revision. Each test shall consist of 4 test cylinders, 2 to be broken in 7 days and 2 to be broken at 28 days. Mixes shall be subject to laboratory control and inspection at the mixer plant and cylinders will be taken at the place of concrete placement.
- C. The minimum number of specimens or cylinders to be taken is:

Structural Pours	1 to 4 Cubic Yards	4 Cylinders
Any Pours	4 to 100 Cubic Yards	4 Cylinders
Any Pours	101 to 200 Cubic Yards	8 Cylinders
Any Pours	201 to 300 Cubic Yards	12 Cylinders
Any Pours	Over 300 Cubic Yards	4 Cylinders/100Cu.Yd.

All testing and all concrete laboratory inspection, sampling and testing throughout the work shall be done by an approved independent testing laboratory and paid for by the Owner. However, all the materials and concrete for the mix design and concrete for all test cylinders taken during the progress of the work shall be furnished by the Contractor at his expense. All other materials for testing concrete placed in the work shall be furnished by the laboratory making the concrete tests.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement

1. Cement shall be standard portland cement or high early strength portland cement, conforming to all of the requirements of ASTM Standard Specifications for Portland Cement, Type 1, Type 11, and Type 111, shall be used only when specifically authorized by the Engineer. No cement of dark color shall be used.
2. When weighed in the conventional manner, portland cement shall weigh not less than 94 pounds per standard sack.
3. Unless otherwise specified as shown on the plans, Type 1, portland cement shall be used in all concrete.

B. Fine Aggregate

1. Fine aggregate shall be natural siliceous sand, consisting of hard, clean, strong, durable and uncoated particles, conforming to the requirements of ASTM Standard Specifications for Concrete Aggregates, Serial Designation C 33, latest revision. The mortar strength developed in such test shall be 90 percent of the developed by standard Ottawa sand tested under identical conditions.
2. Fine aggregate shall have fineness modulus of 2.40 minimum and 3.00 maximum. The fineness modulus shall not vary more than 0.10 plus or minus from the sample initially approved. The grading should be within the following limits if practicable:

<u>Sieve No</u>	<u>Cumulative & Retained</u>
4	0 to 5
8	10 to 25
16	20 to 50
30	40 to 75
50	70 to 95
100	92 to 99

If the available sources of fine aggregate will not yield the above grading, the Engineer will approve modifications in the grading which do not adversely affect the work. However, no individual size should exceed 35 percent and the amount passing the No. 50 sieve should be at least 15 percent.

C. Coarse Aggregate

1. Coarse aggregate shall consist of clean, natural, washed gravel or crushed stone suitably processed and conforming to the requirements of ASTM Standard Specifications for Concrete Aggregate, Serial Designation C 33, latest revision.
2. Coarse aggregate as delivered to the mixing plant shall be graded, or individual sizes shall be so combined as to fall within the following limitations:

Percentage by Weight Passing

Laboratory Sieves with Square Openings

Screen Size Inches	2" Max. (No. 357)	1-1/2" Max. (No. 467)	1" Max. (No. 57)	3/4" Max. (No. 67)
2-1/2	100	----	----	----
2	95-100	100	----	----
1-1/2	----	95-100	100	----
1	35-70	----	95-100	100
3/4	----	35-70	----	95-100
1/2	10-30	----	25-60	----
3/8	----	10-30	----	20-55
No.4	0-5	0-5	0-10*	0-10*

*Not more than 5 percent shall pass No. 8 Sieve

3. Coarse aggregate which fails to pass the soundness test, as specified, shall be used only with the approval of the Engineer who may, at his option, order that freezing-and-thawing test be made.
4. Unless otherwise shown on the plans or directed by the Engineer, the maximum size of aggregate shall not exceed:
 - a. One-fifth the dimension for nonreinforced members;
 - b. Three-fourths the clear spacing between reinforcing bars or between reinforcing bars and forms, or
 - c. One-third the depth of nonreinforced slabs on ground.

D. Water

Water used in mixing concrete shall be fresh, clean, potable water free from injurious amounts of oil, acid, alkali, vegetable, sewage and/or organic matter. Water shall be considered as weighing 8.33 pounds per gallon.

E. Admixtures

1. Except as herein specified, no curative or hardening admixtures shall be used.
2. An air entrainment agent capable of providing 3-6 percent air shall be used.
3. A workable admixture of "Pozzolith", "WRDS4A" or "Plastiment" as manufactured by Master Builders Company, W.R. Grace and Company and Sika Company, respectively, or approved equal, shall be used in recommended and approved proportions. When using "Pozzolith", "WRDA", or "Plastiment", an air entrainment agent shall be added in proper proportions to secure 3-6 percent air.

2.02 VAPOR BARRIER

Vapor barriers shall be installed under concrete slabs on ground where shown on the drawings or as directed by the Engineer. Vapor barriers shall be constructed of .006 inch (6 Mil.) polyethylene sheets placed on a cushion of fine aggregate meeting the requirements of Section 3.06. All joints in polyethylene sheets shall be lapped 18 inches and taped.

2.03 STRENGTH

Concrete ingredients shall be selected, proportioned and mixed in such manner as will produce concrete which will develop the compressive strength started below in 28 days, when tested in accordance with the procedures set forth in the ASTM Standard Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field, Serial Designation C 31, latest revision, and in ASTM Standard Method of Test for Compressive Strength of Molded Concrete Cylinders, Serial Designation C39, latest revision:

<u>Class</u>	<u>Minimum Average 5 Consecutive Specimens</u>	<u>Minimum for Any One Specimen</u>
A	4000 pounds per sq. in.	3500 pounds per sq. in.
B	3000 pounds per sq. in.	2500 pounds per sq. in.

PART 3 - EXECUTION

3.01 STORAGE OF CONCRETE MATERIALS

- A. Cement shall be shipped to the site of the mixer plant in bulk, paper or cloth bags, at the option of the Contractor. Upon arrival it shall be stored immediately in a thoroughly dry, weather-tight and properly ventilated building with adequate provisions for the prevention of absorption of moisture. It shall be stored in a manner that will permit easy access for inspection and identification of each shipment. Storage facilities shall be provided by and at the expense of the Contractor and approved by the Engineer prior to arrival of the first shipment.
- B. Sand and coarse aggregates shall be stored in separate stockpiles at points selected to provide maximum drainage and to prevent the inclusion of any foreign material during rehandling. Stockpiles of coarse aggregates shall be built in horizontal layers to avoid segregation and breakage. Where concrete volumes required batching of various aggregate sizes, a separate stockpile for each size shall be maintained.

3.02 PROPORTIONING

- A. Concrete materials shall be proportioned by weight to produce a workable mixture in which the water content and slump shall not exceed the maximum herein specified and the volume of cement shall not be less than herein specified.
- B. The exact proportions of concrete ingredients within the limits here specified shall be varied to conform to the varying quality of the ingredients. The Contractor shall provide all equipment necessary to determine positively and to control the actual amounts of all materials entering into the concrete. The proportions shall be changed whenever such changes become necessary to obtain the specified and desired workability, density, strength, and uniformity. The Contractor shall not be compensated for any such changes unless they involve the use of cement in excess of the maximum specified herein.
- C. Materials shall be measured by weight. The types of equipment and methods used for measuring material shall be subject to the approval of the Engineer.
- D. The following water cement ratios with proper proportioning of aggregate and with approved admixture shall be used to obtain concrete meeting these specifications.

<u>Class of Concrete</u>	<u>Aggregate Size</u>			
	<u>2"Max.</u>	<u>Max.</u>	<u>1-1/2"</u> <u>1"Max.</u>	<u>3/4"Max.</u>
<u>Class A</u>				
Min.cement per CY of Concrete	5.3 CF	5/8 CF	6.2 CF	6.6 CF
Max.water-cement ratio by weight	0.49	0.49	0.49	0.49
Max.water per CF of cement	5.5Gals.	5.5gals.	5.5Gals.	5.5Gals.
<u>Class B</u>				
Min.cement per CY of Concrete	5.0 CF	5.5 CF	5.9 CF	6.3 CF
Max.water-cement ratio by weight	0.62	0.62	0.62	0.62
Max.water per CF of cement	7.0Gals.	7.0Gals.	7.0Gals.	7.0Gals.

- E. The amount of moisture carried on the surface of the coarse aggregate and sand particles shall be included in calculating the water content of each mix. The amount of water and cement used shall be the minimum amount necessary to produce a plastic mixture of the specified strength and of the desired workability. In general, the slump shall be between 1-1/2 inches and 4 inches, and in no case shall it be more than 5 inches, when determined in accordance with the ASTM Standard Method of Slump Test of Consistency of Portland Cement Concrete, Serial Designation C-143, latest revision.
- F. The total volume of aggregate to be used in each cubic yard of concrete shall be determined by recognized standards for designing concrete mixes, utilizing the actual screen analysis of the aggregates.
- G. Maximum size of aggregate in concrete for various portions of the work shall be designated by the Engineer based on thickness of section and clearance of reinforcement.

3.03 MIXING AND TRANSPORTING CONCRETE

- A. Concrete shall be mixed by one of three alternate methods, namely: (1) by the operation of one or more batch-type mixing plants, each with a rated capacity of 1.2 cubic yard or more, installed at the site of the work; (2) by the operation of a proportioning plant installed in the vicinity of the work and the use of transit mixers for mixing concrete and transporting it to the forms; and (3) by the use of ready-mixed concrete from a central mixing and proportioning plant. The method selected by the Contractor shall be subject to the approval of the Engineer.
- B. The mixing and proportioning plants shall be provided with adequate equipment and facilities for accurate measurement and control of the quantities of material and water used in the concrete, and for readily changing the proportions to conform to the varying conditions and requirements of the work.
- C. If ready-mixed concrete is to be used in lieu of concrete mixed at the site of the work, materials shall conform to requirements of paragraphs 2.01A through 2.01E, inclusive, of these specifications. Proportioning, mixing and transportation of concrete to the forms and the transit or truck mixers and operation of same all shall be in strict conformity with the requirements of the ASTM Standard Specification, latest revision, for Ready-Mixed Concrete, Serial Designation C 94.
- D. Stationary mixers shall be in accordance with the Concrete Mixer Standards adopted by the Mixer Manufacturer's Bureau of the Associated General Contractors of America. The mixer shall be rotated at the rate recommended by the manufacturer. The mixing time shall be as follows:

<u>Capacity of Mixer</u>	<u>Time in Minutes</u>
1/2 cubic yards	1-1/4
3/4 to 1-1/2 cubic yards	1-1/2
Larger than 1-1/2 cubic yards	2

The mixing time shall be measured from the time that all cement and aggregates and most of the water are in the mixer. Excessive over mixing, requiring additional water to preserve the required consistency will not be permitted.

- E. Chutes may be used to convey concrete only if the concrete slides without internal motion. Vertical drops shall not be greater than 5 feet. Pumped concrete is permissible. In general, concrete shall be positioned as close as possible to its final location to prevent segregation and this should be accomplished by using bottom dump buckets where possible.
- F. If transit or truck mixers are used, the concrete shall be delivered to the forms and discharge from the hauling container within a period of one hour and 30 minutes after the introduction of the mixing water to the cement and aggregates, or the cement to the water aggregates. During hot weather when the air temperature is above 90 degrees, the delivery time limit shall be reduced to 45 minutes. Prolonged mixing, even at agitating speed, shall be avoided where feasible by stopping the mixer and then agitation intermittently. When concrete cannot be delivered to the forms within the time limit specified, a water-reducing retarder, such as Daratard, as manufactured by Grace Construction Materials; Chemtard, as manufactured by Chem-Masters Corporation; or Pozzolith Retarder, as manufactured by Master Builders Company, may be used subject to the permission and approval of the Engineer. Such use of a water-reducing retarder will be permitted only as necessary to supplement (not to replace) other acceptable hot weather procedures. The admixtures used shall not interfere with strength development and other properties of the concrete and provided this use is carefully controlled by the concrete supplier. Before any such admixture is permitted it shall be tested with job site materials under job conditions to determine its compatibility with the other materials and its ability under these conditions to produce the desired properties.

3.04 CONCRETE PLACEMENT

- A. Concrete shall be placed before initial set has occurred and in no event after it has contained its water content for more than one hour and 30 minutes. To prevent separation of the the mix, the concrete shall be deposited in batches by use of a crane and concrete bucket. The bucket shall be deposited in batches by use of a concrete surface and limited to a free drop of not over 5 feet, unless otherwise authorized by the Engineer. The concrete shall be deposited in walls by means of prefabricated rectangular tremies, constructed in short sections and spaced not over 5 feet apart. Placing techniques shall be followed to insure there will be on cold joints or plastic shrinkage cracking.

- B. Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces, free from water, and never upon soft mud, dry absorbent earth or rock, or upon fills that have not been subjected to approved tamping to provide ultimate settlement. No concrete pour shall be started until the condition of the form or place of pouring has been approved by the Engineer.
- C. After the concrete has been deposited it shall be distributed over the entire area within the forms in horizontal layers not more than 18 inches thick. It shall be compacted and worked into all corners and angles and around reinforcement and embedded fixtures in a manner to fill all voids, prevent honeycombing against the forms and avoid segregation of coarse aggregate. This operation shall be performed by the use of spade and internal vibrator. The operation shall be continuous and all concrete shall be in final position before initial set has started.
- D. Vibration shall be transmitted directly to the concrete and in no case shall it be transmitted through the forms. Vibrator driving mechanisms shall revolve at not less than 7000 rpm. The intensity of vibration shall be sufficient to cause settlement to the concrete into place. The vibration shall be of sufficient duration to accomplish the forms along exposed faces in order to secure smooth, dense, even surfaces. Vibrators shall not be used to transport concrete within the forms. Vibrators shall be kept in motion at all times to prevent excessive vibration in one spot.

3.05 FORMS

- A. Forms shall be of wood, steel or other approved material that will give a smooth unmarked finish. Unless otherwise specifically authorized, the sheeting for wood forms shall be tongue-and-groove lumber or plywood of sufficient thickness to secure desired rigidity.
- B. Forms shall be built true and conform to lines and grades shown on the plans and shall be cement mortar tight and sufficiently rigid to prevent displacement. Form surfaces shall be smooth and free from irregularities, dents, sags or holes. Bolts and rods used for internal ties shall be arranged so that when the forms are removed, no metal will be less than 2 inches from any concrete surface. Forms shall be constructed so they can be removed without hammering or prying against the concrete. Wire ties shall not be used. Through-form rods in walls shall be fitted with washers wedged to the rods as water stops. At least one side of a form shall be open above the construction joint to which a pour is about to be made.
- C. Unlined forms shall be coated with a non-staining mineral oil that shall be applied shortly before the concrete is to be placed. Forms for unfinished surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.

- D. All salient corners of beams, slabs, columns and walls shall be provided with a 1 inch by 1 inch (1.4 inch on the diagonal) chamfer formed by wood or metal strips.
- E. Forms shall not be removed without the approval of the Engineer. Removal shall be accomplished in a manner that will prevent injury to the concrete. In general and under average conditions, the Engineer will approve removal of forms as follows:

Slabs	14 days
Monolithic Pipe	7 days
Columns	7 days
Walls	2 days
Other Concrete	2 days

3.06 FINISHING

- A. All permanently exposed surfaces shall be expected to be smooth and of uniform texture and appearance. All holes, pits or imperfections in the surface of the concrete shall be cleaned with a wire brush, thoroughly wetted and completely filled with damp cement mortar composed of 1 part cement to 2 parts concrete sand. The entire surface shall be left smooth and all lines or markings shall be smoothed over to obtain uniform appearance. In the event the Contractor fails to obtain a satisfactory appearance of the concrete in the opinion of the Engineer, the entire surface shall be thoroughly wetted down, kept wet continuously and rubbed with a No. 20 carborundum stone until all lines, markings and surplus materials have been removed from the surface and until the surface shows a uniform smooth finish. After rubbing is completed the concrete surface shall be washed clean with water. Rubbing may be done either by hand or with power tools.
- B. No special concrete or cement mortar topping course shall be used for slab finish unless so shown on the plans. The base slabs shall be brought to a true and even finish by power or hand floating. Where a trowel finish is shown on the plans, it shall be made with steel trowels in such a manner as to produce a dense, smooth, impervious surface, free from blemishes. Care shall be taken that no excess water is present when the finish is made. All permanently exposed edges shall be chamfered with 3/4 inch approved edging tool unless other treatment is indicated on the plans. All slabs shall be finished carefully to the true surfaces shown on the plans so not water can stand on the surface.

3.07 CONSTRUCTION JOINTS

- A. Joints, either vertical or horizontal, shall be made only at the locations indicated on the plans unless permitted by the Engineer and then only at places designated by him. Water stops of type and size shall be used at location shown on the drawings or as directed by the Engineer.

- B. Keys shall be $\frac{1}{3}$ the width of the walls in width and $\frac{1}{6}$ the width of the walls in depth. All keys shall be continuous and none shall be smaller than 4 inches in width and 2 inches in depth.
- C. A jet of air and water shall be applied to the surface of horizontal construction joints to remove all laitance when the concrete has set sufficiently for the jet to expose the coarse aggregate without loosening same. Immediately prior to placing another lift, the surface shall be thoroughly cleaned and washed by water jet followed by air jet to remove standing water. The surface shall then be covered with a $\frac{1}{2}$ inch thick layer of 1.3 cement-sand mortar evenly distributed and of the same water-cement ratio as the concrete to follow. No vertical construction joints in walls shall be used except by special permission.

3.08 EXPANSION AND CONTRACTION JOINTS AND WATER STOPS

- A. Expansion and contraction joints and water stops shall be constructed where shown on the plans. They shall be of type and detail indicated on the plans.
- B. Expansion joint materials and water stops shall be approved by the Engineer.

3.09 WATERTIGHT STRUCTURES

It is the intention of these specifications to provide impervious concrete. All pits below groundwater level and all structures for holding or carrying water must be watertight. A loss of not more than $\frac{1}{4}$ inch depth in 24 hours will be permitted when water-holding structures are filled. All exposed surfaces of waterholding structures and interior surfaces of pits below groundwater level shall be free from visible damp spots or seepage before acceptance. Repeated tests and repairs may be required by the Engineer to obtain watertight structures. All structures shall be drained at the completion of tests unless otherwise directed by the Engineer. The cost and expense of testing and providing watertightness in structures and of remedying defects shall be borne by the Contractor.

3.10 EMBEDDED ITEMS

- A. Wherever steel or cast iron pipe, fittings, valves, collars, sleeves, structural steel, electrical conduits, appurtenances and fixtures, equipment anchorages or castings are shown for embeddment in the concrete, such items must be on hand before concrete is poured. They shall be set in place accurately and firmly braced before concrete is poured around them. No cutouts for future installation of these items shall be permitted.
- B. Before placing concrete the Contractor shall see that all embedded parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from any coating, rust, scale, oil or other foreign matter. The embedding of wood in concrete shall be avoided whenever possible. If wood is allowed it shall be thoroughly wetted before the concrete is placed.

3.11 WATERPROOFING

- A. The use of special admixtures or integral waterproofing compounds for concrete required to be watertight is not required but may be permitted, provided the materials and methods used are approved in writing by the Engineer.
- B. Membrane waterproofing shall be applied to all unexposed exterior surfaces of all building and structures where indicated on the plans except where concrete is poured against the neat lines of rock excavation without forms.
- C. Pitch shall conform to the requirements of Federal Specifications R.P. 381, Type II. Open-mesh, tar-saturated, waterproofing cotton fabric shall conform to the requirements of Federal Specifications HH-C-591.
- D. All surfaces on which the waterproofing is to be applied shall be firm, smooth, dry and free from loose material. The entire surface to be waterproofed shall be given a uniform priming coat of coal tar primer. Then a coat of hot pitch shall be applied to the surface and while still hot and starting at the bottom a layer of tarred cotton fabric shall be embedded into it running horizontally. Successive coating of hot pitch and cotton fabric shall be applied until there are 5 coatings of pitch and 4 layers of fabric. Each layer of fabric shall be thoroughly worked into the hot pitch to prevent wrinkles, buckles, pockets or blisters. Both vertical and horizontal laps shall be 4 inches. Not less than 150 pounds of pitch shall be used per 100 square feet of completed surface and the pitch shall not be heated above 350 degrees F.
- E. At salient corners, 2 extra layers of fabric and pitch extending 1 foot each side of corner shall be applied.
- F. If waterproofing is not punctured by drains, pipes, etc., suitable provisions shall be made to prevent water from getting behind the waterproofing and between it and the surface waterproofed.
- G. Where waterproofing is punctured by drains, pipes, etc., suitable provisions shall be made to prevent water getting behind the waterproofing and between it and the surface waterproofed.
- H. The waterproofing shall be protected by backfilling immediately after completion. Care shall be exercised during backfill operations not to puncture the membrane.

** END OF SECTION **

SECTION 40

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SCOPE

The work covered by this item shall consist of furnishing, bending, placing and tying all steel reinforcement including reinforcing bars, mesh or fabric, dowels and structural steel shapes embedded in the concrete.

1.02 TESTS AND SHOP DRAWINGS

- A. Prior to placing any steel reinforcement, written evidence that such steel has been tested and is in conformity with these specifications must be in the hands of the Engineer. Certified copies of mill tests may be considered evidence of compliance provided such tests as customarily made under satisfactory conditions by responsible personnel and with adequate equipment. In case of doubt, the Engineer may require additional tests by an independent testing laboratory upon mill samples or upon the finished bars as furnished.
- B. Complete detailed shop drawings, bending diagrams and schedules of the steel to be used shall be submitted by the Contractor to the Engineer for review and approval prior to fabrication of the steel. Only steel meeting specification requirements and fabricated in accordance with approved shop drawings shall be used. A minimum of 6 copies of drawings, diagrams and schedules will be required for approval.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars

Reinforcement bars shall conform to the latest requirements of ASTM Standard Specifications, Serial Designation A 615 for Deformed Billet Steel Bars for Concrete Reinforcement. Unless otherwise shown on the plans, all bars #4 and larger shall be Grade 60. All bars #3 and smaller shall be Grade 40. All bars shall be shop fabricated and bent cold. Bars shall be free from defects and kinks and from bends not indicated on the Drawings or approved bending diagrams.

B. Mesh Reinforcement

Steel mesh reinforcement shall be electrically welded, cold drawn, mild steel fabric conforming to the latest requirements of ASTM Standard Specifications, Serial Designation A 185 for Welded Steel Wire Fabric for Concrete Reinforcement.

PART 3 - EXECUTION

3.01 PLACEMENT

- A. On delivery to the site of the work, the steel reinforcement shall be carefully bundled, tagged and stored so the bars for any position in the work may be readily identified. All reinforcing steel shall be stored on timber mats or other approved material covering the ground.
- B. Before being placed in position all steel reinforcement shall be thoroughly cleaned of oil, mill and rust scale, dirt and other coatings that would tend to destroy or reduce the bond. Where there has been a delay in in depositing concrete after the reinforcement has been placed, the reinforcement shall be reinspected and recleaned if necessary.
- C. Reinforcement shall be accurately positioned and tied at intersections with annealed or similar wire, No., 18 gage or heavier, or suitable approved clips. Reinforcement shall be supported by concrete or metal chairs, stays, spacers, hang or other approved supports which shall have sufficient strength and stability to maintain the reinforcement in place throughout concreting operations.
- D. The minimum distance between parallel bars shall be as shown on the plans.
- E. Unless otherwise noted on the plans, rods shall be lapped not less than 24 diameters where splicing is necessary and splices shall be staggered. In all cases the lapped connection shall be sufficient to transfer the full stress between bars by bond and shear and to develop the full strength of the rods. In slabs, beams and girders, no splices shall be made at points of maximum moment and in no case shall adjacent bars be spliced at the same place.
- F. Supports and ties shall not be exposed at the face of the concrete nor shall they discolor the surface of the finished concrete. Reinforcement which has been exposed for bonding with future work shall be protected from corrosion by heavy wrappings of burlap saturated with a bituminous material.
- G. Movement of steel reinforcement in place during concrete operations shall be prevented. Any rods which are displaced shall be restored to proper position before they are completely covered.

3.02 MINIMUM COVER AND CLEARANCE

When concrete in footings or other principal structural members is in contact with the ground, reinforcement shall be protected by not less than 3 inches of concrete. If formed concrete surfaces, after removal of the forms, are exposed to the weather, the reinforcement shall be protected with no less than 2 inches of concrete. Unless shown otherwise on the plans, the protective covering of concrete for reinforcement at surfaces not exposed directly to the ground or weather shall be not less than the following:

Slabs	1 inch
Floors, Walkways, Driveways	1-1/2 inches
Walls less than 12 inches thick	1-1/2 inches
Walls 12 inches or more in thickness	2 inches
Beams and girders - Stirrup Steel	1-1/2 inches
Beams and girders - Main Reinforcement	2 inches
Columns	2 inches

** END OF SECTION **

SECTION 50

DUCTILE IRON PIPE AND DUCTILE IRON AND CAST IRON FITTINGS

Part I - General

1.01 SCOPE

The work covered by this section includes furnishing all labor, equipment, and materials required to furnish, install, and test ductile iron piping, including all fittings, wall pipe and sleeves, couplings, toppings, anchor blocks, and accessories, as specified herein and/or shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. The Contractor shall submit to the Engineer written evidence that the pipe furnished under this specification is in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate ASTM or AWWA testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of pipe materials.
- B. Each ductile iron pipe length and fitting and cast iron fitting shall be clearly marked with the pressure rating, metal thickness class, heat mark, net weight (excluding lining or coating) and name of the manufacturer. In addition, each item of piping shall be marked with an identifying mark corresponding to the appropriate mark on the shop drawings for that particular item of piping.
- C. All ductile iron pipe shall be new and manufactured completely at a single manufacturing facility in the United States of America.

1.03 SHOP DRAWINGS AND SPECIFICATIONS

- A. Complete shop drawings and specifications on all piping and accessories shall be submitted to the Engineer.
- B. Shop drawings shall indicate piping layout in plan and elevations as may be required and shall be completely dimensioned. The Drawings shall include a complete schedule of all pipe, fittings, specials, hangers, and supports. Special castings shall be clearly detailed showing all pertinent dimensions.

- C. The Contractor shall furnish the Engineer with lists, in duplicate, of all pieces of pipe and fittings in each shipment received. These lists shall give the serial or mark number, weight, class, size, and description of each item received.

1.04 SHOP PAINTING

Unless otherwise specified herein, all ductile iron pipe and fittings and cast iron fittings shall be cleaned and provided with a bituminous coating and cement lining applied at the factory.

1.05 GUARANTEE

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

PART 2 - PRODUCTS

2.01 GENERAL

- A. No broken, cracked, deformed, misshaped, imperfectly coated, or otherwise damaged or defective pipe or fittings shall be used. All such material shall be removed from the site of the work.
- B. Unless otherwise shown on the Drawings or directed by the Engineer, the minimum pipe wall thickness and thickness class of pipe shall be as follows:

<u>Pipe Size</u>	<u>Pressure Class</u>	<u>Metal Wall Thickness in Inches</u>
3-Inch Ductile Iron	350	0.25
4-Inch Ductile Iron	350	0.25
6-Inch Ductile Iron	350	0.25
8-Inch Ductile Iron	350	0.25
10-Inch Ductile Iron	350	0.26
12-Inch Ductile Iron	350	0.28
14-Inch Ductile Iron	250	0.28
16-Inch Ductile Iron	250	0.30
18-Inch Ductile Iron	250	0.31
20-Inch Ductile Iron	250	0.33
24-Inch Ductile Iron	250	0.37
30-Inch Ductile Iron	250	0.42
36-Inch Ductile Iron	252	0.47
42-Inch Ductile Iron	250	0.52
48-Inch Ductile Iron	250	0.58
54-Inch Ductile Iron	250	0.65

2.02 DUCTILE IRON PIPE

- A. Ductile iron pipe shall be designed in accordance with ANSI A21.50, Thickness Design of Ductile Iron Pipe, using 60,000 psi tensile strength, 42,000 psi yield strength, and 10 percent elongation.
- B. Ductile iron pipe shall be manufactured in accordance with ANSI A21.51, Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids, and shall be made of ductile iron having a minimum tensile strength of 60,000 psi, a minimum yield strength of 42,000 psi and 10 percent minimum elongation.

2.03 CAST IRON AND DUCTILE IRON FITTINGS

- A. All fittings shall conform in every respect to ANSI A21.10, 2 inches through 48 inches, for Water and Other Liquids.
- B. Unless otherwise shown on the Drawings, directed or specified, all fittings shall be for pressure rating of 250 psi.
- C. In general, flanged fittings shall be ANSI pattern using long radius elbows except where space limitations prohibit the use of same. Design of all fittings, whether long or short pattern, shall be as indicated or dimensioned on the Drawings. Special fittings and cast iron and ductile iron wall pipes and sleeves shall conform to the dimensions and details shown on the Drawings.

2.04 JOINTS FOR DUCTILE IRON PIPE AND FITTINGS AND CAST IRON FITTINGS

A. General

- 1. Joints for ductile iron pipe and fittings and cast iron, fittings shall be mechanical joints, flanged joints, push-on joints, or bell and spigot joints, as shown on the Drawings or specified herein.
- 2. Unless otherwise shown on the Drawings, specified or directed, all ductile iron pipe laid underground shall be joined using mechanical joints or push-on type joints.

B. Mechanical Joints

- 1. Mechanical joints shall consist of a bolt joint of the stuffing box type as detailed in ANSI A21.10 and described in ANSI A21.11.

2. Mechanical joints shall be thoroughly bolted in accordance with the manufacturer's recommendations with Tee Head Bolts and bolts of high strength, heat treated cast iron containing 0.50 copper or high strength low-alloy steel having a minimum yield point strength of 40,000 pounds per square inch and an ultimate tensile strength of 70,000 pounds per square inch.
3. Gaskets and bolts and nuts shall conform to ANSI A21.11. Gaskets shall be of neoprene or rubber of such quality that they will not be damaged by the liquid or gases with which they will come into contact.
4. Glands shall be of high strength cast iron.

C. Flanged Joints

1. Flanged joints shall conform to ANSI B16.1, Class 125, and in accordance with Table 10.23 of ANSI A21.10.
2. Flanged joints shall be bolted with through stud or tap bolts of required size as directed. Bolts and nuts shall conform in dimensions to the American Standard heavy series. Nuts shall be hexagonal, cold pressed. Bolts and nuts shall be cadmium plated, cold pressed, steel machine bolts, conforming to ASTM A 307, Grade B. Cadmium plating shall be by an approved process and shall be between 0.003- to 0.0005- inch thick. After each joint has been made, all bolts, heads, and nuts shall be coated with two coats of heavy asphaltum or other approved coating.
3. Gaskets of "Cranite," red rubber, asbestos composition, or other approved quality shall be used in all flanged joints. Gaskets shall conform to the requirements of ANSI B16.21.
4. Flanged ductile iron pipe approximately twelve (12) inches or less in length shall have flanges cast solidly to the pipe barrel. Flanges on ductile iron pipe longer than twelve (12) inches may be of the screw type. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange neck completely covers the threaded portion of the pipe to protect same against corrosion. Flange faces on cast iron fittings shall be coated with white lead immediately after they have been faced and drilled. All pipe with screw type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the Engineer.
5. Where tap or stud bolts are required, flanges shall be drilled and tapped accordingly.

D. Push-On Joints

1. Push-on joints shall conform to ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as "Fastite," "Bell-Tite," or "Tyton" joints.
2. Gaskets shall be in accordance with ANSI A21.11 and shall be of such quality that they will not be damaged by the liquid or gases with which they will come into contact.

2.05 PIPE COATING AND LINING

- A. All ductile iron pipe and fittings and cast iron fittings buried underground or submerged shall have a standard bituminous outside coating conforming to ANSI A21.6 or A21.51. All exposed ductile iron pipe and ductile iron and cast iron fittings shall have an outside coating of universal primer.
- B. All ductile iron pipe used for water or wastewater shall have cement mortar lining of standard thickness in accordance with ANSI A21.4. Cement mortar lining for cast iron and ductile iron fittings shall be double the standard thickness under ANSI A21.4.
- C. No lining shall be provided for ductile iron pipe and ductile iron and cast iron fittings used for air.
- D. Where a special lining is indicated on the Drawings for resistance to corrosive wastewater, pipe and fittings shall be furnished with a minimum 20 mil thick lining of chemically inert, abrasion resistant polyethylene. The lining shall be a blend of high density and low density polyethylene powders complying with ASTM D 1248 compounded with carbon black to provide resistance to ultraviolet rays during storage above ground. The pipe shall be preheated in a furnace (to ensure uniformity of heat distribution) to an adequate temperature to provide uniform fusing of the polyethylene powders and proper bonding to the pipe. The lining shall be unaffected by hydrogen sulfide, detergents, grease, oil, inorganic acids, alkalis, and most organic materials found in municipal wastewater and shall be suitable for service at operating temperatures of up to 180° F. The lining shall have a Hazen-Williams "C" coefficient of approximately 150 and a Manning "n" coefficient of approximately 0.010. Polyethylene-lined ductile iron pipe shall be U. S. Pipe "Polylined," American Cast Iron Pipe "Polybond," or equal.

2.06 PIPE COUPLINGS

- A. Pipe couplings shall be installed where shown on the Drawings, required for installation, or directed by the Engineer.
- B. Pipe couplings shall conform to the requirements of the section entitled "Pipe Couplings and Expansion Joints" of these Specifications.

2.07 WALL PIPE AND WALL SLEEVES

- A. Contractor shall furnish and install cast iron wall pipe or wall sleeves where ductile iron piping connects with or passes through concrete walls or floors and in locations where small piping and electric wiring and conduits connect with or pass through concrete walls or floors.
- B. Where wall pipes or sleeves are to be installed flush with the wall or slab, the flange or bells shall be tapped for studs. Where the flange or bell will project beyond the wall, the projection shall be sufficient to allow for installation of connecting bolts.

2.08 SPARE PARTS

The Contractor shall furnish four (4) spare gaskets for each size and type of joint requiring the use of a gasket. The Contractor shall furnish eight (8) bolts and nuts of each size and type used for cast iron and ductile iron pipe joints.

PART 3 - EXECUTION

3.01 LAYING

- A. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Great care shall be taken to prevent the pipe coating from being damaged, particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed by the Engineer.
- B. All pipe and fittings shall be carefully examined by the Contractor for defects just before laying and no pipe or fitting shall be laid which is defective. If any defective pipe or fitting is discovered after having been laid, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at his own expense.
- C. All pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.

- D. Pipe laid in trenches shall be laid true to line and grade on a firm and even bearing for its full length at depths and grades as shown on the Drawings. Adequate precautions shall be taken to prevent flotation of pipelines prior to backfilling. Installation of ductile iron pipe in underground pressure piping systems shall conform to the requirements of AWWA C600. Excavation of trenches and backfilling around pipes shall conform to the requirements of the section entitled "Earthwork" of these Specifications.
- E. All ductile iron piping laid underground shall have a minimum of 36 inches of cover above the top of the pipe unless otherwise shown on the Drawings.
- F. All elbows, tees, branches, crosses, and reducers in pressure piping systems shall be adequately restrained against thrust. Underground pressure piping containing unharnessed push-on or mechanical joints or expansion joints shall be restrained by thrust blocks. Thrust blocks shall consist of Class B concrete conforming to the requirements of the section entitled "Cast-In-Place Concrete" of these Specifications and shall be of the size and shape as shown on the Drawings. The Contractor may use forms or earth walls to mold the thrust blocks. When earth walls are used, they shall be cut true to shape and all excess earth removed. The work shall be conducted so that no loose earth will become mixed with the concrete. At the end of 24 hours, damp earth may be placed over the concrete to retain moisture.
- G. All ductile iron pipes entering buildings or basins shall be adequately supported between the structure and undisturbed earth as shown on the Drawings to prevent breakage resulting from settlement of backfill around the structure.
- H. Wall pipe and wall sleeves shall be accurately located and securely fastened in place before concrete is poured. All wall pipe and wall sleeves shall have wall collars properly located to be in the center of the wall where the respective pipes are to be installed.
- I. Wall pipe and wall sleeves shall be installed when the wall or slab is constructed. Blocking out or breaking of the wall for later insertion shall not be permitted.
- J. Cutting or weakening of structural members to facilitate pipe installation shall not be permitted. All piping shall be installed in place with out springing or forcing.
- K. Sufficient couplings and flanged joints shall be provided to facilitate equipment installation and removal.
- L. Exposed ductile iron piping shall be supported as shown on the Drawings and specified in the section entitled "Pipe Supports and Hangers" of these Specifications.

- M. Check Dams: When ductile iron pipe is used as a material for sanitary sewer construction the following shall apply:
1. Check dams shall be installed in the bedding and backfill of all new or replaced sewer lines to limit the drainage area subject to the french drain effect of gravel bedding. Dams shall consist of compacted clay bedding and backfill at least three (3) feet thick to the top of the trench and cut into the walls of the trench two (2) feet. Refer to construction detail drawing 200-395.
 2. Alternatively , concrete may be used, keyed into the trench walls. Dams shall be placed no more than 500 feet apart. The preferred location is upstream of each manhole. All stream crossings will include check dams on both sides of the crossing.

3.02 CUTTING

- A. Whenever pipe requires cutting to fit the lines, the work shall be done in such manner as to leave a smooth end at right angles to the axis of the pipe. When a piece of pipe is cut to fit into the line, no payment will be made for the portion cut off and not used.
- B. Whenever existing pipe requires cutting to install new fittings, the work shall be done in such manner as to leave a smooth end at right angles to the axis of the pipe and special care shall be exercised to guard against breaking or splitting the existing piping.
- C. All cutting of ductile iron pipe shall be done with a cutting saw. All burrs shall be removed from the inside and outside edges of all cut pipe.

3.03 JOINING

A. Mechanical Joints

1. The successful operation of the mechanical joint specified requires that the spigot be centrally located in the bell and that adequate anchorage shall be provided where abrupt changes in direction and dead ends occur.
2. The surfaces with which the rubber gasket comes in contact shall be brushed thoroughly with a wire brush just prior to assembly to remove all loose rust or foreign material which may be present and to provide clean surfaces which shall be brushed with a liberal amount of soapy water or other approved lubricant just prior to slipping the gasket over the spigot end and into the bell. Lubricant shall be brushed over the gasket prior to installation to remove loose dirt and lubricate the gasket as it is forced into its retaining space.

3. Joint bolts shall be tightened by the use of approved wrenches and to a tension recommended by the pipe manufacturer. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side and last, the remaining bolts. This cycle shall be repeated until all bolts are within the range of acceptable torques. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation shall not be permitted.
4. After installation, bolts and nuts in buried or submerged piping shall be given two (2) heavy coats of a bituminous paint.

B. FLANGED JOINTS

1. All flanges shall be true and perpendicular to the axis of the pipe. Flanges shall be cleaned of all burrs, deformations, or other imperfections before joining. Flanged joints shall be installed so as to ensure uniform gasket compression. All bolting shall be pulled up to the specified torque by crossover sequence. Where screwed flanges are used, the finished pipe edge shall not extend beyond the face of the flange, and the flange neck shall completely cover the threaded portion of the pipe.
2. Connections to equipment shall be made in such a way that no strain is placed on the equipment flanges. Connecting flanges must be in proper position and alignment and no external force may be used to bring them together properly.
3. After installation, bolts and nuts in buried or submerged piping shall be given two (2) heavy coats of a bituminous paint.

C. Push-On Joints

1. The inside of the bell and the outside of the pipe from the plain end to the guide stripe must be wiped clean immediately before assembling the pipe joint. Then the rubber gasket shall be inserted into a groove or shaped recess in the bell. Both the bell and spigot ends to be joined shall be wiped again to ensure they are thoroughly clean. A liberal coating of special lubricant furnished by the pipe manufacturer shall be applied to the outside of the pipe from the plain end to the yellow guide stripe and to the inside of the gasket. The plain end shall be centered in the bell and the spigot pushed home. Wherever possible the pipe shall be socketed by hand; however, jacking may be required to push the spigot in place on the larger sizes of pipe. The completed joint shall be permanently sealed and watertight.

2. Whenever the pipe is cut in the field, the cut end shall be conditioned so it can be used in making up a joint by filing or grinding the cut end to remove burrs or sharp edges that might damage the gasket.

D. Permissible Deflection of Joints

1. Deflection of ductile iron pipe at joints for long radius curves or for avoiding obstacles shall be permitted only upon approval of the Engineer.
2. Where deflection of joints is permitted, such deflection shall be made in accordance with and shall not exceed limits provided in Section 9b.5 and Section 9c.4 as applicable, of the AWWA C600.

E. Joints of Dissimilar Metals

When a flanged joint consists of a ductile iron flange mated to a steel or alloy flange, the steel flanges shall be flat faced and furnished with full-faced gaskets, insulating bushings, and stainless steel bolts.

3.04 SERVICE CONNECTIONS

- A. In general and unless otherwise shown, small service lines and branches shall connect to larger cast iron or ductile iron mains using cast iron tapped tees and crosses.
- B. Tapped tees and crosses shall have minimum 2-inch NPT branch connections and shall be furnished with mechanical joint ends.

3.05 DRILLING AND CONNECTING TO EXISTING WATER SYSTEM

- A. Wherever required ductile iron pipe and fittings and cast iron fittings shall be drilled and tapped to receive drainage or any other piping. All holes shall be drilled accurately at right angles to the axis of any pipe or fitting. Where plugs are drilled, holes shall be at right angles to the face of the plug.
- B. Where the size of the pipe to be connected is such as to require bosses for connection and when the pipe wall thickness is too thin to permit the effective length of pipe threads to be utilized as necessary for the size pipe being connected by threads, the Contractor shall furnish such pipe with cast-on bosses suitable for drilling, tapping, and connecting such pipe. Alternately, where shown or specified a tapped saddle clamp may be used in lieu of a cast-on boss.
- C. All tapping shall be carefully and neatly done by skilled workman with suitable tools.

- D. Where connections are made between and old piping the connections shall be made in a through and workmanlike manner using proper fittings and specials to suit actual conditions. It shall be the Contractor's responsibility to verify the type and size of materials in existing water lines and provide tapping devices and/or fittings as required to make the indicated connections.
- E. "Non- Pressure" Connections: Unless otherwise indicated or authorized, make connections to existing water mains by removing plug from existing plugged fittings, or inserting a tee and a proper sleeve in the existing main, as applicable, at each point of connection between new and existing mains. This will require shutting off water in the existing main involved.
1. In general and unless otherwise shown, cut-ins to existing ductile iron piping for installation of new mechanical joint fittings and valves shall be made using cast iron or ductile iron cutting-in sleeves.
 2. Cutting-in sleeves shall have a pressure rating not less than that of the existing pipeline and shall be furnished with a mechanical joint end on one end and a plain end on the other.
- F. BEFORE SHUTTING OFF WATER TO MAKE EACH NON-PRESSURE CONNECTION, OBTAIN APPROVAL OF THE OWNER AND ADVISE ALL AFFECTED CUSTOMERS ACCORDINGLY.
- G. "Pressure" Connections: Where indicated or authorized, make the connection to the existing water main by installing therein a tapping device and tapping valve, and cutting a proper opening in the existing main with a suitable tapping machine, all without shutting off water in existing main involved. Tapping valves and their boxes shall conform in all respects to applicable requirements of Section 90, Valves of these specifications. The tapping valve shall be gate type, each with one flanged end to mate with tapping device flange, and one mechanical joint hub end. Tapping devices shall be as follows:
1. For connections to 10" and smaller existing iron **or PVC water mains, a Ford FAST or Mueller stainless tapping sleeve shall be used. No fabricated 2-piece tapping sleeves shall be used.**
 2. For connections to 12" and larger existing iron water mains, tapping devices shall be ductile iron **mechanical joint (MJ) clamp-on tapping sleeves or split tapping sleeves, Mueller Company H-615 or approved equal**
- H. Existing pipelines that may be cut or damaged during the performance of work under this item shall be repaired, reconnected, and returned to service in equal or better condition in which they were found and in accordance with the requirements of this Specification.

- I. No separate payment will be made for drilling, tapping, making connections, cut-ins, repairs to damaged existing pipelines, and reconnections in existing pipelines.

3.06 CUTTING AND CAPPING EXISTING WATER MAINS

At all locations shown on the plans or where directed by the Engineer the Contractor shall cut and cap the existing water mains. This item shall include excavation, cutting existing water main, furnishing and installing an approved cap and necessary concrete blocking, backfill and all labor and materials required for a complete installation. The water mains to be abandoned will be cut and capped as close as possible to the point of connection to the existing main remaining in service. Be sure to keep the proposed abandoned main in service until all service line transfers have been completed. Where possible, isolate the proposed abandoned main with valves turned off for a 12-24 hour period. This will aid in making sure all service transfers have been completed and if not, the ease of turning the valve on will provide the customer with water. Following that period permanent capping can be completed.

3.07 BLOW-OFF ASSEMBLY FOR END OF LINE

Each end of line blow-off assembly shall be constructed in accordance with the details as shown on the Contract Drawings and the requirements of these Specifications.

3.08 FIELD TESTING

- A. After all piping has been placed and backfilled between the joints, each run of newly laid pipe, or any valved section there of, shall be tested by the Contractor in the presence of the Engineer, and tests shall be continued until all leaks have been made tight to the satisfaction of the Engineer.
- B. All piping shall be subject to a hydrostatic gauge pressure equal to 150 percent of the maximum operating pressure of the pipe section under test or 150 psig, whichever is greater, based on the elevation of the lowest point of the section of pipe under test and corrected to the elevation of the test gauge. The above pressures shall be maintained for a minimum of two consecutive hours. No leakage will be allowed. Leakage may be determined by loss of pressure or other methods approved by the Engineer.
- C. The Contractor shall take all precautions necessary to protect any equipment that might be damaged by the pressures used in the tests. Delicate equipment shall be valved off, removed, or otherwise protected.

- D. All piping shall be securely anchored and restrained against movement prior to application of test pressures. Prior to the pressure test, pipe laid in trenches shall be partially backfilled adequately to secure the pipe during the test. All joints, fittings, and valves will be left open where possible. All exposed pipe, fittings, valves, and joints shall be carefully examined during the pressure test.
- E. Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants, blow-offs, or air release valves are not available at the high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made and insert plugs after the test has been completed.
- F. After satisfactory completion of the pressure test, a leakage test shall be performed on each section of pipe in accordance with Section 4.2 of AWWA C600 at hydrostatic pressure equal to the maximum operating pressure of the pipe section under test, based on the elevation of the lowest point of the line or lowest point of the section under test and corrected to the elevation of the gauge.
- G. Any leakage developing during the test shall be corrected at the Contractor's expense by tightening, replacing packing or gaskets, or replacing defective portions of the piping system. Caulking will not be permitted. If the defective portion cannot be located, the Contractor, at his expense, shall remove and reconstruct as much of the original work as necessary to obtain a facility tested without leakage.
- H. After all tests on any section have been completed to the satisfaction of the Engineer, the Contractor shall carefully clean, blow out, and drain the line of all water to prevent the freezing of the same. The Contractor shall also demonstrate to the satisfaction of the Engineer that any and all lines are free from obstructions and foreign material.
- I. The Contractor shall bear the complete cost of the tests, including set-up, labor, temporary piping, blocking, gauges, bulkheads, water, air, soap solutions, and any other materials required to conduct the tests.

3.09 DISINFECTION

Following installation and testing, potable water lines shall be disinfected in accordance with the requirements of the section entitled "Sterilization" of these Specifications.

****END OF SECTION****

SECTION 60

POLYVINYL CHLORIDE (PVC) WATER PRESSURE PIPE

PART 1 - GENERAL

1.01 SCOPE

- A. The work covered by this section includes furnishing all labor, equipment, and materials required to install and test polyvinyl chloride (PVC) pressure pipe, including valves, unions, fittings, couplings, adapters, and accessories, as shown on the Drawings and/or specified herein.
- B. The Contractor's attention is called to the fact that all PVC piping and accessories are not necessarily shown completely on the Drawings which are more or less schematic. However, the Contractor shall furnish and install all piping indicated or required for proper operation of the equipment or services requiring such piping.

1.02 QUALITY ASSURANCE

- A. The Contractor, at the Engineer's request, shall furnish a certificate from the manufacturer of the pipe and fittings that the manufacturer is fully competent and capable of manufacturing PVC pipe and fittings of uniform texture and strength that will fully comply with these specifications and have so manufactured this class of pipe in sufficient quantities to be certain that it will meet all normal field conditions of usage. The manufacturer must have adequate equipment and quality control facilities to be sure that each extrusion of pipe is uniform in texture, dimensions, and strength.
- B. All pipe shall be tested and inspected at the place of manufacture for all requirements of the latest ASTM and Commercial Standard tests.
- C. Each length of pipe and each fitting shall have the following data clearly marked on each piece:
 - 1. Nominal size
 - 2. Type and grade of material and ASTM standard
 - 3. SDR, class, or schedule rating
 - 4. Manufacturer
 - 5. National Sanitation Foundation's seal of approval

1.03 SHOP DRAWINGS AND MATERIAL SPECIFICATIONS

Complete shop drawings and material specifications shall be submitted to the Engineer upon receipt of bids.

1.04 STORAGE AND PROTECTION

- A. PVC pipe and fittings shall be stored under black plastic cover.
- B. All pipe and accessories shall be stored aboveground and fully supported so as not to bend or deflect excessively under its own weight. Height of stacked pipe shall not exceed 4 feet. Bundled pipe shall not be stacked more than two bundles high.
- C. Kinked, flattened, buckled, broken, or otherwise defective pipe and fittings shall not be used and shall be removed from the site.
- D. Pipe shall be handled using nylon slings. Wire rope slings or chains shall not be used.

1.05 GUARANTEE

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

1.06 RECORD DRAWINGS

Record drawings shall be prepared on reproducible mylars and given to Cleveland Utilities within thirty (30) calendar days of acceptance by C.U. of the completed project. The data to be included on the record drawings shall include as a minimum the following:

1. All changes and revisions to the original water plans;
2. Plan view of the water lines and any revisions;
3. Location of all valves, fire hydrants, tees, blow offs, etc....
4. Length of the water line measured from beginning of job to end of job. This includes any extensions which may be added to original job.

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

- A. 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.
- B. The manufacturer shall provide waterstops, acceptable to the Engineer, which shall be applied to the outside of plastic pipe when the pipe is to be enclosed in any structure where concrete or mortar is used which will prevent leakage along the outer wall of the barrel of the pipe.
- C. No single piece of pipe shall be laid on any project covered by this specification unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed 1/16 inch per foot of length. If the deviation from straightness exceeds this requirement, then the particular piece of pipe shall be rejected for use until it can comply with this provision.
- D. Wyes, tees, bends, and adapters and any other fittings required or directed by the Engineer shall be constructed of ductile iron as directed in Section 50 of these Specifications. Engineering data for such fittings showing cross-sectional views with dimensions shall be provided and such data and fittings shall be approved by the Engineer prior to their use. The materials used in the manufacture of fittings shall conform with the requirements for the pipe with which they shall be used and any variation of such requirements shall be subject to the approval of the Engineer. Fittings shall have wall thicknesses equal to or greater than that of the pipe to which they are joined.

2.02 PIPE

- A. PVC pipe shown on the Drawings to be installed outside of structures or buried underground and used to convey water or wastewater shall have push-on joints unless otherwise noted on the Drawings. All pipe material shall be Grade 1, Type I, polyvinyl chloride (PVC) in accordance with ASTM D 1784, Class 12454-B. All pipe material shall be National Sanitation Foundation approved for use with potable water. Pipe in sizes 2 inches through 12 inches shall be either SDR 21 with 200 psi pressure rating in accordance with ASTM D 2241 or Class 200 in accordance with AWWA C 900, depending on which is called for on the Drawings or in the Bid Schedule. Maximum lengths of pipe shall not exceed 20 feet.

2.03 FITTINGS

- A. All fittings required in PVC piping systems conveying water shall be cast iron or ductile iron as specified in Section 50 of these Specifications. Engineering data for fittings showing cross-sectional views with dimensions shall be provided and such data and fittings shall be approved by the Engineer prior to their use. Connections between cast iron or ductile iron fittings and PVC pipe shall be made by use of special adapters similar to Mueller Transition Gland A-399 by Mueller Company, Transition Gasket F6340 by Clow Corporation or a similar transition which has been approved by the Engineer. The joint shall be mechanical joint for ductile iron or cast iron as described in Section 50 of these Specifications.

2.04 JOINTS

A. Push-On Joints

1. The joints shall be designed so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. The push-on joint shall be single rubber gasket joint designed to be assembled by the positioning of a continuous, molded, rubber ring gasket in an annular recess in the pipe or fitting entering pipe into the socket thereby compressing the gasket radially to the pipe to form a positive seal. The gasket and the annular recess shall be so designed and shaped that the gasket is locked in place against displacement as the joint is assembled. Details of the joint design and assembly shall be in accordance with the joint manufacturer's standard practice. The joints shall be designed so as to provide for the thermal expansion or contraction experienced with a total temperature change of at least 75° F in each joint per length of pipe. The joint shall comply with ASTM F 477.
2. Lubricant furnished for lubricating joints shall be nontoxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to water. The lubricant containers shall be labeled with the manufacturer's name.
3. Gaskets shall meet all applicable requirements of ANSI A21.11. Gasket dimensions shall be in accordance with the manufacturer's standard design dimensions and tolerances. The gasket shall be of such size and shape as to provide an adequate compressive force against the spigot and socket after assembly to effect a positive seal under all combinations of joint and gasket tolerances. The trade name or trademark, size, mold number, gasket manufacturer's mark and year of manufacture shall be molded in the rubber on the back of the gaskets.

4. Gaskets shall be vulcanized natural or vulcanized synthetic rubber. No reclaimed rubber shall be used. When two hardnesses of rubber are included in a gasket, the soft and hard portions shall be integrally molded and joined in a strong vulcanized bond. They shall be free of porous areas, foreign material, and visible defects.
5. The gasket manufacturer shall set up such quality control procedures as will insure the gasket's meeting the requirements of this standard. He shall furnish a monthly report of representative quality control test results to the pipe manufacturer.
6. A sample push-on fitting shall be submitted to the Engineer for examination and approval prior to delivery of any pipe.

PART 3 - EXECUTION

3.01 LAYING PIPE

- A. All provisions with respect to trenching, backfilling, bedding, and pipe laying shall conform to the applicable requirements of the sections entitled "Earthwork" and "Ductile Iron Piping and Ductile Iron and Cast Iron Fittings" of these Specifications.
- B. All provisions with respect to connections and existing utilities shall comply with the applicable requirements of the section entitled "Ductile Iron Piping and Ductile Iron and Cast Iron Fittings" of these Specifications.
- C. When a joint consists of a PVC flange and a metal flange, the metal flange shall be flat faced and furnished with a full face resilient gasket.
- D. Where specifically shown or called for on the Drawings, service line taps into PVC pipe shall be made using tapping saddle constructed for use on PVC pipe. The saddle shall be constructed of bronze or brass, shall have all stainless steel bolts or screws, and have a resilient rubber gasket to provide a positive, watertight seal.
- E. PVC pipe laid underground shall have a minimum of 36 inches of cover in both traveled and non-traveled (open) areas. See construction detail drawing titled "Water Line Depth Requirements" for further details regarding the relationship of water pipe elevation to adjacent roadways, pipe bedding, etc. If this condition cannot be met, ductile iron pipe or concrete encasement must be used.

- F. After completing installation and bedding of water and service lines, backfill to the top of the pipe with suitable material. Install No. 12 or 14 gage cap wire directly over the water and service pipe. Then proceed to backfill to within 18 inches from finished ground elevation. Install a second layer of detection tape (2" WATER LINE) directly over the installed water and service pipe. Provide enough free end at each hydrant, valve, and meter to allow for the wire to be located and attached easily. The wire should be attached to each hydrant, valve and meter as directed by the Engineer. Type, width, color, and marking of wire must be approved by the Engineer.

3.02 FIELD TESTING

- A. After all piping has been placed and backfilled between the joints, each run of newly laid pipe, or any valved section thereof, shall be tested by the Contractor in the presence of the Engineer, and tests shall be continued until all leaks have been made tight to the satisfaction of the Engineer.
- B. All piping shall be subject to a hydrostatic gauge pressure equal to the rated pressure class of the pipe being tested. The allowable leakage shall be as shown in Table 1. The duration of the test shall be a minimum of 2 hours.
- C. The Contractor shall take all precautions necessary to protect any equipment that might be damaged by the pressures used in the tests. Delicate equipment shall be valved off, removed, or otherwise protected.
- D. All piping shall be securely anchored and restrained against movement prior to application of test pressures. Prior to the pressure test, pipe laid in trenches shall be partially backfilled adequately to secure the pipe during the test. All joints, fittings, and valves will be left open where possible. All exposed pipe, fittings, valves, and joints shall be carefully examined during the pressure test.
- E. Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants, blow-offs, or air release valves are not available at the high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made and insert plugs after the test has been completed.
- F. Any excessive leakage developing during the test shall be corrected at the Contractor's expense. If the defective portion cannot be located, the Contractor, at his expense, shall remove and reconstruct as much of the original work as necessary to obtain a facility meeting the specified leakage limits.
- G. After all tests on any section have been completed to the satisfaction of the Engineer, the Contractor shall carefully clean, blow out, and drain the line of all water to prevent the freezing of the same. The Contractor shall also demonstrate to the satisfaction of the Engineer that any and all lines are free from obstructions and foreign material.

- H. The Contractor shall bear the complete cost of the tests, including set-up, labor, temporary piping, blocking, gauges, bulkheads, water, air, soap solutions, and any other materials required to conduct the tests.

TABLE 1

ALLOWABLE LEAKAGE

U. S. Gallons per 100 Joints per Hour

<u>Pipe Diameter (inches)</u>	<u>Test Pressure (psi)</u>			
	<u>50</u>	<u>100</u>	<u>150</u>	<u>200</u>
4	0.35	0.50	0.60	0.75
6	0.53	0.75	0.90	1.10
8	0.70	1.00	1.20	1.40
10*	0.88	1.25	1.50	1.75
12*	1.05	1.50	1.80	2.10

*Single-gasket coupling is one joint. Twin-gasket coupling is two joints.

3.03 DISINFECTION

After installation and testing, all potable water piping shall be disinfected in accordance with the requirements of Section 130 entitled "Sterilization" of these Specifications.

** END OF SECTION **

SECTION 65

WATER SERVICE LINE INSTALLATION

PART 1 - GENERAL

1.01 SCOPE

A. Water Service Lines - Existing & New

This section shall include the replacement of existing substandard water services and the installation of new services where directed by the Engineer, or shown on the contract Drawings. It shall include excavating, backfilling, furnishing all material, providing temporary service lines where necessary, and providing all labor and work necessary for the construction of the sizes and types of water service lines as listed in the Contract Documents.

The following type of connections are as follows:

1. Connection of an existing service line in good condition to a new water line.
2. Connection of a new service line to a new water line or an existing water line.
3. Connection of a new service line to an existing service line in good condition.
4. Connection of an approved service line to a curb stop in a new meter box (prestub) and/ or connection to an existing meter in an existing meter box.

1.02 TYPES OF WATER SERVICE LINES TO BE REPLACED

Existing service lines are to be replaced where they are smaller than 3/4 inch in size, or where they are galvanized iron lines, or lead lines. Existing copper service lines, PVC lines, and polyethylene lines in good condition, that are 3/4 inch or larger will not be replaced, unless directed by the Engineer.

1.03 METER BOXES

Below are the conditions where meter boxes shall be installed, replaced or relocated:

1. New water meter boxes shall be installed when they are required for a proposed meter set as shown on the contract Drawings or directed by the Engineer.

2. Meter boxes requiring relocation, or any existing water meter box that, in the opinion of the the Engineer is substandard, shall be relocated or replaced at the Owners expense.
3. Any meter box relocated or disturbed by the Contractor in his construction operations shall be considered "incidental to construction". The costs of such relocation or replacement shall be borne by the Contractor.

1.04 GUARANTEE

The Contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties" of these Specifications.

Part 2 - PRODUCTS

2.01 WATER SERVICE LINES, FITTINGS AND METER BOXES

- A. The Contractor shall furnish all service line pipe and fittings conforming to the following:
 1. Pipe - 3/4 inch minimum; Copper Type K Soft Annealed conforming to ASTM B88 47, **PEX Type "A" with taped on tracer wire**, or approved equal.
 2. Corporation Stop - Size as required for service - 3/4 inch minimum. Conforming to AWWA Standard C800-66-Tapered CC Pipe Threads, Ford F1000, or equal.
 3. Meter Stop - Ford Lockwing Angle Valve with compression joint, KV43-332W, or equal.
 4. Fittings - Compression fittings approved by Cleveland Utilities.

B. METER BOXES

The Contractor shall furnish polyethylene meter boxes as manufactured by Southeastern Distributors, Franklin, North Carolina (MB-1) or approved equal. An aluminum or cast iron cover may be used or equal. All meter boxes and frames and covers shall be approved by the Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION OF SERVICE LINES AND METER BOXES

- A. A complete service line shall be installed at all new connections to the water distribution systems. Service lines shall be installed between the water main and the property line. Where road crossings are required, service lines shall be installed by boring and jacking wherever feasible.
- B. Each water service line shall be connected to the water main through a brass corporation stop. The water main shall be tapped and the corporation stop inserted at a 45⁰ angle from the top of the water main under pressure. Service clamps or saddles must be used when connecting water service lines to PVC water mains.
- C. The water service line shall be laid to a depth of at least (18) inches below finished grade of the traveled area from the water main to the meter box.
- D. The excavation, bedding and backfilling for service lines shall be the same as required for "Polyvinyl Chloride (PVC) Water Pressure Pipe", Section 60 of these specifications.
- E. Each new water service or replacement of existing substandard service shall include a meter stop. The meter stop shall be at the end of the service and within the meter box.
- F. Metallic detection tape (WATER LINE) will be installed along and over the water service line according to the specifications for PVC water lines entitled "Polyvinyl Chloride (PVC) Water Pressure Pipe", Section 60.
- G. Meter boxes shall be set at the property line and connected to the new service line. The exact field location of the meter box shall be determined by the Engineer and shall be located to provide easy access to the meter reader and serviceman, be not a hazard to the customer or public, be reasonably well protected against frost, mechanical damage and tampering.

** END OF SECTION **

SECTION 70

POLYVINYL CHLORIDE (PVC) SEWER AND SERVICE PIPE

PART 1 - GENERAL

1.01 SCOPE

The work covered by this section includes furnishing all labor, equipment, and materials required to install and test polyvinyl chloride (PVC) pipe, including accessories, as shown on the Drawings and/or specified herein.

1.02 QUALITY ASSURANCE

- A. The Contractor, at the Engineer's request, shall furnish a certificate from the manufacturer of the pipe and fittings that the manufacturer is fully competent and capable of manufacturing PVC sewer pipe, fittings, and accessories of uniform texture and strength that will fully comply with these Specifications and have so manufactured this class of pipe in sufficient quantities to be certain that it will meet all normal field conditions of usage. The manufacturer must have adequate equipment and quality control facilities to be sure that each extrusion of pipe is uniform in texture, dimensions, and strength.
- B. Pipe shall be tested when requested by the Engineer and all pipe so designated shall be tested in accordance with ASTM D 2412 "Standard Method of Test for External Loading Properties of Plastic Pipe by Parallel Plate Loading."
- C. Each length of pipe and each fitting shall have the following data clearly marked on each piece:
 1. Manufacturer's name
 2. Pipe size
 3. PVC compound used
 4. ASTM material specification for the PVC compound used

1.03 SHOP DRAWINGS AND MATERIAL SPECIFICATIONS

Complete shop drawings and material specifications shall be submitted to the Engineer upon receipt of bids.

1.04 STORAGE AND PROTECTION

- A. PVC pipe and fittings shall be stored under black plastic cover.

- B. All pipe and accessories shall be stored aboveground and fully supported so as not to bend or deflect excessively under its own weight. Height of stacked pipe shall not exceed 4 feet. Bundled pipe shall not be stacked more than two bundles high.
- C. Kinked, flattened, buckled, broken, or otherwise defective pipe and fittings shall not be used and shall be removed from the site.
- D. Pipe shall be handled using nylon slings. Wire rope slings or chains shall not be used.

1.05 GUARANTEE

The Contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties" of these Specifications.

1.06 RECORD DRAWINGS

Record drawings shall be prepared on reproducible mylars and given to Cleveland Utilities within thirty (30) calendar days of acceptance by C.U. of the completed project. The data to be included on the record drawings shall include as a minimum the following:

1. All changes and revisions to the original sewer plans;
2. Planview and profile of the sewers and any revisions;
3. Location of all tees or wyes as measured from the nearest downstream manhole;
4. Length of the sewer service line measured from the center of the collector line to the end of the pipe;
5. Approximate depth of the end of each sewer service pipe.
6. Where the sewer service line is not perpendicular to the centerline of the collector line, a measurement from the downstream manhole must be made to a point located on the collector line that is perpendicular to the end of the sewer service line. The length of the sewer service from this point to the end of the pipe must also be noted.
7. All bench marks used for sewer line design and construction must be shown on both construction and record drawings. Permanent bench marks shall be located adjacent to every third manhole on the project and the description and elevation noted on the construction plans. Review the drawing entitled "Measurement Examples for Locating Sewer Service Lines" located in the back of these specifications so proper information can be shown on as-built drawings.

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

- A. The pipe and fittings shall be homogeneous 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.
- B. The manufacturer shall provide waterstops, acceptable to the Engineer, which shall be applied to the outside of the plastic pipe when the pipe is to be enclosed in any structure where concrete or mortar is used which will prevent leakage along the outer wall of the barrel of the pipe.
- C. No single piece of pipe shall be laid on any project covered by this Specification unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed 1/16 inch per foot of length. If the deviation exceeds this requirement, then the particular piece of pipe shall be rejected from use until it can comply with this provision.
- D. Wyes, tees, bends, adapters, and any other fittings required or directed by the Engineer shall be provided. Engineering data for such fittings showing cross-sectional views with dimensions shall be provided and such data and fittings shall be approved by the Engineer prior to their use. The materials used in the manufacture of fittings shall conform to the requirements for the pipe with which they shall be used and any variation of such requirements shall be subject to the approval of the Engineer. Fittings shall have wall thicknesses equal to or greater than that of the pipe to which they are joined.

2.02 PIPE

- A. PVC piping and accessories shall be made from Virgin Type I, Grade 1 PVC compounds with physical and chemical properties conforming to those defined and described in ASTM D 1784 for "Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds."
- B. The standard length of PVC pipe under this Specification shall not exceed 12.5 feet, except that all pipe used in service lines shall not exceed 20 feet in length unless otherwise approved by the Engineer.
- C. The PVC pipe and accessories shall be manufactured in accordance with the requirements of ASTM D 3034, Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings. Four-inch-diameter pipe for service lines (house connections and all other diameter pipe for gravity sewers shall have an SDR of 35 or less. The pipe shall be manufactured to the following dimensions: (All dimensions in inches)

<u>Nominal Size</u>	<u>Outside Diameter</u>	<u>SDR Designation</u>	<u>Minimum Wall Thickness</u>
4	4.215	33.5	0.125
6	6.275	35.0	0.180
8	8.400	35.0	0.240
10	10.500	35.0	0.300
12	12.500	35.0	0.360
15	15.300	35.0	0.437

2.03 JOINTS

- A. PVC pipe joints shall be the bell and spigot type subject to the approval of the Engineer.
- B. Joints shall be sealed with a rubber O-ring gasket, and shall be of a composition and texture which is resistant to common ingredients of sewerage, industrial wastes including oils and ground water, and which will endure permanently under the conditions likely to be imposed by this usage. The gasket installation shall be done in accordance with the pipe manufacturer's instructions using all the necessary materials, lubricants and equipment recommended by the manufacturer.

PART 3 - EXECUTION

3.01 PIPE LAYING

- A. Before sewer pipe is placed in position in the trench, the bottom and sides of the trench shall be carefully prepared and bracing and sheeting installed where required. A mason's line, supported at intervals not exceeding 50 feet, shall be stretched tightly above ground level at a grade parallel to and directly above the axis line of the pipe. Each pipe shall be accurately placed to the exact line and grade called for on the Drawings by measuring down from this line to the invert of the pipe in place. The Contractor shall furnish all labor and materials necessary for erecting batter boards and establishing lines and grades therefor.
- B. The Contractor may use the laser beam method of setting a line and grade for the sewer by using the laser beam coaxially through the center of the sewer being laid. The laser beam projector is to be rigidly mounted to its support platforms, with a two-point suspension, or equivalent, assuring that all ground and equipment vibrations are kept to an absolute minimum. All equipment including equipment necessary to control atmospheric conditions in the pipe to keep line and grade to acceptable standards of accuracy shall be furnished by the Contractor. The laser beam system must be operated by competent experienced men who have been properly trained to operate the equipment used.

- C. The Contractor shall stake check pegs at all manholes throughout the job. Check pegs midway between manholes and any other check points deemed necessary to assure accuracy of the equipment shall be provided by the Contractor.
- D. Each piece of pipe and special fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells uphill. No pipe shall be laid except in the presence of an inspector representing the Engineer. Trench bottoms found to be unsuitable for foundations after pipe laying operations have started shall be corrected and brought to exact line and grade with approved compacted materials as provided under the section entitled "Earthwork" of these specifications.
- E. Bell holes shall be of sufficient size to allow ample room for making the pipe joints properly. Bell holes shall not be cut out more than ten joints ahead of pipe laying. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length as shown on the Drawings. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe in order to avoid sudden offsets or inequalities in the flow line.
- F. Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the joints are completely set or before the trench has been backfilled. The Contractor at no time shall open up more trench than his available pumping facilities are able to dewater. Where sewer pipelines are located in or across stream beds or drainage ditches, the Contractor shall divert the stream flow and dewater each section as the work progresses.
- G. No joints shall be made where pipe or joint materials have been soiled by earth in handling until such soiled surfaces are thoroughly cleaned by wire brushing and wiping until all traces of the earth are removed.
- H. As the work progresses, the interior of all pipe shall be kept thoroughly clean. After each line of pipe has been laid, it shall be carefully inspected and all earth, trash, rags, and other foreign matter removed from the interior. A filled bag or other approved type of follower shall be pulled through the line immediately after each joint is made in order to remove any debris which may be left on the inside of the pipe.
- I. Backfilling of trenches shall be started immediately after the pipe in place has been inspected and approved by the Engineer and backfill shall be deposited and compacted as provided under the section entitled "Earthwork" of these Specifications.
- J. As a general rule, in traveled areas where cover is less than 4 feet, or in open areas where cover is less than 2 1/2 feet ductile iron pipe or concrete encasement shall be used.

- K. Installation of service pipe shall conform to the appropriate requirements of main line sewers.
- L. Connections of service lines to the main sewer shall be made with bends of the proper degree to make the service run perpendicular to the main sewer. Pipe shall be laid to a uniform line and grade. Minimum grade shall be 1 percent.
- M. The end of all service connections shall be plugged with a PVC plug and sealed with plastic joint material.
- N. Crushed stone bedding and backfill material, concrete encasement and protection, etc., for service line installation shall be provided as conditions require and as directed by the Engineer.
- O. No service connections shall be covered until they have been inspected and located by the Engineer.
- P. CHECK DAMS
 - 1. Check dams shall be installed in the bedding and backfill of all new or replaced sewer lines to limit the drainage area subject to the french drain effect of gravel bedding. Dams shall consist of compacted clay bedding and backfill at least three (3) feet thick to the top of the trench and cut into the walls of the trench two (2) feet. Refer to construction detail drawing 200-395.
 - 2. Alternatively, concrete may be used, keyed into the trench walls. Dams shall be placed no more than 500 feet apart. The preferred location is upstream of each manhole. All stream crossings will include check dams on both sides of the crossing.

3.02 INSTALLATION OF TEES, RISERS, AND PLUGGED SERVICE STUBS

- A. Tee branches shall be installed in the sewer lines at all places shown on the Drawings, specified herein or otherwise directed by the Engineer. Tee branches on pipe less than 12 inches in diameter shall be cast or extruded and manufactured monolithic with the barrel.
- B. Riser connections, of the size and type shown on the Drawings shall be installed at the locations shown on the Drawings or directed by the Engineer. A plastic film marking tape 5-foot long shall be placed 12 inches over the top of each riser during backfilling to mark the location of the riser. The marking tape shall be heavy gauge polyethylene film (.004 inch thick). Tape shall be standard red color imprinted with the words "Warning - Buried Sewer Line Below." Tape shall be Allen Marking Tape No. AMT-1212 as manufactured by the Allen System, Inc., Glen Ellyn, Illinois, or equal. A second marking tape containing a metallic core which shall be located with a metal detector shall be laid on top of the first marking tape. This tape shall be 5 feet long and 2 inches wide. The tape shall be Allen Detectotape Catalogue No. ADT-1003 for buried sewer line as

manufactured by the Allen System, Inc., or equal. An additional piece of approved metallic detection tape shall be tied to the end of the riser pipe and brought vertically to finished grade as backfilling progresses.

- C. All sewer service stubs shall have a length of Allen Detectotape, Catalogue No. ADT-1003, attached to the end of the service stub and extend vertically to the surface of the ground.
- D. Plugged pipe stubs for future connections to manholes and sewerage structures shall be installed where shown on the Drawings or directed by the Engineer. The pipe stubs shall be installed with the bell encased in the wall of the manhole and the bell opening flush with the outside wall of the manhole or structure.
- E. Plugged stubs and such branches of pipelines that are not to be used immediately shall be closed with PVC stoppers held securely in place.
- F. Where specifically directed by the Engineer or shown on the Drawings, connections to reinforced concrete pipe over 18 inches in diameter shall be made in accordance with details shown on the Drawings.

3.03 CONNECTIONS

- A. If the work consists of the construction of a sewer that is to replace an existing sewer, all of the existing service lines shall be kept in operation and connected to the new line. Reconnections shall be made with flexible rubber couplings, i.e. Fernco or equal, and approved by Cleveland Utilities (C.U.). Detection tape equal to Allen Detectotape Catalogue # ADT-1003 as manufactured by Allen System, Inc. or approved equal, shall be tied around the existing service line at the point of reconnection and then brought straight up to the finished ground surface.
- B. Connections shall be made to all existing sewer lines in the vicinity of the work by removing a section of the sewer from the existing line and inserting in the space a tee branch of proper size, or by the construction of a manhole, regulator chamber or other structure as shown on the Drawings.
- C. Connections to existing manholes or inlets where no plugged stubs exist shall be made by cutting a hole in the wall of the existing structure, inserting a length of sewer pipe into the hole, filling around same with concrete or mortar and troweling the inside and outside surfaces of the joint to a neat finish. All sewer pipe shall have a rubber waterstop (concrete manhole adapter), i.e. Fernco, or approved equal approved by C.U. It shall be installed and embedded in the cement mortar patch. The bottom of the manhole shall be shaped to fit the invert of the sewer pipe as specified under the section entitled "Manholes" of these Specifications.

- D. Connections to building services shall be made in a neat and workmanlike manner. Cleanout plugs shall be installed, when directed by C.U., by making the connections with a standard wye or tee.

3.04 EXISTING UTILITIES

- A. All existing sewers, water lines, gas lines, underground conduits, telephone lines, sidewalks, curbs, gutters, pavements, electric lines, or other utilities or structures in the vicinity of the work shall be carefully protected by the Contractor from damage at all times. No separate payment shall be made for removing and replacing and/or repairing damaged existing sewers; water, gas, electric, telephone lines or conduits; or other utilities, culverts, drains, or conduits of similar existing services or structures. Similar repair and replacement of sidewalks, curbs, gutters, and pavements are provided elsewhere in these Specifications.
- B. Sewers to be installed parallel to any existing or proposed water main shall be laid at least 10 feet, horizontally, from the water main. If conditions prevent the 10-foot separation, the sewer may be constructed closer to a water main if it is laid in a separate trench and if the bottom of the water main is at least 18 inches above the top of the sewer.
- C. When sewers cross under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main. If necessary, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint ductile iron pipe for a distance of 10 feet on each side of the sewer. One full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible.
- D. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both water main and sewer shall be constructed of mechanical-joint ductile iron pipe and shall be pressure tested to assure water tightness.
- E. When sewer lines cross under culverts where the sewer and the culvert are less than 18 inches apart, the sewer line shall be encased in concrete as shown on the Standard Drawings.

3.05 INSPECTION AND TESTING

- A. After completion of any section of sewer, the grades, joints, and alignment shall be true to line and grade. Joint surfaces shall be smooth. There shall be no visual leakage and the sewer shall be completely free from any cracks and from protruding joint materials, deposits of sand, mortar, or other materials on the inside.

- B. One hundred percent of all PVC pipe 8 inches in diameter and greater shall be deflection tested. The maximum allowable deflection for PVC is 5 percent. After the PVC pipe has been installed and backfilled, the Contractor shall check the deflection by pulling a rigid ball or an Engineer approved 9-arm mandrel sized at 95 percent of the actual inside diameter of the pipe used through the pipe. "Flexible pipe is considered to have reached the limit of service ability when a deflection of 5% is attained" (WPCF MOP # 9, p. 222). Since research indicates that trench loads can increase for periods in excess of 10 years to loads almost twice the original load, a safety factor of 2 is recommended. The appropriate allowable deflection when installed (must be less than 5%) may be calculated using the pipe stiffness formula in ASTM D2321. Deflection tests shall not be conducted before the elapse of 24 hours after backfilling. Any pipe not passing the mandrel shall be replaced and rechecked.
- C. Infiltration shall not exceed 25 gallons per 24 hours per inch of diameter per mile of sewer. Contractor shall furnish all supplies, materials, labor, services etc., needed to make infiltration or exfiltration tests including water. No separate payment will be made for equipment, supplies, material, water, or services.
- D. Any leakage, including active seepage, shall be corrected by removal and replacement of pipe or joint where such leakage exists until the pipelines meet the requirements of the allowable leakage specifications.
- E. All sewer pipes shall be tested using low pressure air testing in accordance with the procedures and standards listed below:
1. Clean pipe to be tested by propelling snug-fitting inflated rubber ball through pipe with water.
 2. Plug all pipe outlets with suitable test plugs. Brace each plug securely to prevent blowouts. As a safety precaution, pressurizing equipment shall include a regulator set at slightly above test pressure to avoid over pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manhole during testing.
 3. During manhole fabrication, a 1/2-inch diameter threaded pipe nipple shall be cast through the manhole wall directly on top of one of the sewer pipes entering the manhole. The threaded end of the nipple shall extend no more than two inches on the inside of the manhole. The total length of the nipple shall exceed the manhole wall thickness by no less than four inches. The pipe nipple shall be non-corrosive and resistant to chemicals common to domestic sewage. Special attention shall be given to providing a permanent, watertight seal around the pipe nipple at the manhole wall. The pipe nipple shall be sealed with a threaded 1/2-inch cap or plug. Every manhole need not have a pipe nipple, but 20 percent of all manholes on each line shall have an installed nipple. The Engineer shall assist the Contractor in selecting appropriate locations for manholes with pipe nipples installed.

4. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig greater than the average back pressure of any groundwater above the pipe (0.433 psi per foot of groundwater above the pipe invert), but not greater than 9.0 psig.
5. After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
6. When pressure decreases to 3.5 psig, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 3.0 psig. Minimum permissible pressure holding times for runs of single pipe diameter are indicated in the table in seconds. No separate allowance shall be given for laterals.

SPECIFICATION TIME REQUIRED FOR A
0.5 PSIG PRESSURE DROP
 FOR SIZE AND LENGTH OF PIPE INDICATED

Pipe Dia. (in.)	Min. Time (min. sec.)	Length for Min. Time (ft.)	Time for Longer Length (sec.)	<u>Specification Time for Length (L)</u> <u>Shown (Min:sec)</u>				
				100 feet	200 feet	300 feet	350 feet	400 feet
8	3:47	298		3:47	3:47	3:48	4:26	
10	4:43	239		4:43	4:43	5:56	6:55	
12	5:40	199		5:40	5:42	8:33	9:58	
15	7:05	159		7:05	8:54	13:21	15:35	
18	8:30	133		8:30	12:49	19:14	22:26	25:38
21	9:55	114		9:55	17:27	26:11	30:32	34:54
24	11:20	99	6.837xL	11:24	22:48	34:11	39:53	45:35
27	12:45	88	8.653xL	14:25	28:51	43:16	50:30	57:42
30	14:10	80	10.683xL	17:48	35:37	53:25	62:19	71:13
33	15:35	72	12.926xL	21:33	43:56	64:38	75:24	86:10
36	17:00	66	15.384xL	25:39	51:17	76:55	89:44	102:34

F. The sewer lines installed as part of the work governed by these specifications will be subject to television inspection by Cleveland Utilities. This work will be provided by C.U. at no charge to the contractor/developer according to the following terms:

1. Initial television inspection
2. Second return television inspection will be to verify that the initial defects have been corrected.
3. Thereafter the contractor/developer will be billed on a cost-plus-15% basis for manpower and equipment required to verify correction of installation defects.

3.06 CLEANUP

After completing each section of the sewer line, the Contractor shall 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 right-of-way in a clean and neat condition. Unless otherwise called for on the Drawings, the Contractor shall restore all disturbed areas to as close to its original condition as possible. Restoration shall include but not be limited to grassing, replacing shrubbery, trees, fences and other improvements which have been disturbed.

Cleanup and restoration shall be completed as soon as possible and shall not exceed (30) calendar days after each section of sewer line is installed. Should the Contractor fail to do the cleanup as soon as possible or within 30 calendar days, payment made for pipe sewers and service lines for that section of the sewer not cleaned up shall be removed from the periodic estimate until the cleanup work is completed.

**** END OF SECTION ****

SECTION 80

MANHOLES

PART 1 - GENERAL

1.01 SCOPE

Work covered by this section includes all labor, equipment and materials required to furnish and install precast concrete manholes as described herein and/or shown on the plans approved or prepared by Cleveland Utilities, and/or Cleveland Utilities Standard Specifications and Details.

1.02 DESIGN CRITERIA

A. Description

Precast manholes and junction chambers shall be constructed of specified material to the sizes, shapes and dimensions, and at the locations shown on the plans/details or as otherwise directed by the Engineer. The height or depth of the manhole will vary with the location, but unless shown otherwise on the plans, shall be such that the top of the manhole frames will be at the finished grade of the pavement or ground surface and the invert will be at the designed elevations. Wall thickness of brick or precast concrete manholes shall be as shown on the plans/details.

B. Drop Manholes

Where the different in the invert elevation of a sewer 18 inches in diameter or smaller and any other sewer intersecting in one manhole is 2 feet or more, a drop manhole shall be constructed as shown on the plans/details. They shall be similar in construction to the standard manhole except than a drop connection of pipe and fittings of the proper size and material shall be constructed inside or outside the manhole as shown on the plans/details or approved by Cleveland Utilities.

C. Distances between manholes

1. Distances between manholes shall not exceed 400 feet for sewer pipe 15 inches in diameter or less.
2. Distance between manholes shall not exceed 500 feet for sewer pipe between 18 inches to 30 inches in diameter.
3. Distance up to 600 feet may be approved in cases where adequate modern cleaning equipment for such spacing is provided.

1.03 QUALITY ASSURANCE

Prior to delivery all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the Engineer, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials which fail to conform to these specifications shall be rejected. After delivery to the site, any materials which have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site.

1.04 SHOP DRAWINGS AND SPECIFICATIONS

Detailed shop drawings of precast manhole sections, manhole frames, covers and steps shall be submitted for approval of the Engineer in accordance with provisions set forth in these specifications.

1.05 GUARANTEE

The contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties" of these Specifications.

PART 2 - PRODUCTS

2.01 CONCRETE AND REINFORCEMENT

Concrete, cement, sand and water used in manhole construction shall conform to the applicable requirements of Section 30 of these specifications. All concrete shall be Class A. Steel reinforcement shall conform to the applicable requirements of Section 40 of these specifications.

2.02 PRECAST CONCRETE MANHOLES

- A. Precast concrete manholes shall consist of precast reinforced concrete sections, an eccentric cone or flat slab top section, or a conical cone only if directed by Cleveland Utilities, and a base section conforming to the typical manhole details as shown on the contract drawings or Cleveland Utilities Standard Specifications and Details.
- B. Precast manhole sections shall be manufactured, tested, and marked in accordance with the latest provisions of ASTM Standard Specifications, Serial Designation C 478.
- C. The minimum compressive strength of the concrete for all sections shall be 4,000 psi.
- D. The maximum allowable absorption of the concrete shall not exceed 8 percent of the dry weight.

- E. The circumferential reinforcement in the riser sections, conical top sections and base wall sections shall consist of one line of steel and shall be not less than 0.17 square inches per lineal foot.
- F. The ends of each reinforcement in the riser section and the bottom end of the manhole top section shall be so formed that when the manhole risers and the top are assembled, they will make a continuous and uniform manhole.
- G. Joints of the manhole sections shall be tongue-and-groove joint type. Sections shall be joined with either rubber O-rings conforming to the applicable provisions of ASTM C443, latest revision, or an approved butyl joint sealant. **A butyl sealant sheet shall be placed around the outside perimeter of each joint of the manhole riser sections. The outside of each joint must have ConSeal CS-50 Liquid Butyl Primer or approved equal applied prior to the installation of the butyl sealant sheet.**
- H. Each section of the precast manhole shall have not more than two holes for the purpose of handling and installing. These holes shall be tapered and shall be plugged with rubber stoppers or mortar after installation.
- I. Reinforced plastic steps shall be installed in each section of the manhole in accordance with the standard details.
- J. Standard precast manhole bases and inverts shall be constructed of Class A concrete in accordance with standard details and inverts shall have the same cross section as the invert of the sewers which they connect. The manhole base and invert shall be carefully formed to the required size and grade by gradual and even changes in sections, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations. Changes in direction of flow through the manhole shall be made to a true curve with as large a radius as the size of the manhole will permit.
- K. Pipe openings in manholes
 1. All openings into manholes shall have an integrally cast A-lock elastomeric ring, Kor-N-Seal rubber boots, or approved flexible connector and shall be installed as recommended by the manufacturer. After pipe has been installed the opening shall be filled with a non-shrinking grout.
 2. All sewer pipe installed in an existing manhole shall have a rubber waterstop (concrete manhole adapter), i.e. Fernco, or approved equal. It shall be installed and embedded in the cement mortar patch. The invert shall be properly formed as directed by the Engineer.

2.05 FRAMES, COVERS AND STEPS

- A. Manhole rims, toe pockets and covers shall be cast iron conforming to the minimum requirements of Federal Specifications WW-1-652 or to the latest ASTM Standard Specifications, ASTM A48 Class 35B for "Gray Iron Castings" and AASHTO M105 Class 35B. All castings shall be made accurately to the required dimensions, fully interchangeable, sound, smooth, clean and free from blisters and/or other defects. Defective castings which have been plugged or otherwise treated shall not be used. All regular manhole frame and covers shall be **U.S. Foundry #924/#926-US Hinged Ring and Cover**. Frame/casting shall incorporate a gasket to help reduce surface water infiltration (watertight).
- B. Manhole frames and covers shall be of the size shown on the construction detail drawings and shall have a minimum 24" clear opening and must be USF #924/#926 or approved by Cleveland Utilities.
- C. The contact surfaces of all manhole covers and the corresponding supporting rings in the rims shall be machined to provide full perimeter contact.
- D. All sanitary sewer manhole covers shall have the work "SEWER" cast on the top in letters 2 inches high.
- E. Reinforced plastic manhole steps shall conform to the minimum requirements of ASTM 2146-68 under Type II, Grade 16906 and ASTM C-478, paragraph 11. The reinforcing bar shall be a grade 60, deformed 1/2-inch reinforcing bar conforming to all the requirements of ASTM A-615.

PART 3 - EXECUTION

3.01 EXCAVATION FOR PRECAST MANHOLES

- A. Unless otherwise directed by Cleveland Utilities, excavation in which manholes are to be installed shall be excavated in open cut to the depths required by field conditions/approved plans or as specified by Cleveland Utilities. In general this shall be interpreted as machine excavation shall not exceed the depth below which the manhole can be properly bedded.
- B. Depth of excavation for the manhole shall be as shown on the approved plans and/or as directed by Cleveland Utilities to obtain sufficient bearing. Excavation may be undercut to a depth below the required invert elevation that will permit installing the manhole on a bed of granular material to provide continuous support for the manhole. Manhole bedding shall be as set out in paragraph 3.02 hereinafter.
- C. Excavations shall be of sufficient dimensions to provide free working space on all sides of the manhole and to permit proper backfilling around the manholes. All excavated materials shall be placed a minimum of two feet (2') back from the edge of excavation.

- D. Excavation shall be kept free of water during the installation of the manhole and until the manhole has been backfilled. Removal of water shall be at the Contractor's expense. Dry conditions shall be maintained in the excavations until the backfill has been placed. All water shall be pumped or drained from the excavation and disposed of in a suitable manner without damage to adjacent property or to other work.
- E. All excavated material not required for backfilling purposes shall be disposed of in a manner satisfactory to Cleveland Utilities.
- F. All excavation activities shall be accomplished in accordance with the applicable safety laws and regulations. Cleveland Utilities does not assume responsibility of any degree or sort for the acts of the Contractor.

3.02 PRECAST MANHOLE BEDDING

- A. All manholes shall be supported on a bed of granular material. A manhole shall never be supported directly on a rock surface. Bedding shall not be a separate pay item unless otherwise noted on the Approved Plans or in the specifications. Bedding shall be provided in earth bottom and rock bottom excavations and shall be a minimum of 6" below manhole base.
- B. Bedding material shall meet the Tennessee Department of Transportation No. 57 crushed stone specification.
- C. In wet, yielding and mucky locations where the manhole is in danger of sinking below grade or floating out of line or grade or where backfill materials are of such a fluid nature that such movement of the pipe and/or manhole might take place during the placing of the backfill; the manhole must be weighted or secured permanently in place by such means as will prove effective. When ordered by Cleveland Utilities, unsuitable materials in subgrade shall be removed below ordinary excavation depth in order to prepare a proper bed for the manhole to be installed on. Extra crushed stone or other granular material, if necessary, as determined by Cleveland Utilities to replace unsuitable subgrade material shall be a separate pay item. Removal/excavation of the unsuitable material is not a separate pay item.

3.03 MANHOLE FRAME INSTALLATION

- A. The manhole frame casting shall be centered over the opening in the cone or grade ring of the manhole with a bituminous mastic joint sealing compound applied between the concrete and the casting.
- B. The frame shall be bolted to the cone or grade ring with wedge anchors in all areas except in roadways (paved surfaces).

3.04 TESTING

This specification shall govern the vacuum testing of manholes and shall be used as a method of determining acceptability by Cleveland Utilities.

- A. Manholes shall be tested after assembly/installation and prior to backfilling with all connections in place.
 - 1. Lift holes shall be plugged with an approved non-shrink grout prior to testing.
 - 2. Drop connections shall be installed prior to testing.
 - 3. The vacuum test shall be done with the frame secured to the cone on all manholes outside of paved areas. The vacuum test shall be done without the frame secured in place when the manhole is within paved areas.
- B. Test Procedure
 - 1. The method used shall be a vacuum test in which manholes are plugged, pumped to 5 psi vacuum or 10" of mercury (HG) vacuum, and held for a minimum of 1 minute. The acceptable standards for leakage for a four foot diameter manhole shall be in accordance with the following:

<u>Manhole Depth</u>	<u>Minimum Elapsed Time for a 1 psi drop or a 2" mercury drop</u>
10' or less	60 seconds
11' to 15'	75 seconds
16' to 25'	90 seconds

For a five(5') foot diameter manhole, add an additional 15 seconds and for six(6') foot diameter manhole, add an additional 30 seconds to the time required for a four(4') foot diameter manhole.

- 2. If a manhole fails the vacuum test, the manhole be repaired with a non-shrink grout or other approved material based on the material of which the manhole is constructed and the manhole re-tested.
- 3. If the manhole mastic is pulled out during the vacuum test, the manhole shall be dis-assembled and the mastic replaced.
- 4. At the Contractor's option, manholes may be tested after backfilling. If the contractor chooses to test after backfilling and the testing fails, the Contractor shall excavate and perform all repairs to the manhole.

3.05 PLACEMENT OF PRECAST MANHOLE ON EXISTING SANITARY SEWER LINE

Where a manhole is to be placed on an existing sanitary sewer line the contractor shall install a precast manhole base with flexible rubber boots on the line. The area where the base is to be placed shall be leveled with graded No. 7 stone. The existing sewer line shall be cut and base properly placed. In most conditions PVC pipe will be used to connect the existing pipe to the manhole boots. The appropriate flexible couplings will be used to connect the existing and new sewer pipe together. The contractor shall be sure to tighten all clamps securely to avoid leaks. All new and existing sewer pipe exposed shall be properly bedded with No. 7 stone. After final installation of the manhole has been completed and before backfilling around manhole, Cleveland Utilities must approve the installation.

** END OF SECTION **

SECTION 90

VALVES

PART 1 - GENERAL

1.01 SCOPE

Under this section the Contractor shall furnish all the materials for and shall properly set in place at the location shown on the drawings, or as directed by the Engineer, all gate valves, butterfly valves, check valves, pressure relief valves, air release valve, pressure sustaining or back pressure valves, altitude valves, specialty valves, handwheels, valve boxes, etc. of the size, types and pressures specified which are necessary for the proper completion of the work included under this contract.

1.02 DETAILED DRAWINGS

- A. Before any valves or gates and floor stands are delivered to the work, the Contractor shall submit for the approval of the Engineer detailed drawings and specifications, dimensions, weights and operational data covering the same.
- B. No valves shall be installed until the Engineer has approved the detailed drawings.

1.03 PAINTING

All valves, extension stems, brackets, gates and fittings where not constructed of brass, aluminum, bronze or of finished steel, shall be painted at the point of manufacture in accordance with the American Water Works Association Specifications for Painting Cast Iron Water Pipes and Fittings, or in accordance with approved manufacturer's standards, except machined surfaces which shall be given a suitable coating of grease or other protective material. Floor stands shall be filled and painted with three coats of an approved machinery enamel of color selected by the Engineer. After erection, all valves, floor stands, etc. shall be painted as directed by the Engineer.

1.04 GUARANTEE

The Contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties" of these Specifications.

PART 2 - PRODUCTS

2.01 GENERAL

- A. For the purpose of designating the type and grade of a particular valve, gate, floor stand, etc. desired, a manufacturer's name and list or figure number is given on the drawings or specified. Valves, gates, floor stands, etc. of other manufacture may be substituted, provided the Contractor proves to the satisfaction of the Engineer that they are equal or superior to those designated for the particular work intended.
- B. All valves shall have the name of the manufacturer, pressure, and size of the valve cast upon the body or bonnet in raised letters.
- C. Valves and operating mechanisms shall be of the proper size and dimensions to fit the pipe connections thereto and shall be installed in the position and within the space shown on the plans.
- D. All castings, whether of bronze, iron or steel shall be sound and smooth, without swells, lumps, blisters, sand holes or other imperfections and shall be made in accordance with best foundry practice. All materials, unless specifically noted otherwise shall be of the grade and qualities as established by the specifications of the ASTM listed as follows:

All iron castings	A126, Grade B
All steel castings	A216
Stem, bolts and nuts	B21, Grade A, half hard
Stem nut and yoke nut	B132, Grade B
Stuffing box gland	B62) With some modifications
Bushings	B62) Permissible as approved

Disc facings for valves shall be of metal alloy composed of copper 89-92%; tin 0.5-1.5%; lead 0.75-2.0%; and zinc 7-8%.

2.02 GATE VALVE

- A. All gate valves shall be of a construction equal to those indicated herein, subject of the Engineer's approval, and shall be nut, wrench, chain or wheel operated with extension stems as required (See Construction Detail 200-435). All valves shall be of the stationary spindle type unless otherwise specified or shown.
- B. Unless otherwise designated, all valves used for wastes and drain lines shall be of the single disc, double-seat, solid wedge resilient seat type.
- C. Gate valves on potable water supply lines shall be either the double disc type or solid wedge resilient seat type and shall conform to AWWA specifications for water valves, ANSI/AWWA C500 latest revision or AWWA C509-1985 respectfully. Types of valves must be shown on the contract drawings and approved by the Engineer.

- D. Except where otherwise specified, all one and one-half inch valves or smaller shall be of the best quality bronze body, bronze mounted, solid wedge type, non-rising stem gate valves.
- E. All gate valves two inches and larger in size shall be of iron body, bronze mounted, and shall have a non-rising bronze stem. Valves shall open by turning to the left by operating with a 2-inch nut. All gland bolts for iron body valves shall be steel with steel nuts. All gate valves shall be equipped with o-ring seals. Also see Item (G).
- F. Unless otherwise specified or shown, all gate valves for underground installation shall have mechanical joint ends.
- G. Alternate - Item (E) for iron body two inch gate valve - A 2 inch high tensile bronze gate valve with a strong and sturdy malleable-iron handwheel will be accepted. Valves shall contain a solid brass wedge and have a pressure rating of 150 psi/350 psi; and/or equal to No. 49-U as manufactured by Jenkins Brothers.

2.03 BUTTERFLY VALVE

- A. Butterfly valves shall be for water service and shall conform to ANSI/AWWA C504 latest revision Class 150B for Rubberseated Butterfly Valves.
- B. All butterfly valves shall be for buried service and shall have a 2-inch square geared operating nut. Seals shall be standard O-ring seals. All valves shall open by turning to the left (counter-clockwise).
- C. Butterfly valves shall have mechanical joint ends conforming to ANSI/AWWA C111/A21.11 latest revisions.
- D. All butterfly shall have the name of the manufacture, class, and size of the valve cast into the body in raised letters.
- E. All valves shall be furnished with necessary accessories including rubber gaskets, glands, and bolts.

2.04 CHECK VALVE

- A. Check valves one and one-half inches and smaller for use in water and sewage pipelines shall be brass or bronze body, swing type with bronze renewable discs and shall be equal to Chapman swing bronze check valve, List 20 for 300-pound water pressure.

- B. Check valves two inches and larger for use in water and sewage pipelines shall, unless otherwise specified, be iron body, bronze mounted, horizontal swing type, fitted with removable bronze seats and with removable covers or handhold plates. Check valves shall be equipped with extended hinge pin, an outside lever and adjustable weight. Where required, the valves shall be suitable for installation in vertical pipelines. Valves shall be equal to Chapman List 22A, Standard Pressure Swing Check Valves.

2.05 ALTITUDE VALVE

- A. Altitude valve to be furnished and installed in the concrete pit at the water storage tank shall have cast iron bodies and bonnets with bronze trim and shall be rated for 150 pounds working pressure.
- B. Altitude valves shall be designed for cushioned closing and to prevent surges on shutoff. Valve speed control shall be adjustable and an indicator shall show valve position.
- C. Renewable cups and seat washer shall eliminate metal-to-metal contact.
- D. Altitude valves shall be Golden Anderson Valve Specialty Company Standard Altitude Valve, Figure 32-D, or approved equal.

2.06 WATER PRESSURE REDUCING VALVE

- A. Water pressure reducing valves 2 inches in size and smaller shall have cast iron body, bronze trim, screwed ends, shall be rated for 250 pounds working pressure, and shall be Golden Anderson Valve Specialty Company Figure 43-U or approved equal.
- B. Water pressure reducing valves larger than 2 inches in size shall have cast iron body, bronze trim, flanged ends, shall be rated for 300 pounds working pressure, and shall be Golden Anderson Valve Specialty Company Figure 45-U or approved equal.

2.07 WATER PRESSURE RELIEF, PRESSURE SUSTAINING, OR BACK PRESSURE VALVE

Water pressure relief valves shall be specified according to actual field conditions and shall be of the Clayton 50-01 Series or approved equal.

2.08 ANGLE VALVE

Angle valves shall be all brass and equal to Ford KV43-332W.

2.09 GAUGE COCKS AND PET COCKS

- A. Gauge cocks shall be all brass with threaded female connections and lever handle and shall be equal to Crane No. 712.
- B. Pet cocks shall be all brass with lever handle of minimum .25" in size and shall be equal to Crane No. 702.

2.10 AIR RELEASE VALVE

- A. Air release valves shall be manufactured by **A.R.I. Company; the model will be based on the application, water/sewer, high/low pressure, etc. Air release valves from other manufactures will be considered, if they are comparable to the equivalent A.R.I model.** The valve shall be suitable for operating under a working pressure of 300 psi.
- B. Air release valves shall be installed complete with valve pit and cover, corporation stops, gate valves and at the locations shown on the plans. Concrete for pit shall be in accordance with Item 30 of these specifications. Cast iron frame and cover shall conform to requirements of Item 80 of these specifications.
- C. Air release valve shall be installed on discharge side of well and high service pumps.

2.11 FLOOR AND VALVE BOXES AND COVERS

- A. The valve boxes and covers shall be of the 2-piece slip type and shall be equal to standard valve box No. 5461-S of the required length as manufactured by the Acheson Foundry. The covers for valve boxes shall indicate the letter "S" cast thereon in raised letter where used on waste lines and the letter "W" where used on potable water lines.
- B. Floor boxes and covers shall be equal to Clow No. F-5690, F-5695, or approved equal, and similar equipment of approved manufacture, with "S" or "W" cast thereon in raised letters as specified in (B) above.
- C. The contractor shall furnish, where valve depth dictates, an additional short valve box bottom and a 6-inch diameter PVC pipe extension for bringing slip type cast iron valve boxes to finished grade. The additional short valve box bottom shall be installed on top of the valve. The PVC pipe extension shall be placed on top of the short valve box bottom. The normal slip type valve box (top and bottom) shall be placed on top of the PVC pipe extension and adjusted to the finished grade. The square nut must be centered in both the extension and valve box for free movement. Ductile iron pipe valve box extensions shall be substituted for

PVC valve box extensions if shown on the contract drawings or directed by Cleveland Utilities. Where the valve operating nut is three feet or more below finished grade a valve key extension (see CU Construction Detail 200-435) shall be fabricated and installed to "transfer" the height of the valve operating nut to 1' - 6" below the finished grade.

2.12 CORPORATION STOP AND SERVICE SADDLES

Unless otherwise shown or specified, all taps in cast iron pipe shall be provided with corporation stops. Corporation stops shall be sized as required for services 3/4" minimum. Corporation stops shall conform to AWWA standard C800-66 Tapped CC Pipe Threads, Ford F1000 or equal. Brass service saddles shall be used on all PVC water pipe. The saddle shall be sized as required by the size of the water pipe and be Ford S70-603 or equal. Required corporation stops shall be Ford F1000 or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All valves shall be set carefully and accurately to the lines and grades given and where set against concrete shall be thoroughly anchored to the same with approved expansion bolts or with anchor bolts cast in the concrete positioned accurately by means of secure and suitable templates.
- B. Operating stands shall be centered over the gate stem, shall be shimmed and grouted to true position and adequately bolted to the concrete. Suitable anchor bolts shall be furnished with all floor stands.
- C. All connections to pipe or specials shall have the necessary flange, or screwed joints, as specified for cast iron pipe under Section 50 , "Cast Iron and Ductile Iron Pipe".
- D. Particular attention is called to the fact that screwed connections shall be carefully made and care shall be taken in making screw joints so that the pipe does not disturb the proper functioning of the valve.

3.02 TESTING

All valves shall be tested at the point of manufacture and made drip tight when tested under the hydrostatic head specified. After the valves are set in place and are ready to operate, the Contractor shall test them under the rated working pressure and conditions and any valve found to leak shall be made watertight or airtight and if found to be of faulty design shall be satisfactorily repaired or replaced by the Contractor.

** END OF SECTION **

SECTION 100

FIRE HYDRANTS

PART 1 - GENERAL

1.01 SCOPE

Under this item the Contractor shall furnish and install fire hydrants at the locations shown on the plans or as otherwise directed by the Engineer.

1.02 INSPECTION AND TESTS

Certified manufacturer's test reports will be acceptable under this item unless Owner authorizes inspection and tests by an independent testing laboratory at his own expense.

1.03 GUARANTEES

The Contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties", of these Specifications.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Fire hydrants shall be cast iron, fully bronze mounted, suitable for a working pressure of 150 psi and conform to the latest American Water Works Association Specifications C-502. They shall be similar and equal to compression type hydrants as manufactured by the Muller Company, U.S. Pipe Company and M & H Valve and Fittings Company.
- B. Hydrants shall be constructed in a manner that will permit withdrawal of internal working parts without disturbing the barrel or casing. Valve shall be compression type, opening against pressure and so constructed that the main valve will remain closed should the hydrant be broken off by a traffic accident. Valve opening shall be at least 5 1/4 inches in diameter and shall have a net area of waterway at the smallest part of not less than 120 percent of the valve opening when the valve is wide open. There shall be no chattering or water hammer under any conditions of operation.
- C. Barrel shall be made in two pieces with flanged joint above the finished grade or ground line. Flange bolts shall be breakable type. Two positive acting, non-corrodible drain valves shall be provided in the hydrant shoe automatically to open and provide rapid and complete drainage of the hydrant barrel when the main valve is closed.

- D. Hydrant bonnet shall be designed to protect the operating head against rust, corrosion and dirt. The stuffing box shall have bronze glands and O-ring seal. Suitable means shall be provided for lubricating the stem threads, O-ring and bearing surfaces in the bonnet.
- E. The main valve rod shall be of steel and shall be bronze sheathed where it passes through the stuffing box. Stem shall be equipped with a safety or breakable stem coupling to prevent damage to the stem when hydrant is hit by a vehicle. A positive stop shall be provided to permit full opening of the valve and prevent over travel of the stem.
- F. Each hydrant shall be tested at the factory to a hydrostatic pressure of 300 psi with valve in both open and closed positions. Manufacturer's certificates shall be furnished to the Engineer stating that such tests have been passed successfully before shipping any hydrants to the project.
- G. The direction of opening shall be cast on the head of the hydrant and it shall be as directed by the Engineer.
- H. Operating nut shall be National Standard 1 1/2-inch pentagon shaped.
- I. Two 2 1/2-inch hose nozzles and one 4 1/2-inch pump nozzle shall be provided on each hydrant. Hose and pumper nozzles shall be of bronze or noncorrosive metal, and threads shall be National Standard. Nozzle caps shall be securely chained to the barrel.
- J. Hydrants that are to be connected to cast iron pipe shall be equipped with mechanical joint inlet with gland, gaskets, bolts and nuts. Suitable ring tight or fluid tight inlets shall be provided on hydrants that are to be connected to cement asbestos pipe.
- K. Fire hydrants shall be painted one coat of zinc chromate primer and two finishing coats of enamel equal to Sonneborn's Hydrant Enamel or approved equal. Color shall be factory orange above the ground. Where paint has been damaged by shipping or during installation, the damaged surfaces shall be repainted in the field.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fire hydrants at approximate locations as indicated on the Contract Drawings as approved by the Engineer. It may be necessary to determine in the field the final location of the fire hydrant. If hydrant locations are changed, approval must be obtained by the Engineer.

- B. Fire hydrant installations shall include a 6" gate valve for fire hydrant leads where tapping sleeves and valves are required for connection to existing water lines. A 6" gate valve shall also be installed on fire hydrant leads for new waterlines. All fire hydrant locations and valves shall be shown on the Contract Drawings and approved by the Engineer.
- C. Fire hydrant leads shall be of ductile iron material and have a diameter of 6 inches.
- D. Set each hydrant on a 4" thick 15" square minimum size precast concrete slab, in true plumb position, with lowest nozzle at least 12" above finished grade. Securely block and anchor hydrant by using retainer glands to prevent it from blowing off of lead, and place at least 1/4 cubic yard of crushed stone around base to at least 12" above and 12" below the drain hole for proper drainage. See the Drawings of these specifications.
- E. Fire Hydrant extensions: Normal fire bury lengths for new water line installations is 3.5 feet. Where conditions or circumstances require a longer bury length, fire hydrant extensions may be ordered and installed only with the approval of the Engineer. Each extension length must be reviewed and approved by the Engineer on a case by case basis. Payment for fire hydrant extensions will be made per vertical foot as stated in the contract Bid Schedule. No payment will be made for extensions where the Contractor did not meet all water line extension requirements of these specifications or did not obtain the approval from the Engineer.

** END OF SECTION **

SECTION 110

SEEDING

PART 1 - GENERAL

1.01 SCOPE

- A. The work covered by this section consists of furnishing all labor, equipment, and material required to place topsoil, seed, commercial fertilizer, agricultural limestone, and mulch material, including seedbed preparation, harrowing, compacting, and other placement operations on graded earthen areas as described herein and/or shown on the Drawings. In general, seeding operations shall be conducted on all newly graded earthen areas not covered by structures, pavement, or sidewalks; all cleared or grubbed areas which are to remain as finish grade surfaces; and on all existing turf areas which are disturbed by construction operations and which are to remain as finish grade surfaces. Areas disturbed by borrow activities shall also be seeded according to these Specifications.
- B. The work shall include temporary seeding operations to stabilize earthen surfaces during construction or inclement weather and to minimize stream siltation and erosion. Temporary seeding shall be performed at the times and locations as directed by the Engineer.

1.02 QUALITY ASSURANCE

- A. Prior to seeding operations, the Contractor shall furnish to the Engineer labels or certified laboratory reports from an accredited commercial seed laboratory or a state seed laboratory showing the analysis and germination of the seed to be furnished. Acceptance of the seed test reports shall not relieve the Contractor of any responsibility or liability for furnishing seed meeting the requirements of this section.
- B. Prior to topsoil operations, the Contractor shall obtain representative samples and furnish soil test certificates including textural, pH, and organic ignition analysis from the State University Agricultural Extension Services or other certified testing laboratory.

1.03 GUARANTEES

The Contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties", of these Specifications.

PART 2 - PRODUCTS

2.01 TOPSOIL

- A. Utilizing designated stockpiles or borrow areas on site, the Contractor shall place a minimum of 4 inches of topsoil over all graded earthen areas and over any other areas to be seeded. Sources of topsoil shall be approved by the Engineer prior to disturbance. Importing topsoil from offsite sources shall be at the discretion of the Engineer and shall be justification for additional compensation to the Contractor. A Change Order properly authorized by the Owner shall be agreed upon prior to importing offsite topsoil. No additional compensation will be allowed for spreading of topsoil.
- B. Topsoil shall be a friable loam containing a large amount of humus and shall be original surface soil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2 inch in diameter, lime, cement, bricks, ashes, cinders, slab, concrete, bitumen or its residue, boards, sticks, chips, or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and perennial weed seeds, and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life.
- C. Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, sandy loam, or a combination thereof. The pH shall range from 6.0 to 7.0. Topsoil shall contain not less than 5 percent nor more than 20 percent, by weight, of organic matter as determined by loss on ignition of oven-dried samples to 100°C.

2.02 SEED

- A. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the U. S. Department of Agriculture Federal Seed Act.
- B. All seed shall be from the last crop available at time of purchase and shall not be moldy, wet, or otherwise damaged in transit or storage.
- C. Seed shall bear the grower's analysis testing to 98 percent for purity and 90 percent for germination. At the discretion of the Engineer, samples of seed may be taken for check against the grower's analysis.
- D. Species, rate of seeding, fertilization, and other requirements are shown in the Seeding Requirements Table.

2.03 FERTILIZER AND LIMING MATERIALS

- A. Fertilizer and liming materials shall comply with applicable state, local, and federal laws concerned with their production and use.
- B. Commercial fertilizer shall be a ready mixed material and shall be equivalent to the grade or grades specified in the Seeding Requirements Table. Container bags shall have the name and address of the manufacturer, the brand name, net weight, and chemical composition.
- C. Agricultural limestone shall be a pulverized limestone having a calcium carbonate content of not less than 85 percent by weight. Agricultural limestone shall be crushed so that at least 85 percent of the material will pass a No. 10 mesh screen and 50 percent will pass a No. 40 mesh screen.

2.04 MULCH MATERIAL

- A. All mulch materials shall be air dried and reasonably free of noxious weeds and weed seeds or other materials detrimental to plant growth.
- B. Mulch shall be composed of wood cellulose fiber, straw, or stalks, as specified herein. Mulch shall be suitable for spreading with standard mulch blowing equipment.
- C. Wood-cellulose fiber mulch shall be as manufactured by Weyerhaeuser Company, Conway Corporation, or equal.
- D. Straw mulch shall be partially decomposed stalks of wheat, rye, oats, or other approved grain crops.
- E. Stalks shall be the partially decomposed, shredded residue of corn, cane, sorghum, or other approved standing field crops.

2.05 MULCH BINDER

- A. Mulch on slopes exceeding 3:1 ratio shall be held in place by the use of an approved mulch binder. The mulch binder shall be non-toxic to plant life and shall be acceptable to the Engineer.
- B. Emulsified asphalt binder shall be Grade SS-1, ASTM D 977. Cutback asphalt binder shall be Grade RC 70 or RC 250.

2.06 INNOCULANTS FOR LEGUMES

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

2.07 WATER

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

PART 3 - EXECUTION

3.01 SECURING AND PLACING TOPSOIL

- A. Topsoil shall be secured from areas from which topsoil has not been previously removed, either by erosion or mechanical methods. Topsoil shall not be removed to a depth in excess of the depth approved by the Engineer.
- B. The area or areas from which topsoil is secured shall possess such uniformity of soil depth, color, texture, drainage, and other characteristics as to offer assurance that, when removed the product will be homogeneous in nature and will conform to the requirements of these Specifications.
- C. All areas from which topsoil is to be secured, shall be cleaned of all sticks, boards, stones, lime, cement, ashes, cinders, slag, concrete, bitumen, or its residue, and any other refuse which will hinder or prevent growth.
- D. In securing topsoil from a designated pit, or elsewhere, should strata or seams of material occur which do not come under the requirements for topsoil, such material shall be removed from the topsoil, or if required by the Engineer, the pit shall be abandoned.
- E. Before placing or depositing topsoil upon any areas, all improvement within the area shall be completed, unless otherwise approved by the Engineer.
- F. The areas in which topsoil is to be placed or incorporated shall be prepared before securing topsoil for use.

3.02 SEEDBED PREPARATION

- A. Before fertilizing and seeding, the topsoil surfaces shall be trimmed and worked to true line free from unsightly variation, bumps, ridges, and depressions.

- B. Not earlier than 24 hours before the seed is to be sown, the soil surface to be seeded shall be thoroughly cultivated to a depth of not less than 2 inches with a weighted disc, tiller, pulvimixer, or other equipment, until the surface is smooth and in a condition acceptable to the Engineer.
- C. If the prepared surface becomes eroded as a result of rain or for any other reason, or becomes crusted before the seed is sown, the surface shall again be placed in a condition suitable for seeding.
- D. Ground preparation operations shall be performed only when the ground is in a tillable and workable condition, as determined by the Engineer.

3.03 FERTILIZATION AND LIMING

- A. Following seedbed preparation, fertilizer shall be applied to all areas to be seeded so as to achieve the application rates shown in the Seeding Requirements Table.
- B. Fertilizer shall be spread evenly over the seedbed and incorporated into the soil for a depth of 1/2 inch by hand raking on the golf and country club properties and by hand raking or mechanical means over any other areas to be seeded.
- C. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. The seed shall not remain in water containing fertilizer for more than 30 minutes when a hydraulic seeder is used.
- D. Agricultural limestone shall be thoroughly mixed into the soil according to the rates in the Seeding Requirements Table. The specified rate of application of limestone may be reduced by the Engineer if pH tests indicate this to be desirable. It is the responsibility of the Contractor to obtain such tests and submit the results to the Engineer for adjustment in rates.
- E. It is the responsibility of the Contractor to make one application of maintenance fertilizer according to the recommendations listed in the Seeding Requirements Table.

3.04 SEEDING

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

- B. Seeds shall be uniformly sown by an approved mechanical method to suit the slope and size of the areas to be seeded, preferably with a broadcast type seeder, windmill hand seeder, or approved mechanical power drawn seed drills. Hydro-seeding and hydro-mulching may be used on steep embankments, provided full coverage is obtained. Care shall be taken to adjust the seeder for seedings at the proper rate before seeding operations are started and to maintain their adjustment during seeding. Seed in hoppers shall be agitated to prevent segregation of the various seeds in a seeding mixture.
- C. Immediately after sowing, the seeds shall be covered and compacted to a depth of 1/8 to 3/8 inch by a cultipacker or suitable roller.
- D. Leguminous seeds shall be inoculated prior to seeding with an approved and compatible nitrogen-fixing inoculant in accordance with the manufacturer's mixing instructions.

3.05 MULCHING

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

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

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

- C. Mulch on slopes greater than 3:1 ratio shall be held in place by the use of an approved mulch binder. Binder shall be thoroughly mixed and applied with the mulch. Emulsified asphalt or cutback asphalt shall be applied at the approximate rate of 5 gallons per 1,000 square feet as required to hold the mulch in place.
- D. The Contractor shall cover structures, poles, fence, and appurtenances if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.
- E. Mulch and binder shall be applied by suitable blowing equipment at closely controlled application rates in a manner acceptable to the Engineer.

3.06 WATERING

- A. Contractor shall be responsible for maintaining the proper moisture content of the soil to ensure adequate plant growth until a satisfactory stand is obtained. If necessary, watering shall be performed to maintain adequate water content in the soil.
- B. Watering shall be accomplished by hoses, tank truck, or sprinklers in such a way to prevent erosion, excessive runoff, and overwatered spots.

3.07 MAINTENANCE

- A. Upon completion of seeding operations, the Contractor shall clear the area of all equipment, debris, and excess material and the premises shall be left in a neat and orderly condition.
- B. The Contractor shall maintain all seeded areas without additional payment until final acceptance of the work by the Owner, and any regrading, re-fertilizing, re-liming, re-seeding, or re-mulching shall be done at his own expense. Seeding work shall be repeated on defective areas until a satisfactory uniform stand is accomplished. Damage resulting from erosion, gullies, washouts, or other causes shall be repaired by filling with topsoil, compacting, and repeating the seeding work at his expense.

SEE "SEEDING REQUIREMENTS TABLE" ON PAGE 110-8

** END OF SECTION **

SECTION 120

NEW AND REPLACEMENT PAVEMENT, CURBS, AND SIDEWALKS

PART 1 - GENERAL

1.01 SCOPE

The work to be performed under this section shall include replacing existing sidewalks, curbing and pavement in paved streets, driveways and parking areas where such sidewalks, curbing and pavement have been removed for constructing water pipelines, fire hydrants, sewers, manholes and all other water and sewer appurtenances and structures. It shall also include temporary paving, curbing, new sidewalks and pavements shown on the Drawings. All utility valves and manholes covered over by paving operations shall be raised to grade after paving is completed.

1.02 GUARANTEE

The Contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties" of these Specifications.

PART 2 - PRODUCTS

2.01 TYPES OF PAVEMENT

- A. All existing pavement in streets or driveways which is removed, destroyed or damaged by construction of sewerage or water works shall be replaced as shown on the drawings with the same type of pavement surface as that which existed before construction work was started. Materials, equipment and construction methods used for paving work shall conform to the specifications applicable to the particular type required for replacement, repair or new pavements.
 1. Portland cement concrete pavement or base courses shall be replaced with Class "A" concrete in accordance with Section 30, Cast-In-Place Concrete, of these specifications. The surface finish of the concrete pavement replaced shall conform to that of the existing pavement. The surface of the replaced concrete base course shall be left rough. The slab shall be of depth equivalent to the existing concrete pavement, or base course, but in no case less than 7 inches thick. Expansion joints removed shall be replaced. Concrete pavements or concrete base courses where required or where shown on the drawings shall be reinforced and shall conform to details shown on the drawings and applicable specifications of Section 306, Portland Cement Concrete Base, and Section 501, Portland Cement Concrete Pavement, Tennessee Department of Highways, Standard Specifications for Road and Bridge Construction, latest edition.

2. Type 1 asphalt concrete surface mix shall be used when conditions require replacing existing asphalt concrete surface mix pavement. With this condition a 2" layer of bituminous binder (Hot-Mix, 307-B) shall be applied followed by a 2" layer of asphalt concrete surface (Hot-Mix, 411-D) as shown on the Drawings of these specifications. Both mixes shall conform to either the Asphalt Concrete Surface (Hot Mix), Section 411, or the Bituminous Plant Mix Base (Hot-Mix), Section 307, Tennessee Department of Highways, Standard Specifications for Road and Bridge Construction, latest edition. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, firm, properly cured, dry, and the tack coat has been applied.
3. Type 2 asphalt concrete binder mix shall be used when conditions require replacing existing asphalt concrete binder mix pavement or any other paving surface not described in Section 2.01A(2) above. When this condition occurs a 4" layer of bituminous binder (Hot-Mix, 307-B) shall be placed as shown on the Drawings of these specifications. This mix shall conform to the Bituminous Plant Mix Base (Hot-Mix), Section 307, Tennessee Department of Highways, Standard Specifications for Road and Bridge Construction, latest edition. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, firm, properly cured, dry, and the tack coat has been applied.
4. Where sewerage or water lines and appurtenances are constructed in or across unpaved, chert, or crushed stone surfaced streets, roadways or driveways, the surface removed or damaged shall be repaired or replaced with crushed stone in accordance with Section 401, Mineral Aggregate Surface, of the Tennessee Department of Highways, Standard Specifications for Road and Bridge Construction, latest edition. This surfacing must be authorized by the Engineer.
5. Temporary patching of street cuts or any other damaged areas may require the placement of crushed stone as specified in item 2.01-A(4) above or colmix to depth of 4 inches. These areas will be specified in the Contract Documents as well as shown on the Contract Drawings.

PART 3 - EXECUTION

3.01 REPLACING PAVEMENT

- A. Pavements removed or damaged shall be replaced in accordance with the following procedures:

1. The existing street pavement or surface shall be removed along the line of work for the allowable width specified for the trench or structure. All edges of the existing pavement shall be cut to straight, vertical edge and care shall be used to get a smooth joint between old and new pavement and to produce an even surface on the completed street. Cement concrete base slabs and crushed stone bases, if required, shall be placed and the concrete allowed to cure for three days before asphalt concrete surface courses are applied. Expansion joints where applicable shall be replaced in a manner equal to the original joint.
2. After the installation of the sewer and water lines the trench shall be backfilled with thoroughly compacted crushed stone as specified on the Drawings. Backfill shall be placed as specified in the Section 20 entitled "Earthwork", Paragraph 2.06, of these Specifications.
3. Trench backfill along streets shall be covered with a temporary paving as specified above. This temporary paving shall be applied level with the existing paved surface at a time directed by the Engineer. Prior to the application of the temporary paving the crushed stone backfill shall be maintained carefully at grade and dust free. Additionally, immediately prior to the application of permanent paving by the Contractor or acceptance by the City, The Contractor shall again compact the top of all trench backfill in the streets with a hydrotamper and add sufficient crushed stone to bring surface back to bottom of permanent paving as shown on the Drawings.
4. Unless otherwise shown or specified all paved surfaces shall be replaced with pavement of like kind as specified in Paragraph 2.01. The pavement shall be the specified full trench width as shown in the Bid Schedule.
5. Where pavement is specified for trench width, the temporary surface shall be compacted and finished to the base grade compatible with the type of pavement to be applied before pavement is placed. Additional width of pavement to be removed, if any, as shown on the Drawings shall be done immediately prior to replacing the pavement. Any additional pavement or street surface removed or damaged beyond the limits shown on the Drawings shall be replaced or repaired by the Contractor at the Contractor's expense.
6. Wherever sewer or water lines are constructed across state highways, the Contractor shall comply with all requirements and provisions of the Standard Method of the Tennessee Department of Transportation for opening trenches through highways and replacing pavements as shown on the Drawings and specified herein. All such work shall be subject to inspection and approval by the Tennessee Department of Transportation.
7. Contractor shall remove all surplus excavation materials and debris from the street surfaces and right-of-way and shall restore street, roadway or sidewalk surfacing to its original condition. This work shall be considered as cleanup and no separate payment will be made for this item.

8. All new and existing utility valves and manholes covered over by paving operations shall be raised to grade after paving is completed. This shall be done by excavating around and raising the item to grade. The excavation shall be circular and of such dimension that a concrete collar a minimum of 8 inches thick and 8 inches deep can be poured around the item that is raised to grade. Sanitary sewer manholes shall have the top of the frame set at a height to prevent surface water from running into the manhole.

3.02 NEW PAVEMENTS FOR ACCESS ROADS AND PARKING AREAS

- A. Access roads to treatment plant sites, parking areas and roadways shall be surfaced wherever called for on the plans with crushed stone which shall be placed sufficiently thick to produce a road surface of uniform thickness shown in the drawings after compaction and shaped to required line and grade. Such roadway surfaces shall be constructed in accordance with the requirements of Section 303, Mineral Aggregate Base, of the Tennessee Department of Highways, Standard Specifications for Road and Bridge Construction, latest edition.
- B. The completed crushed stone road base shall be maintained by the Contractor in a smooth, first-class condition to required line, grade and cross section until the entire surface area has become stabilized and compacted.
- C. After the surface has become stabilized to the satisfaction of the Engineer the entire surface shall be covered with a asphaltic concrete pavement (plant mix) as herein before described in Paragraph 2.01. Surfaces shall conform to the lines, grades, cross sections and thickness indicated on the contract drawings.
- D. The bituminous concrete pavement shall not be placed until all other items of construction have been completed. Roadway materials shall not be placed upon wet foundations or on frozen subgrade.

3.03 MAINTENANCE

The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the project. Maintenance shall include such dragging, reshaping, wetting and rerolling as are necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces and repair of damaged or unsatisfactory surfaces to the satisfaction of the Engineer. Maintenance shall also include sprinkling as may be necessary to abate dust from the gravel surface.

3.04 SIDEWALK REPLACEMENT

- A. Materials

1. All concrete sidewalks shall be built and/or replaced with Class "A" concrete which shall conform with requirements of the section "Cast-In-Place Concrete" of these specifications.
 2. Prefomed joints shall be 1/2-inch thick conforming to the latest edition of AASHO Standard Specifications, M59, for prefomed bituminous fiber joints.
 3. Concrete forms shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength when in place to hold the concrete true to line and grade without springing or distortion.
- B. When a section of sidewalk is removed the existing sidewalk shall be cut to a near line perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing contraction joints unless such joints do not exist in which case the cut shall be made at minimum distances shown on the plans.
- C. Existing concrete sidewalks that have been cut and removed for construction purposes shall be replaced with sidewalks of the same width and surface as the portion removed and shall have a minimum uniform thickness of 4 inches. The new work shall be neatly joined to the old concrete so that the surface of the new work shall form an even unbroken plane with the old sidewalk.
- D. The subgrade for concrete sidewalks shall be formed by excavating to a depth equal to the thickness of the concrete. Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrade shall be compacted by hand tamping or rolling. Soft, yielding or unstable material shall be removed and unyielding surface at proper line, grade and cross section.
- E. Expansion joints shall be required to replace any existing expansion joints that are removed with the sidewalk or in new construction wherever shown on the plans. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2 inch of the top of finished concrete surface.
- F. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured.

3.05 REPLACING CURBS

- A. All existing curbs which are removed, damaged, or destroyed during construction of the sewerage and water works shall be replaced in accordance with the following:

1. Asphaltic concrete curbs shall be constructed with the same dimensions as the existing curb using concrete pavement Grading E, conforming to Paragraph 2.01 of these specifications. Prior to constructing curbs on pavement, the pavement shall be dry and cleaned of all loose material and a tack coat of RS-2 asphalt shall be applied to the curb area of the pavement at the rate of 0.08 to 0.20 gallons per 15 linear feet of curb area.
2. Portland cement concrete curbs shall be constructed with the same dimensions as the existing curb using Class A concrete in accordance with the sections entitled "Cast- In-Place Concrete" and with Section 702, "Cement Concrete Curb", Tennessee Department of Transportation, Standard Specifications for Road and Bridge Construction, latest edition.

**** END OF SECTION ****

SECTION 130

STERILIZATION

PART 1 - GENERAL

1.01 SCOPE

- A. Under this item the Contractor shall furnish all equipment, labor and materials including chlorine or chlorine compounds required for adequately sterilizing all units of the work. Unless otherwise specified, the water mains shall be treated in accordance with the latest AWWA Standard for disinfecting water mains, ANSI/AWWA C651, latest revisions.

PART 2 - PRODUCTS

2.01 STERILIZATION AGENT

The sterilization agent applied shall be free chlorine or a chlorine compound. The method of application and type of sterilizing agent shall be approved by the Engineer.

PART 3 - EXECUTION

3.01 STERILIZATION PROCEDURE

- A. Upon completion of the construction and installation of equipment, the Contractor shall sterilize all plant units, piping, pumps and connections thereto, all distribution system piping and storage tanks and any surfaces that shall be in contact with the potable water.
- B. Prior to sterilization, all surfaces shall be thoroughly flushed with clear water.
- C. Sterilization shall be accomplished by the application of clear water containing a minimum of 50 parts per million of available chlorine. The chlorine bearing water shall remain in contact with the surfaces being sterilized for a period of not less than 24 hours. At the end of the contact period the chlorine residual in all units and at extremities of pipelines and other representative points shall be at least 25 ppm.

APPLICATIONS OF 70% CHLORINE TO NEW WATER LINES FOR STERILIZATION

$$\text{VOLUME} = 0.785D^2H \text{ (IN CUBIC FEET)}$$

SIZE OF PIPE 100	DIAMETER FT	CUBIC FT/FT	GALS/FT	CHLORINE OZ PER
2"	0.1667 =	0.0218	0.16	0.15oz
4"	0.3333 =	0.0872	0.65	0.60oz
6"	0.5000 =	0.1963	1.47	1.37oz
8"	0.6700 =	0.3524	2.64	2.45oz
10"	0.8333 =	0.5451	4.08	3.79oz
12"	1.0000 =	0.7850	5.88	5.47oz
14"	1.1667 =	1.0685	8.01	7.45oz
16"	1.3333 =	1.3956	10.47	9.74oz
18"	1.5000 =	1.7663	13.25	12.32oz
20"	1.6667 =	2.1806	16.36	15.20oz
24"	2.0000 =	3.1400	23.55	21.90oz

- D. In the process of chlorinating newly constructed units and newly installed pipe, all valves or other appurtenances shall be operated while the units and pipelines are filled with the chlorinating agent.
- E. Upon completion of the sterilization procedure all units and piping shall be flushed with potable water until the chlorine residual remaining is 1.0 part per million or less and the replacement water throughout the units, upon suitable bacteriological tests, has proved to be of acceptable quality. This satisfactory quality of water should continue for two full days as demonstrated by laboratory examination of samples taken from a tap located and installed in such a way as to prevent outside contamination.
- F. No portion of new work shall be placed in service to consumers until sterilization has been completed and approved by the Engineer. Should the initial treatment fail to result in acceptable water, the chlorination procedure shall be repeated until satisfactory results are obtained.

3.02 UNITS TO BE STERILIZED

- A. All units of water treatment plants including all water piping, pumps, filter and clear well.
- B. Steel and/or concrete water storage tanks and connections.
- C. The entire water distribution system including:
 - 1. New pipelines
 - 2. Existing pipelines reconnected to new lines
 - 3. Filtered water supply lines
 - 4. Booster pumping stations.
- D. Potable water supply lines in sewage treatment plants and other structures.

**** END OF SECTION ****

SECTION 140

RAILROAD AND HIGHWAY CROSSINGS BORING METHOD

PART 1 - GENERAL

1.01 SCOPE

The work covered by this section includes furnishing all labor, materials, service, and equipment required to properly complete sewer and/or water pipeline construction, by boring, under railroads and federal or state highways, as described herein and/or shown on the Drawings.

1.02 SHOP DRAWINGS AND SPECIFICATIONS

Complete specifications and product information shall be submitted to the Engineer in accordance with the requirements of the section.

1.03 STORAGE AND DELIVERY

All materials shall be stored and protected with strict conformance to the manufacturer's recommendations and as approved by the Engineer.

1.04 GUARANTEES

The Contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties", of these Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel casing pipe for sizes 6 inches and smaller shall conform to ASTM A 120 (standard weight), of the latest standard specifications.
- B. Steel casing pipe, sizes 8 inches through 54 inches, shall be spiral or straight seam welded steel pipe conforming to ASTM A 139 Grade B of the latest standard specifications.
- C. All steel casing pipe shall be bituminous coated inside and out.
- D. All corrugated metal casing pipe shall be hot dipped galvanized.
- E. Corrugated metal casing pipe shall conform to the following specifications depending on the type of crossing:

1. Highway

- a. Corrugated pipe material shall conform to the latest revision of ASTM A 444 (AASHTO M218).
- b. The pipe shall be single riveted with circumferential (annular) seams and a full circular cross section.
- c. The corrugations shall be 2-3/4-inch pitch by 1/2-inch depth.
- d. The minimum material thickness (including galvanizing) shall be 20 gauge.
- e. All joints shall be connected with the standard type single piece band connector of the same material and coatings as the pipe.
- f. All corrugated metal pipe shall conform to the latest revision of AASHTO M190.

2. Railroad

- a. Corrugated metal pipe material shall conform to the latest revision of ASTM A 444.
- b. The pipe shall be single riveted with circumferential (annular) seams and a full circular cross section.
- c. The pipe shall have Class I corrugations and have a minimum material thickness of 18 gauge.
- d. All joints shall be connected with corrugated coupling bands fabricated of the same material as the pipe.
- e. All corrugated metal pipe shall conform to American Railway Engineering Association (AREA) Manual, Volume 1, Chapter 1, Part 4.
- f. The pipe shall be coated with a bituminous coating according to AREA Manual, Volume 1, Chapter 1, Part 4.

- F. The sand fill between the casing pipe and carrier pipe, where permitted, shall conform to the section entitled "Cast-In-Place Concrete" Part 2.01 B (Fine Aggregate) of these Specifications.

PART 3 - EXECUTION

3.01 GENERAL

- A. Any solidification of embankments, boring headings, headings or sides shall be the Contractor's responsibility and shall be done at his own expense.
- B. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
- C. The casing pipe shall be jacked into the boring as soon as possible after the boring is made. Lengths of casing pipe as long as practical shall be used. Joints between sections shall be completely welded as recommended for joining the particular type of pipe.
- D. Once the jacking procedure has begun, it should be continued without stopping until completed subject to weather and conditions beyond the control of the Contractor.
- E. Any replacement of carrier pipe in an existing casing shall be considered a new installation, subject to the applicable requirements of these Specifications.
- F. Open cut installations, where permitted, shall be in accordance with the details and procedures shown on the Drawings. For open cut installations, corrugated metal pipe may be substituted for casing pipe.
- G. Care shall be taken to ensure that casing pipe installed by boring and jacking or open cut method will be at the proper alignment and grade.
- H. The Contractor shall maintain and operate pumps, well points, and drainage system equipment to keep work dewatered at all times.
- I. Adequate sheeting, shoring, and bracing for embankments, operating pits, and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring and bracing shall be left in place, cut off, or removed, as designated by the Engineer.
- J. Trench excavation; mining for tunnels; all classes and types of excavation; the removal of rock, muck, debris; the excavation of all working pits; and backfill requirements of the section entitled "Earthwork" are included under this section.
- K. Carrier pipe for all lines 6 inches and larger shall have push-on joints and fitting.
- L. After the casing pipe is installed, the carrier pipe shall be installed exercising care at all times to protect the interior of the casing pipe and to maintain tight, full seated joints in the carrier pipe. The carrier pipe shall be installed at the proper line and grade without any sags or high spots.

- M. The carrier pipe shall be laid on the bottom of the casing pipe and secured to the bottom of the casing pipe by placing along the sides and top waterproof pressure treated wood blocks spaced along the pipe and secured together so that they remain firmly in place. The spacing of such blocks longitudinally in the casing pipe shall not be greater than 10 feet. This or any approved procedure shall secure the carrier pipe to the bottom of the casing pipe. In sewer applications installation shall make sure proper grade for flow is maintained.
- N. Except where prohibited, sand shall be forced under pressure into the annular space between the carrier pipe and the casing pipe. This shall begin at the center of the crossing and completely fill the space to each end. Care shall be exercised at all times to maintain the carrier pipe at its proper line and grade.

3.02 RAILROAD CROSSINGS

- A. The Contractor shall secure permission from the railroads to schedule work so as not to interfere with the operation of the railroads. All work will be done under the supervision of the Engineer and the railroads involved. The Contractor will furnish the railroad with such additional insurance as may be required, cost of the same to be borne by the Contractor.
- B. The casing pipe shall extend no less than 25 feet from the centerline of outside track to the end of the pipe. The casing pipe shall extend beyond the railway right-of-way limits, if necessary, to obtain this distance.
- C. All work on railway right-of-way including necessary supporting of tracks, safety of operations, and other standard and incidental operation procedures shall be under the supervision of the appropriate authorized representative of the railway system affected and any decisions of this representative pertaining to construction and/or operations shall be final and constructions must be governed by such decisions.
- D. If, in the opinion of the railway company, it becomes necessary to provide flagging protection, watchmen, removal or replacement of tracks, or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall reimburse the railroad in cash for such services, in accordance with accounting procedures agreed on by the Contractor and affected railway company before construction is started.

3.03 HIGHWAY CROSSINGS

- A. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the state highway right-of-way.

- B. Work along or across the state highway department rights-of-way shall be under the supervision of the Engineer and state highway department engineer.
- C. All water and sewer pipelines installed under paved roads and paved crossroads within the rights-of-way of the state highway department shall be encased. This includes, but is not limited to, all water and sewer service lines.
- D. For open trench cut installations, the Contractor shall make satisfactory arrangements to detour traffic around the area of highway where work is in progress, with minimum inconvenience placed on the traveling public. The Contractor shall provide suitable flagmen, watchmen, safety devices, and other services and facilities as may be required by the state highway department. The cost of the same shall be borne by the Contractor.
- E. All water and sewer lines shall have a minimum cover of 30 inches unless otherwise shown on the Drawings, but in no case shall the minimum, cover be less than that required by the regulations of the highway agency involved.
- F. Unless otherwise shown, encasement shall extend 5 feet beyond the highway embankment or back of side ditch. On curbed portions of conventional highways the casing pipe shall extend to the back of curb or sidewalk.
- G. For open trench cut installations, the Contractor shall be responsible for scheduling and coordinating all construction work. All work at one particular crossing shall be completed with the trench backfilled, compacted, and a temporary crushed stone surface provided for traffic before any work is started on another such crossing.
- H. All installations shall be done to leave free flows in drainage ditches, pipes, culverts, or other surface drainage facilities of the highway, street, or its connections.
- I. Where sodding is disturbed by excavation or backfilling operation, such areas shall be replaced by mulch sodding on slopes 5 percent or less. All slopes over 5 percent shall be replaced with block sodding. No separate payment shall be made for sodding which shall be included in the bid prices for installation of pipe.
- J. All trench excavation within the right-of-way, but not under pavement, shall be backfilled by tamping in 6-inch layers.
- K. All surplus material shall be removed from the right-of-way and the excavation finished flush with surrounding ground.
- L. Grout backfill shall be used for unused holes or abandoned pipes.
- M. Boring, jacking, or driving of carrier or casing pipes under existing highways shall be accomplished without jetting, sluicing, or wet boring.

- N. No excavated material or equipment shall be placed on the pavement or shoulders of the highway without the express approval of the state highway department engineer.
- O. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed which are placed on the right-of-way in advance of construction shall be placed in such a manner as not to interfere with the safe operation of the highway.

**** END OF SECTION ****

SECTION 145

RAILROAD AND HIGHWAY CROSSINGS TUNNEL METHOD

PART 1 - GENERAL

1.01 SCOPE

The Contractor shall, under this item, furnish all of the necessary labor, materials, equipment and services for mining the tunnels and furnishing and installing the carrier pipe including necessary shafts and sumps for the proper installation of the pipe lines including furnishing and placing of concrete, liner plates, pressure grout, cradles, bases, fills, wood blocking, horizontal alignment and settlement monitoring equipment, and all other appurtenances required for the proper completion of the sewer construction in tunnels as shown on the contract drawings and as specified herein.

It is understood that a diversity of materials may be encountered in sinking the shafts and excavating the tunnels, including clay, quicksand, rock, and debris from previous construction, etc. It will be the Contractor's responsibility for safety within the tunnel and completing the tunnel installation for any and all conditions for the price bid in the Bid Schedule.

1.02 SHOP DRAWINGS AND SPECIFICATIONS

Complete specifications and product information shall be submitted to the Engineer in accordance with the requirements of the section.

A. Shop drawing shall include the following:

1. Tunnel linings showing sizes, shapes, methods of attachment, and connection details with location and details of grout holes.
2. Design mix of concrete grout.
3. Tunnel method of construction:
 - a. The contractor has the option to select the exact method of excavation used in the tunneling method, including ground water control.
 - b. The contractor shall submit working drawings and a written procedure describing in detail the proposed tunnel method and entire operation for conformity and compliance with the Specifications. This shall include but not be limited to tunnel shafts, tunnel support, dewatering, ground stabilization if proposed, excavation procedures, support of tunnel face and initial supports, grouting procedures, detection of surface movement, procedure for installing pipe, supports, and anchors, and placement of

grout between pipe and tunnel liner. If, in the opinion of the Contractor, modifications to the methods are required during construction, working drawings shall be submitted which delineate such modifications and reasons for said modifications.

- c. The Contractor is required to submit for approval the method he proposes for monitoring settlement and horizontal alignment prior to the start of construction.

B. Certified test reports shall be submitted for the following:

1. Liner plate segments for tunnel linings.
2. Tunnel liner plate connectors.

1.03 STORAGE AND DELIVERY

All materials shall be stored and protected with strict conformance to the manufacturer's recommendations and as approved by the Engineer.

1.04 GUARANTEES

The Contractor shall provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Guarantees and Warranties", of these Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cement, sand, concrete, grouting material and steel reinforcing shall conform to the requirements of the applicable items of these Specifications.
- B. Structural steel liner plates shall be as manufactured by Armco Drainage and Metal Products Company, Republic Steel Corporation, Commercial Pantex-Sika, or approved equal. Liner plates shall conform to ASTM Specification A 569 and shall be of the thickness shown on the Drawings. Liner plates shall be of the two-flange, lap-joint or the four-flange type. Bolts and nuts used shall be a minimum of 1/2-inch in diameter for plate thickness equal to or greater than 0.179 inch; bolts and nuts shall also conform to the latest revision of ASTM A 307. Each liner plate ring shall have three 1-1/2-inch or 2-inch-diameter grout holes with plug for grouting in each ring. Rings shall be installed with holes set to allow complete filling of voids with grout. Liner plates used for railroad crossings shall be hot dipped galvanized in accordance with AREA 1-4-25 or ASSHTO M167.

- C. All plates shall be of uniform fabrication and those intended for one size tunnel shall be interchangeable.
- D. The material used for the construction of these plates shall be new, unused and suitable for the purpose intended. Workmanship shall be first class in every respect.
- E. Carrier pipe shall be push-on joint ductile iron pipe conforming to the Section of these Specifications entitled "Ductile Iron Pipe, Ductile Iron and Cast Iron Fittings".
- F. Grout fill between the tunnel liner and carrier pipe shall consist of a sand-cement grout with one part portland cement and three parts fine aggregate. The water-cement ratio shall be 0.62 by weight.
- G. The void behind the liner plates shall be filled with sand-cement pressure grout. The sand-cement content shall be one part portland cement to 3 parts fine aggregate. The water-cement ratio shall be 0.62 by weight.
- H. The minimum liner plate thickness shall be the thicker of that shown on the Drawings or listed in the Bid Schedule. At the Contractor's option, a heavier gauge liner plate material may be used at no increase in cost to the Owner.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor or Subcontractor must be fully equipped and experienced in the installation of large diameter structures by tunneling. As evidence of his experience in this type of work, the Contractor shall submit to the Engineer specific information covering the successful installation by his company of at least six similar structures.
- B. The Contractor shall inspect the location where the tunnel is to be installed and familiarize himself with the conditions under which the work will be performed and with all necessary detail as to the orderly prosecution of the work. The omission of any details for the satisfactory installation of the work in its entirety, which may not appear herein, shall not relieve the Contractor of full responsibility.
- C. Construction of the tunnel shall be carried on in such a manner that settlement of the ground surface above the tunnel shall be held to an absolute minimum. Where ground conditions are unstable, a suitable shoring method must be implemented, as approved by the Engineer, and shall be used to prevent caving of material above the tunnel before the liner plates can be installed.

- D. Mining for tunnels and all classes and types of excavation, the removal of rock, muck, debris, the excavation of all working pits backfill, requirements of Section 20, "Earthwork," are included under this section.
- E. Tunnel construction shall be performed so as not to interfere with, interrupt, or endanger surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the tunnel. Support the ground continuously in a manner which will prevent the loss of ground and keep the perimeters and face of the tunnel, passages, and shafts stable. The Contractor shall be responsible for all settlement resulting from tunnel operations and shall repair and restore damaged property to its condition prior to being disturbed at no cost to the Owner. Rock, voids, unstable materials, debris, and/or water, if encountered, shall not entitle the Contractor to additional compensation.
- F. Tunnel Operations
 - 1. Control the tunnel face using such support procedures as breasting, poling plates, face jacks, sliding tables, either singly or in combination, spaced as required.
 - 2. When using liner plates, advance excavation in increments, sufficient for the placement of one ring of liners and install liner plates immediately after each increment of excavation. Excavate in such a manner that voids behind the liner plates are held to a minimum. Completely fill such voids with grout placed under pressure.
 - 3. Whenever the tunnel operation is suspended, support the tunnel face by positive means and keep dewatering system operating. Have qualified personnel periodically check conditions that might threaten the stability of the tunnel.

3.02 EXCAVATION METHODS

- A. Underground excavation shall be performed by methods best suited to the local conditions and which do not induce damage to adjacent surface or underground structures and/or utilities. Excavation shall be performed to the size, shape, and within the tolerances shown on the contract drawings, or herein specified, for the type of lining to be installed, and to accommodate all of the necessary tunnel supports and other components as indicated on the contract drawings, as directed or approved by the Engineer, according to conditions encountered.
- B. Prior to the start of excavation in any area, the Contractor shall submit to the Engineer a detailed plan showing pertinent data in detail for each stage of excavation including equipment to be used in accomplishing the work to be performed.

- C. Adequate sheeting, shoring and bracing for embankments, operating pits, and as elsewhere required shall be placed and maintained in order that work may proceed safely and expeditiously. Upon completion of the work, the sheeting, shoring and bracing shall be left in place, cut off, or removed as designated by the Engineer.
- D. Any solidifications of embankments or unstable soil in the heading or sides of the tunnel shall be the Contractor's responsibility and shall be done at his expense.
- E. All excavation for the entire length of the tunnel shall be done by tunneling from one end of the tunnel. The periphery of the tunnel shall be trimmed smooth to fit the outside of the steel liner plate as nearly as is practical.

3.03 SAFETY AND INTEGRITY OF STRUCTURES

- A. The Contractor shall assume full responsibility for the safety of all excavations performed under this section, as well as for the safety and integrity of all existing structures, equipment, and personnel that may be affected by his work, until the completion and acceptance of the work. In fulfillment of his responsibility, the Contractor, subject to the provisions of these Specifications, shall adopt any and all measures that he may consider necessary to avoid damage to excavations and structures.
- B. All drilling, blasting, barring down of loose rock, mucking-out and removal of material shall be performed, and surrounding rock supported, in a manner that will insure the safety of the personnel and the work.

3.04 BLASTING

- A. Blasting shall be permitted only after the proper precautions have been taken for the protection of all persons, work and property. Blasting within 50 feet of cured concrete, except shotcrete, will be permitted only after submission by the Contractor of a plan showing the relative positions of the concrete, the area to be blasted and blasting technique to be employed. In any event, all concrete work shall be protected by limiting the size of blasts, covering blasts, and by other means until it is certain that there is no danger of damage caused by either shock waves or fly rock.

3.05 BLASTING TECHNIQUES

- A. The Contractor shall exercise all possible care in his drilling and blasting operations to ensure the stability of the remaining rock and to keep over break and over drilling to a minimum. All excavated surfaces shall be as smooth and sound as the nature of the rock permits. It shall be the Contractor's responsibility to produce the most satisfactory surface utilizing the rock failure process of blasting, by determining the proper relationships of the factors of burden, spacing, depth of charge, amount and type of explosive, hole size and delay pattern, as well as other necessary considerations to achieve the required results.

- B. For the surfaces of all walls and arches, controlled perimeter blasting techniques involving the positioning of closely spaced, uniformly loaded perimeter holes, shall be used to produce smooth excavated surfaces. Modifications to the controlled blasting methods shall be made as required to achieve the best obtainable results and to keep the vibrations within limits acceptable to the Engineer.

3.06 BLASTING INFORMATION TO BE FURNISHED BY THE CONTRACTOR

The service of at least one person thoroughly qualified in the use of explosives shall be provided by the Contractor to design the blasts and implement their execution. Prior to the start of work, the Contractor shall submit qualifications of such person or persons to the Engineer for approval and will be responsible for all blasting and field supervision aspects of the project and his position will not be substituted without approval by the Engineer.

3.07 TEMPORARY VENTILATION

The Contractor shall provide temporary ventilation of the underground work areas in a manner that will ensure the supply of fresh air in adequate quantities at all times.

3.08 DUST CONTROL

All drilling and tunneling operations shall be conducted by methods and with equipment which shall positively control dust, fumes, vapors, gases, fibers, fogs, mists or other atmospheric impurities.

3.09 TEMPORARY DRAINAGE FACILITIES

- A. The Contractor shall furnish, operate and maintain temporary drainage to remove all water entering the excavation. Water bearing seams in the rock tunnel shall be drained as directed by the Engineer. The Contractor shall furnish and place approved or directed by the Engineer, and shall connect them to the drainage system in order to prevent the water flowing into the tunnel from interfering with or damaging the work. The pans and shields are to be properly supported. The cost of furnishing, maintaining and removing such temporary pans and shields is deemed to be included in the unit prices for tunneling.
- B. The Contractor shall maintain and operate pumps, well points, drainage system and equipment to keep the work dewatered at all times, as may be necessary.
- C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24-hour basis keeping excavation free of water until the backfill operation is in progress. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.

3.10 DISPOSAL OF EXCAVATED MATERIAL

The disposal of all excavated material or spoil shall be the responsibility of the Contractor. He shall remove all spoil from the site of the work and dispose of the same, at his own expense, at sites secured by him, unless specified disposal areas are provided.

3.11 INSTALLATION OF LINER PLATES

- A. Steel liner plates shall be installed in excavated tunnels. The liner plates shall be installed progressively as excavation proceeds. Excavation shall not continue more than 24 inches past the end of the liner plate already in place. At this time an additional section of liner shall be installed before excavation shall continue.

Grout shall be placed under pressure in the annular void as the excavation proceeds. Grouting shall be done continuously after each ring is installed.

When work is interrupted for any reason, no ring shall be left ungrouted. Grouting shall follow progressively with each adjacent set of holes. Grout should be continuously placed as close to the heading as possible, using grout stops if necessary. Grout shall be injected in the lower holes first, moving upward as the back space is filled. Threaded plugs shall be installed after filling each grout hole. The water-cement ratio and cement sand content of the grout shall be as specified previously in this section and as approved by the Engineer. All grout shall be placed under pressure sufficient to fill all voids entirely by pumps and/or other equipment manufactured for the purpose and operated in accordance with the manufacturer's instructions.

- B. Steel liner plates shall be installed in accordance with manufacturer's instructions to lines and grades as shown on the contract plans.
- C. As liner plate rings are installed, the Contractor shall consecutively number the rings, using a method which will remain legible while the work progresses. The number shall be placed at the three or nine o'clock position and carried at that location through the entire length of tunnel. Furthermore, the distance from the tunnel entrance shall be labeled at even 10-foot increments.

3.12 INSTALLATION OF CARRIER PIPE

- A. After the tunnel liner is installed, the carrier pipe shall be installed exercising care at all times to protect the interior of the tunnel liner and to maintain tight, full seated joints in the carrier pipe. The carrier pipe shall be installed at the proper line and grade without any sags or high spots.
- B. The carrier pipe shall be held in place in the tunnel liner by the use of hardwood blocks spaced radially around the pipe and secured together so that they remain firmly in place. The spacing of such blocks longitudinally in the casing pipe shall not be greater than 10 feet.

3.13 FILL BETWEEN TUNNEL LINER AND CARRIER PIPE

- A. After each joint of the carrier pipe has been installed properly and secured as described above, the annular space between carrier pipe and the tunnel liner shall be filled using sand-cement grout as described previously in this section. The grout shall be installed beginning at the end of each piece of pipe and shall completely fill the space to the other end before the next joint of pipe is installed. Care shall be exercised at all times to maintain the carrier pipe at its proper line and grade.

3.14 SETTLEMENT

- A. The Contractor shall take appropriate measures to monitor surface and subsurface settlement on a daily basis at no additional cost to the Owner.
- B. The Contractor shall report any settlement or horizontal movement to the Engineer and to the Agent of the highway or railroad immediately and confirm the report in writing as soon as practical after discovery of the settlement or movement, and take immediate remedial action at no cost to the Owner.
- C. In the event that settlement or heave becomes apparent, the Contractor shall immediately cease work and take immediate required action to prevent further settlement or heave. The Contractor shall also restore surface elevations to the levels existing prior to the start of tunnel operations.
- D. Whenever the tunnel operation is suspended, support the tunnel face by positive means and keep dewatering system operating. Have qualified personnel periodically check conditions which might threaten the stability of the tunnel.

** END OF SECTION **

SECTION 150

SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.01 SCOPE

- A. This section shall consist of temporary control measures as shown in the plans or directed by the Engineer during the life of the Contract to control erosion and water pollution, through the use of berms, dikes, dams, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other control devices.
- B. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features, to assure economical, effective, and continuous erosion control throughout the construction and post-construction period.

PARTS 2 - PRODUCTS

2.01 TEMPORARY BERMS

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

2.02 TEMPORARY SLOPE DRAINS

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

2.03 SEDIMENT STRUCTURES

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

2.04 CHECK DAMS

- A. Check dams shall be installed in the bedding and backfill of all new or replaced sewer lines to limit the drainage area subject to the french drain effect of gravel bedding. Dams shall consist of compacted clay bedding and backfill at least three (3) feet thick to the top of the trench and cut into the walls of the trench two (2) feet. Refer to construction detail drawing 200-395.
- B. Alternatively, concrete may be used, keyed into the trench walls. Dams shall be placed no more than 500 feet apart. The preferred location is upstream of each manhole. All stream crossings will include check dams on both sides of the crossing.

2.05 TEMPORARY SEEDING AND MULCHING

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

2.06 BRUSH BARRIERS

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

2.07 BALED HAY OR STRAW CHECKS

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

2.08 TEMPORARY SILT FENCES

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

PART 3 - EXECUTION

3.01 PROJECT REVIEW

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

3.02 PRE-CONSTRUCTION CONFERENCE

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

3.03 CONSTRUCTION REQUIREMENTS

- A. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface of erodible earth material exposed by excavation, borrow and fill operations and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other water impoundment. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, seeding or other control devices or methods as necessary to control erosion. Cut and fill slopes shall be seeded and mulched as the excavation proceeds to the extent directed by the Engineer.
- B. The Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in his accepted schedule. Temporary pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
- C. Where erosion so likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise erosion control measures may be required between successive construction stages. Under no conditions shall the surface area of erodible earth material exposed at one time by clearing and grubbing, exceed 750,000 square feet without approval by the Engineer.

- D. The Engineer will limit the area of excavation, borrow, and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.
- E. Under no conditions shall the amount of surface area or erodible earth material exposed at one time by excavation or fill within the project area exceed 750,000 square feet without prior approval by the Engineer.
- F. The Engineer may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project conditions.
- G. In the event of conflict between these requirements and pollution control laws, rules, or regulations or other Federal, State, or Local agencies, the more restrictive laws, rules, or regulations shall apply.

3.04 CONSTRUCTION OF STRUCTURES

A. Temporary Berms

A temporary berm shall be constructed of compacted soil, with a minimum width of 24 inches at the top and a minimum height of 12 inches with or without a shallow ditch, constructed at the top of fill slopes or transverse to centerline on fills. Temporary berms shall be graded so as to drain to a compacted outlet at a slope drain. The area adjacent to the temporary berm in the vicinity of the slope drain must be properly graded to enable this inlet to function efficiently and with minimum ponding in this area. All transverse berms required on the downstream side of a slope drain shall extend across the grade to the highest point at approximately a 10-degree angle with a perpendicular to centerline. The top width of these berms may be wider and the side slope flatter on transverse berms to allow equipment to pass over these berms with minimal disruptions. When practical and until final roadway elevations are approached, embankments should be constructed with a gradual slope to one side of the embankment to permit the placement of temporary berms and slope drains on only one side of the embankment.

B. Temporary Slope Drains

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

2. Fiber matting and plastic sheeting shall not be used on slopes steeper than 4:1 except for short distances of 20 feet or less.
3. All temporary slope drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base for temporary slope drains shall be compacted and concavely formed to channel the water or hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain. Energy dissipaters, sediment basins, or other approved devices shall be constructed at the outlet end of the slope drains to reduce erosion downstream. An ideal dissipater would be dumped rock or a small sediment basin which would slow the water as well as pick up some sediment. All temporary slope drains shall be removed when no longer necessary and the site restored to match the surroundings.

C. Sediment Structures

1. Sediment structures shall be utilized to control sediment at the foot of embankments where slope outlet drains; at the bottom as well as in the ditch lines atop waste sites; in the ditch lines or borrow pits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long as they are wide.
2. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.

D. Check Dams

1. Check dams shall be utilized to retard stream flow and catch small sediment loads. Material utilized to construct check dams are varied and should be clearly illustrated or explained in the Contractor's erosion control plan.
2. All check dams shall be keyed into the sides and bottom of the channel a minimum depth of 2 feet. A design is not needed for check dams but some typical designs are shown in the standard plans.
3. Stone check dams should generally not be utilized where the drainage area exceeds fifty (50) acres. Log and pole structures should generally not be used where the drainage area exceeds five (5) acres.

E. Temporary Seeding and Mulching

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

F. Brush Barriers

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

G. Baled Hay or Straw Erosion Checks

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

H. Temporary Silt Fences

1. Temporary silt fences shall be placed on the natural ground, at the bottom of fill slopes, in ditches, or other areas where siltation is a problem. Silt fences are constructed of wire mesh fence with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored into the soil.
2. The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Engineer. The silt accumulation at the fence may be left in place and seeded, removed, etc., as directed by the Engineer. The silt fence becomes the property of the Contractor whenever the fence is removed.

3.05 MAINTENANCE

- A. The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.
- B. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense.
- C. Where the work to be performed is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls and falls within the specifications for a work item that has a contract price, the units of work shall be paid for at the proper contract prices.

3.06 EROSION CONTROL OUTSIDE PROJECT AREA

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

**** END OF SECTION ****

Water General Notes:

1. THE NOTES ON THIS DRAWING SHALL APPLY TO ALL OF THE DRAWINGS IN THIS CONTRACT.
2. ALL UTILITY WORK SHALL BE IN STRICT ACCORDANCE WITH THE LATEST "STANDARD SPECIFICATIONS AND CONSTRUCTION DETAIL DRAWINGS" OF CLEVELAND UTILITIES AS WELL AS ANY REQUIREMENTS OF THE STATE OF TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION.
3. THE WATER CONSTRUCTION PROJECT SHALL INVOLVE THE INSTALLATION OF APPROXIMATELY ___ L.F. OF 8- INCH, ___ OF 6-INCH AND ___ L.F. OF 2-INCH, CLASS 200 P.V.C. PIPE AND OTHER APPROPRIATE FITTINGS AND MATERIAL. BIDS ARE TO INCLUDE REPAIRS TO ALL FENCES, YARDS, ROADS, AND DRIVEWAYS.
4. THE EXISTING ELEVATIONS SHOWN ON THE DRAWINGS WERE OBTAINED FROM CITY OF CLEVELAND TOPOGRAPHIC MAPS AND ARE APPROXIMATE.
5. NON-METALLIC DETECTION TAPE SHALL BE INSTALLED 18" ABOVE THE WATERLINE, ALONG WITH NUMBER 12 OR 14 GAUGE CAP WIRE TAPED TO THE WATERLINE AS SHOWN IN CLEVELAND UTILITIES DETAIL DRAWING NUMBER 200-30.
6. ALL WATERLINE P.V.C. PIPE SHALL BE SDR21 WITH 200 P.S.I. PRESSURE RATING IN ACCORDANCE WITH A.S.T.M. D-2241. THE PIPE MUST BEAR THE NATIONAL SANITATION FOUNDATION TESTING LABORATORIES, INC. SEAL OF APPROVAL FOR POTABLE WATER OR AN APPROVED EQUAL. ALL DUCTILE IRON WATERLINE PIPE SHALL BE PRESSURE CLASS 350 WITH CEMENT MORTAR LINING.
7. LUBRICANTS SHALL BE NON-TOXIC AND SHALL NOT PROMOTE BIOLOGICAL GROWTH. SOLVENT-CEMENTED JOINTS ARE NOT PERMITTED.
8. PROCEDURES FOR DISINFECTING POTABLE WATERLINES SHALL CONFORM TO THE REQUIREMENTS OF A.W.W.A. C651. ALL WATERLINES SHALL BE DISINFECTED, BACTERIOLOGICAL TESTED, AND PRESSURE TESTED ACCORDING TO CLEVELAND UTILITIES' SPECIFICATIONS PRIOR TO LINE ACCEPTANCE AND THE WATERLINE BEING PLACED INTO SERVICE.
9. PRESSURE AND LEAKAGE TESTS SHALL BE PERFORMED IN STRICT ACCORDANCE WITH CURRENT A.W.W.A. STANDARD C600 AND/OR MANUFACTURER'S PROCEDURES.
10. ALL VALVES AND FITTINGS ARE TO CONFORM TO THE LATEST A.W.W.A. STANDARDS.
11. THE CONTRACTOR SHALL MAKE ARRANGEMENTS WITH THE UTILITY COMPANY FOR CONNECTION TO THE EXISTING UTILITY LINES. THE CONTRACTOR SHALL ADJUST THE LOCATION OF THE PROPOSED WATERLINE TO AVOID CONFLICTS WITH OTHER UTILITIES.
12. THE CONTRACTOR SHALL CALL "TENNESSEE ONE – CALL" AT LEAST TEN BUSINESS DAYS PRIOR TO THE START OF ANY CONSTRUCTION ON THE SITE (1-800-351-1111).
13. THE EXISTING UTILITY FACILITIES, EASEMENTS, AND THEIR LOCATION ARE TAKEN FROM READILY AVAILABLE INFORMATION. THE ACTUAL LOCATIONS OF THE UTILITY FACILITIES AND EASEMENTS MAY VARY SOMEWHAT FROM THE LOCATION SHOWN AND THERE MAY BE UTILITY FACILITIES EXISTING THAT ARE NOT SHOWN OR INDICATED ON THE DRAWINGS. THE SITE UTILITY CONTRACTOR SHALL CONTACT ALL AGENCIES WITH UTILITY FACILITIES IN THE VICINITY OF THE WORK AND SHALL LOCATE ALL UNDERGROUND FACILITIES BEFORE BEGINNING CONSTRUCTION.
14. THE CONTRACTOR SHALL PROVIDE FOR ANY NECESSARY BONDS AS REQUIRED BY GOVERNING AGENCIES.
15. WHERE THE PROPOSED WATER EXTENDS UNDER ANY CITY OF CLEVELAND PAVED STREET, THE TRENCH MUST BE BACKFILLED WITH STANDARD FLOWABLE FILL AS SHOWN ON "CONSTRUCTION DETAIL DRAWINGS" 200-35.
16. INSTALL PIPE JOINT RESTRAINTS FOR BELL AND SPIGOT JOINTS ONE FULL PIPE JOINT (20 FT.) FROM THE END OF THE WATERLINE AS SHOWN ON "CONSTRUCTION DETAIL DRAWING" 200-115.
17. A RESTRAINER SHALL BE PLACED ON THE PIPE SIDE OF THE FLUSH/POST HYDRANT AND VALVE. THE RESTRAINER TIES THE PIPE AND FITTING TOGETHER.
18. THE INITIAL PRESSURES AND FLOWS WERE OBTAINED FROM CLEVELAND UTILITIES.
19. UNNECESSARY DESTRUCTION OF TREES ALONG THE WATERLINE RIGHT-OF-WAY WILL NOT BE PERMITTED. ALL REASONABLE EFFORTS WILL BE MADE BY THE CONTRACTOR TO PROTECT AND SAFEGUARD TREES.
20. WHERE WATERLINES CROSS IMPROVED, GRASSED, OR LAWN AREAS, ALL SOD, SHRUBS, FLOWERS, ETC... SHALL BE REPLACED IN THE ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.

21. THE CONTRACTOR SHALL PROVIDE ANY REQUIRED TRAFFIC CONTROL DURING CONSTRUCTION.
22. ALL EXCAVATING IS UNCLASSIFIED AND SHALL INCLUDE ALL MATERIALS ENCOUNTERED.
23. SOME OF THE OFF-SITE PROPERTY LINE INFORMATION WAS OBTAINED FROM BRADLEY COUNTY TAX MAPS AND IS APPROXIMATE.
24. THERE SHALL BE NO OPEN BURNING OF CONSTRUCTION MATERIALS OR DEBRIS WITHOUT FIRST OBTAINING A PERMIT FROM THE TENNESSEE DEPARTMENT OF AIR POLLUTION CONTROL. IF A CONTRACTOR DESIRES TO PERFORM OPEN BURNING, HE/SHE WILL BE RESPONSIBLE FOR OBTAINING ANY PERMITS AND FOR VIOLATION OF AIR POLLUTION LAWS. TO OBTAIN A PERMIT, CALL 478-0337 OR ANY FIRE HALL.
25. SILT FENCE AND/OR HAY BALES SHALL BE PLACED AT LOCATIONS DIRECTED BY CLEVELAND UTILITIES TO PROVIDE FOR EROSION CONTROL.
26. ALL WATERLINE WORK MUST BE COMPLETED BY A LICENSED CONTRACTOR IN THE STATE OF TENNESSEE. THE CONTRACTOR MUST BE APPROVED BY CLEVELAND UTILITIES PRIOR TO THE START OF UTILITY CONSTRUCTION.
27. ALL FITTINGS AND PIPES UNDERNEATH THE EXISTING OR THE PROPOSED ROADWAYS SHALL BE DUCTILE IRON.
28. ALL WATERLINES ARE TO BE INSTALLED WITHIN THE EXISTING RIGHT-OF-WAY UNLESS APPROVED PRIOR TO CONSTRUCTION BY CLEVELAND UTILITIES. INSTALL THE PROPOSED WATERLINE WITHIN FIVE FEET OF THE BACK OF THE RIGHT-OF WAY WHERE POSSIBLE.
29. THE COSTS FOR STREAM CROSSINGS SHALL BE INCLUDED IN THE UNIT PRICE BID. NO SEPARATE PAYMENT SHALL BE ALLOWED.
30. WATERLINE SHALL NOT BE PLACED UNDER THE EXISTING PAVED ROADWAY OR ITS SHOULDER UNLESS APPROVED PRIOR TO CONSTRUCTION BY CLEVELAND UTILITIES.
31. THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING ALL ASPHALT, PAVED ROAD/SHOULDER IN GOOD CONDITION. METAL STABILIZER PADS AS WELL AS METAL TRACKS SHALL NOT COME IN CONTACT WITH ASPHALT PAVED SURFACES. A PROTECTIVE COVERING SHALL BE REMOVED TO AID IN DUST CONTROL.
32. ALL FIRE HYDRANTS AND POST HYDRANTS SHOULD BE PLUMBED WITH BREAK-AWAYS AT PROPOSED GROUND LEVEL (I.E. FIRE HYDRANTS SHOULD NOT LEAN TO ONE SIDE AND NOT STAND TOO HIGH OR LOW). ALL GATE VALVE BOXES SHOULD BE LEVEL WITH FINAL ELEVATIONS.
33. THE CONTRACTOR IS TO NOTIFY CLEVELAND UTILITIES BEFORE BEGINNING ANY CONSTRUCTION IN ORDER TO COORDINATE THE LOCATION OF THE PROPOSED WATERLINE AND ATTAIN A COUNTY RIGHT OF WAY PERMIT OR CITY OF CLEVELAND STREET CUT PERMIT.
34. OPERATION OF EXISTING VALVES:
 - (1) IN NON-EMERGENCY SITUATIONS, THE WATER SHOULD NOT BE TURNED OFF WITHOUT FIRST NOTIFYING THE CUSTOMERS AFFECTED. THIS MAY REQUIRE NEWSPAPER AND RADIO ANNOUNCEMENTS OR PERSONAL CONTACT, PREFERABLY A DAY OR MORE IN ADVANCE.
 - (2) WHEN WATER IS PLANNED TO BE OFF, IT SHOULD BE TURNED OFF IN THE PRESENCE OF WATER DIVISION PERSONNEL, AND THEN ONLY AFTER INSURING THAT THE CONTRACTOR IS ADEQUATELY PREPARED TO EXPEDITE AND COMPLETE THE WORK, AND NOTICE HAS BEEN GIVEN.
 - (3) THE CONTRACTOR'S PERSONNEL SHOULD NEVER HANDLE CUSTOMER MATTERS, BUT SHOULD OBTAIN A WATER DIVISION PERSON TO RESPOND TO THE CUSTOMER.
35. ALL DUCTILE IRON FITTINGS AND VALVES ARE TO BE CONNECTED WITH ANCHOR COUPLINGS UNLESS SPECIFICALLY NOTED OTHERWISE. ALL PIPES SHALL BE ATTACHED TO FITTINGS OR VALVES WITH MEGALUG GLANDS OR OTHER APPROVED RESTRAINT TYPE FITTINGS.
36. ROADWAY PAVEMENT LOCATIONS WERE ASSUMED TO BE IN THE MIDDLE OF THE EXISTING RIGHT-OF-WAYS AND WERE NOT FIELD LOCATED. REVISIONS IN WATERLINE LOCATIONS MAY BE NECESSARY DUE TO THE ACTUAL LOCATION OF THE PAVEMENT.
37. NO WORK SHALL BE DONE ON PRIVATE PROPERTY UNTIL A UTILITY EASEMENT HAS BEEN OBTAINED AND RECORDED.

38. EXISTING WATER SERVICE LINES ARE TO BE TIED INTO THE PROPOSED WATERLINE WITH THE LEAST AMOUNT OF DISTURBANCE POSSIBLE.
39. THE LOCATION OF THE EXISTING EDGE OF PAVEMENT AND OTHER UTILITIES SHOWN ARE APPROXIMATELY ONLY AND HAVE NOT BEEN SURVEYED OR LOCATED IN RELATIONSHIP TO THE ACTUAL PROPERTY LINES.
40. ANY WATER METERS SET AT OR ABOVE ELEVATION 925 MAY NOT DELIVER SUFFICIENT PRESSURE TO SATISFY THE PROPERTY OWNERS' REQUIREMENTS. IT SHALL BE THE PROPERTY OWNERS' RESPONSIBILITY TO INSTALL A BOOSTER PUMP ON THEIR SERVICE LINE IF THEY REQUIRE ADDITIONAL WATER PRESSURE ABOVE THAT PROVIDED BY CLEVELAND UTILITIES.
41. ALL ELEVATIONS SHOWN ON THIS PROJECT ARE BELOW THE 925-FOOT ELEVATION.
42. INSTALL KICKERS AS REQUIRED ENSURING THAT THE PIPE AND FITTINGS DO NOT BLOW LOOSE.
43. ALL 5-1/4" FIRE HYDRANTS SHALL BE ORDERED FROM THE FACTORY IN A PRE-PAINTED ORANGE COLOR.
44. VALVE KEY EXTENSIONS ARE TO BE PROVIDED AS REQUIRED. COST IS TO BE INCLUDED IN THE PRICE FOR VALVES (SEE DETAIL 200-435).
45. BACKFILL ALL VALVES, FIRE HYDRANTS, BLOW-OFF ASSEMBLIES, AND OTHER APPURTENANCES THAT ARE PERSONNEL OPERATED WITH 1" DIAMETER CRUSHED STONE; TOP SIX (6) INCHES SHALL BE CRUSHER RUN. SLOPE STONE SURFACE TO DRAIN POSITIVELY AWAY FROM CONSTRUCTION AREA.
46. ALL ROADWAY BORES SHALL BE COMPLETED BEFORE OTHER PIPELINE WORK IS FINALIZED IN THE VICINITY OF THE BORE.
47. IN AREAS SUBJECT TO CORROSION/WASH OUT, PROVIDE MINIMUM 6" RIP RAP WITH FILTER FABRIC (LARGE STONE REQUIRED FOR CREEK CROSSING AND AREAS SUBJECT TO STREAM FLOW).
48. FOR MULTIPLE CUSTOMERS ON ONE LOT, INSTALL 1-INCH SERVICE UNDER ROAD, INSTALL Y-BRANCH AND CONTINUE 3/4" SERVICE LINE.
49. IT IS THE POLICY OF CLEVELAND UTILITIES TO ENSURE COMPLIANCE WITH TITLE VI OF THE CIVIL RIGHTS ACT OF 1964; 49 CFR, PART 21; RELATED STATUTES AND REGULATIONS TO THAT END THAT NO PERSON SHALL BE EXCLUDED FROM PARTICIPATION IN OR BE DENIED BENEFITS OF, OR BE SUBJECTED TO DISCRIMINATION UNDER ANY PROGRAM OR ACTIVITY RECEIVING FEDERAL FINANCIAL ASSISTANCE OR ANY OTHER FUNDING SOURCE ON THE GROUNDS OF RACE, COLOR, SEX, NATIONAL ORIGIN, OR ANCESTRY. BY VIRTUE OF SUBMITTING A RESPONSE TO THIS SOLICITATION, BIDDERS AGREE TO COMPLY WITH THE SAME NON-DISCRIMINATION POLICY.

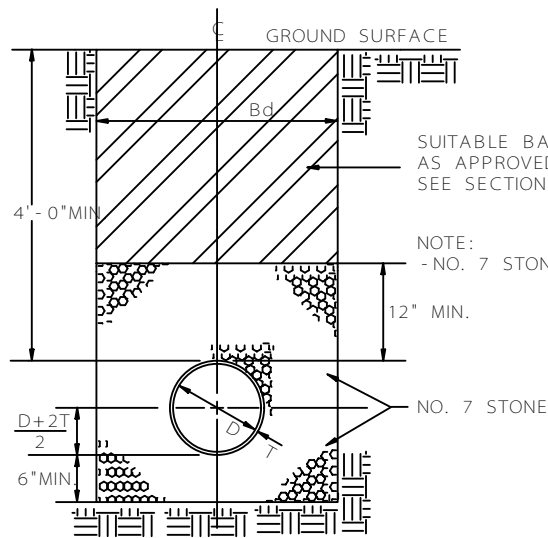
SEWER GENERAL NOTES

1. ALL UTILITY WORK SHALL BE IN STRICT ACCORDANCE WITH THE LATEST STANDARDS AND SPECIFICATIONS OF CLEVELAND UTILITIES AS WELL AS ANY REQUIREMENTS OF THE STATE OF TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION. ALL MATERIALS (PIPE, MANHOLES, FRAMES, COVERS, CONCRETE, ETC...) SHALL HAVE SHOP DRAWINGS SUBMITTED TO CLEVELAND UTILITIES FOR APPROVAL BEFORE BEING USED TO CONSTRUCT THE PROJECT FACILITY. CUT SHEETS SHALL BE DELIVERED TO CLEVELAND UTILITIES FOR APPROVAL BEFORE CONSTRUCTION BEGINS.
2. DUCTILE IRON PIPE SHALL BE CLASS 50 AND PVC PIPE SHALL BE SDR-35 IN ACCORDANCE WITH THE APPROPRIATE ASTM AND CLEVELAND UTILITIES SPECIFICATIONS.
3. ALL CONCRETE SHALL HAVE A MINIMUM STRENGTH OF 3000 PSI.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS OF PAVEMENT REPLACEMENT WHERE UTILITY LINES ARE TO BE EXTENDED.
5. THE CONTRACTOR SHALL MAKE ARRANGEMENTS WITH THE UTILITY COMPANY FOR CONNECTIONS TO THE EXISTING UTILITY LINES.
6. THE EXISTING UTILITY FACILITIES, EASEMENTS, AND THEIR LOCATION WERE TAKEN FROM ACTUAL FIELD SURVEYS, AS WELL AS READILY AVAILABLE INFORMATION. THE ACTUAL LOCATION OF THE UTILITY FACILITIES AND EASEMENTS MAY VARY SOMEWHAT FROM THE LOCATION SHOWN AND THERE MAY BE UTILITY FACILITIES EXISTING THAT ARE NOT SHOWN NOR INDICATED ON THE DRAWINGS. THE UTILITY CONTRACTOR SHALL CONTACT ALL AGENCIES WITH UTILITY FACILITIES IN THE VICINITY OF THE WORK AND SHALL LOCATE ALL UNDERGROUND FACILITIES BEFORE BEGINNING CONSTRUCTION.
7. THE CONTRACTOR SHALL PROVIDE ANY NECESSARY BONDS AS REQUIRED BY GOVERNING AGENCIES.
8. ALL EXCAVATING IS UNCLASSIFIED AND SHALL INCLUDE ALL MATERIALS ENCOUNTERED.
9. ALL REQUIRED EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED PRIOR TO THE BEGINNING OF CONSTRUCTION.
10. ALL EXTERNAL DROP CONNECTIONS SHALL HAVE A DUCTILE IRON NIPPLE OUT OF THE MANHOLE AND A DUCTILE IRON 90% BEND FROM THE BOTTOM OF THE DROP CONNECTION. SEE C.U. CONSTRUCTION DETAIL NO. 300-360.1.
11. THE CONTRACTOR SHALL CALL "TENNESSEE ONE-CALL" AT LEAST THREE BUSINESS DAYS PRIOR TO THE START OF ANY CONSTRUCTION ON THE SITE (1-800-351-1111).
12. THERE SHALL BE NO OPEN BURNING OF CONSTRUCTION MATERIALS OR DEBRIS WITHOUT FIRST OBTAINING A PERMIT FROM THE TENNESSEE DEPARTMENT OF AIR POLLUTION CONTROL. IF A CONTRACTOR DESIRES TO PERFORM OPEN BURNING, HE/SHE WILL BE RESPONSIBLE FOR OBTAINING ANY PERMITS AND FOR VIOLATION OF AIR POLLUTION LAWS. TO OBTAIN A PERMIT, CALL 478-0337 OR ANY FIRE HALL.
13. SILT FENCE AND/OR HAY BALES SHALL BE PLACED AT LOCATIONS DIRECTED BY CLEVELAND UTILITIES TO PROVIDE FOR EROSION CONTROL.
14. ALL UTILITY WORK MUST BE COMPLETED BY A LICENSED CONTRACTOR IN THE STATE OF TENNESSEE. THE CONTRACTOR MUST BE APPROVED BY CLEVELAND UTILITIES PRIOR TO THE START OF UTILITY CONSTRUCTION.
15. CRUSHED STONE BACKFILL SHALL BE USED WHERE SEWER LINES ARE WITHIN OR ADJACENT TO ROADWAY PAVING.
16. FLOWABLE FILL BACKFILL SHALL BE INSTALLED PER C.U. DETAIL # 200-25 FOR ALL SEWER LINES CROSSING CITY OF CLEVELAND STREETS.
17. ALL SEWER SERVICE OR TEE INSTALLATIONS SHALL BE LOCATED SUCH THAT OTHER UTILITIES WILL

NOT BE IN CONFLICT WITH ACCESS TO THE SEWER SERVICE OR TEE. THE END OF ALL SEWER SERVICES SHALL BE A MINIMUM OF TWENTY FEET BEHIND THE RIGHT-OF-WAY LINE. ANY FAILURE TO ADHERE TO THE ABOVE POLICY WILL BE CORRECTED AT THE DEVELOPER'S EXPENSE.

18. THE FINAL PLAT FOR THE SUBDIVISION WILL NOT BE SIGNED BY CLEVELAND UTILITIES AND NO WATER METERS WILL BE SET IN THE AFFECTED DEVELOPMENT UNTIL AS-BUILT DRAWINGS, PROFESSIONALLY PREPARED ON MYLAR MEDIUM, HAVE BEEN DELIVERED TO AND ACCEPTED BY CLEVELAND UTILITIES. FOR EXAMPLE, HAND-WRITTEN, BARELY-LEGIBLE NOTES ON AN OLD SET OF PROJECT PLANS WILL NOT BE ACCEPTED AS SUITABLE AS-BUILT OR RECORD DRAWINGS.
19. DURING THE ENTIRE CONSTRUCTION PHASE OF THE WATER AND/OR SEWER PROJECT, THE DEVELOPER SHALL ENSURE THAT ALL PROPERTY CORNERS ARE KEPT LOCATED.
20. THE CONTRACTOR SHALL NOTIFY CLEVELAND UTILITIES BEFORE BEGINNING ANY CONSTRUCTION IN ORDER TO COORDINATE THE LOCATION OF THE PROPOSED LINES. THE CONTRACTOR SHALL ALSO ATTAIN ANY NECESSARY COUNTY R.O.W. PERMITS AND/OR CITY OF CLEVELAND STREET CUT PERMITS.
21. THE CONTRACTOR SHALL VERIFY ALL INVERT AND TOP ELEVATIONS OF EXISTING AND PROPOSED SANITARY SEWER AND STORM DRAINAGE STRUCTURES, AS WELL AS PROPOSED ROAD GRADES. ANY DISCREPANCIES SHALL BE IMMEDIATELY REPORTED TO THE CLEVELAND SURVEYING COMPANY.
22. IT IS THE POLICY OF CLEVELAND UTILITIES NOT TO DISCRIMINATE ON THE BASIS OF RACE, COLOR, NATIONAL ORIGIN, AGE, SEX, OR DISABILITY IN ITS HIRING AND EMPLOYMENT PRACTICES, OR IN ADMISSION TO, ACCESS TO, OR OPERATION OF ITS PROGRAMS, SERVICES AND ACTIVITIES. WITH REGARD TO ALL ASPECTS OF THIS CONTRACT, CONTRACTOR CERTIFIES AND WARRANTS IT WILL COMPLY WITH THIS POLICY.

CONSTRUCTION DETAIL DRAWINGS



SUITABLE BACKFILL MATERIAL
AS APPROVED BY THE ENGINEER
SEE SECTION 20, "EARTHWORK"

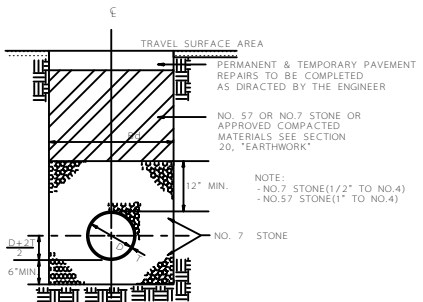
NOTE:
- NO. 7 STONE (1/2" TO NO. 4)
12" MIN.

NO. 7 STONE

PIPE DIA. Inches	Bd TRENCH WIDTH TOP OF PIPE Feet
4"	2.00
6	2.00
8	2.33
10	2.50
12	2.67
15	3.00
18	3.25
21	3.54
24	3.83
27	4.08
30	4.42
33	4.75
36	5.67
42	6.25
48	6.83
54	7.42
60	8.00
66	8.58
72	9.17
78	9.75
84	10.33

Bd - Maximun Trench Width at 12" above top of Pipe if Ditch is cut wider than Bd shown the contractor will be required to increase bedding to compensate for additional load on pipe at his own expense.

TRENCH DETAIL FOR SEWER PIPE
(NOT IN TRAVELED AREA)
FOR P.V.C., P.E. & D.I. PIPE.



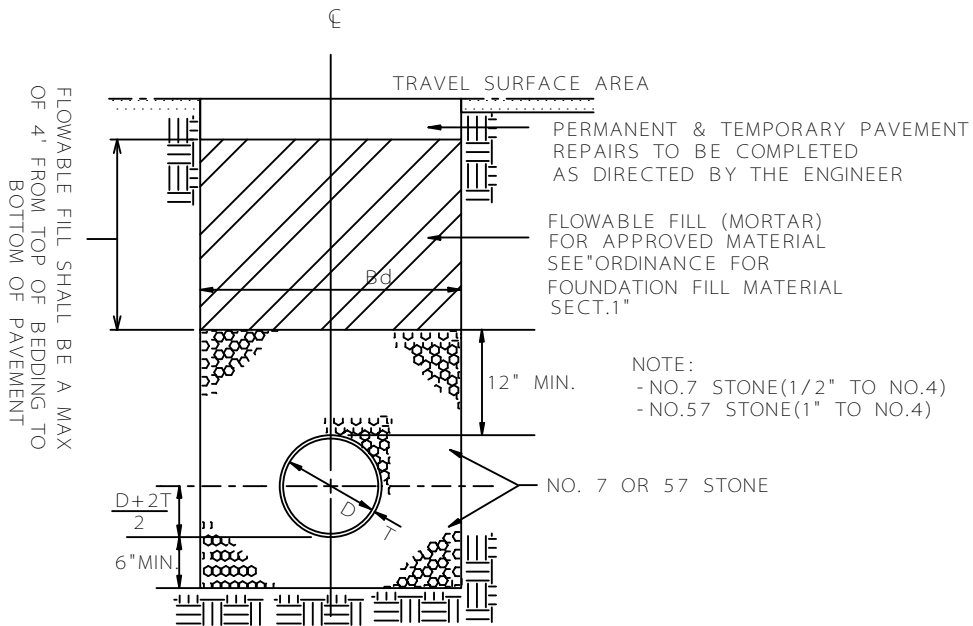
PIPE DIA. INCHES	Bd. TRENCH WIDTHS TOP OF PIPE FEET
4	2.00
6	2.33
8	2.67
10	3.00
12	3.33
15	3.75
18	4.17
21	4.58
24	5.00
27	5.42
30	5.83
33	6.25
36	6.67
42	7.50
48	8.33
54	9.17
60	10.00
66	10.83
72	11.67
78	12.50
84	13.33

Bd- Maximum Trench width at 12" above top of Pipe & Ditch is cut wider than Bd shown the contractor will be required to increase bedding to compensate for additional load on pipe at his own expense.

TRENCH DETAIL FOR SEWER PIPE (FOR TRAVELED AREA OUTSIDE CITY LIMITS) FOR P.V.C., P.E. & D.I. PIPE.

200 - 20

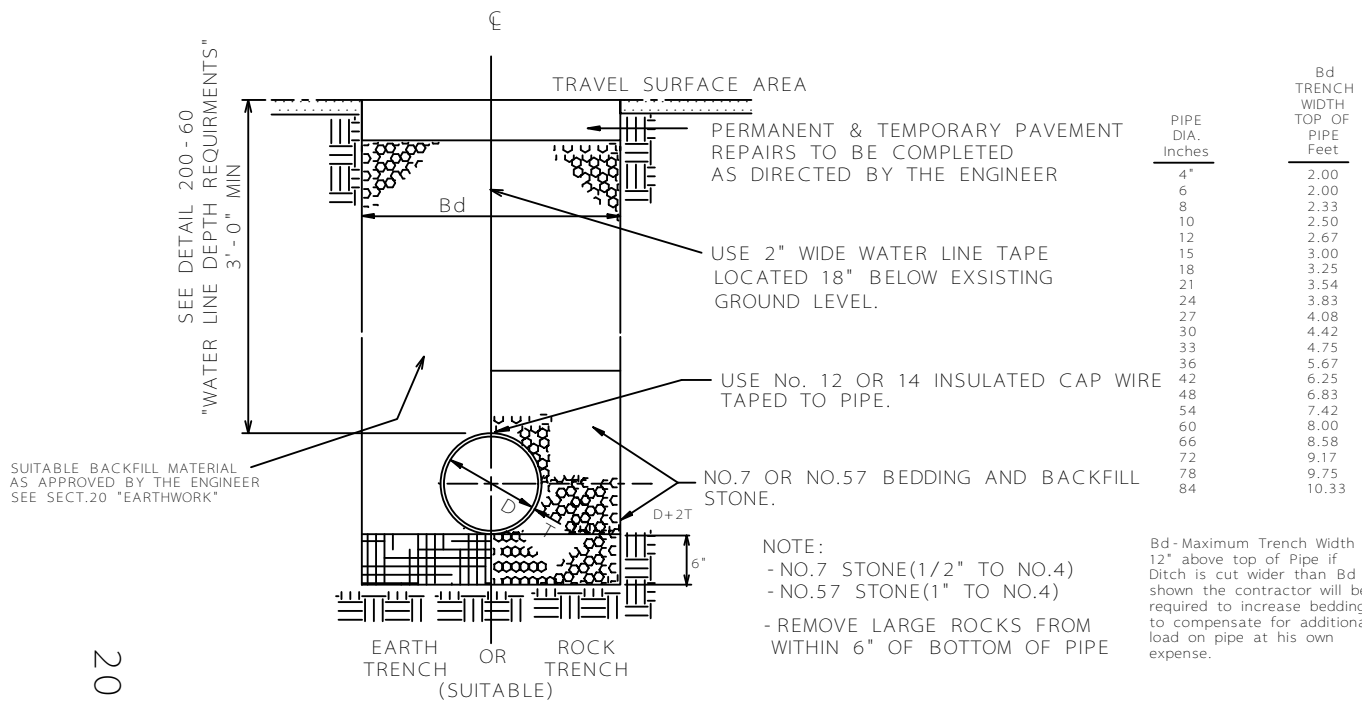
200 - 20



PIPE DIA. Inches	B _d TRENCH WIDTH TOP OF PIPE Feet
4"	2.00
6	2.00
8	2.33
10	2.50
12	2.67
15	3.00
18	3.25
21	3.54
24	3.83
27	4.08
30	4.42
33	4.75
36	5.67
42	6.25
48	6.83
54	7.42
60	8.00
66	8.58
72	9.17
78	9.75
84	10.33

B_d - Maximun Trench Width at 12" above top of Pipe if Ditch is cut wider than B_d shown the contractor will be required to increase bedding to compensate for additional load on pipe at his own expense.

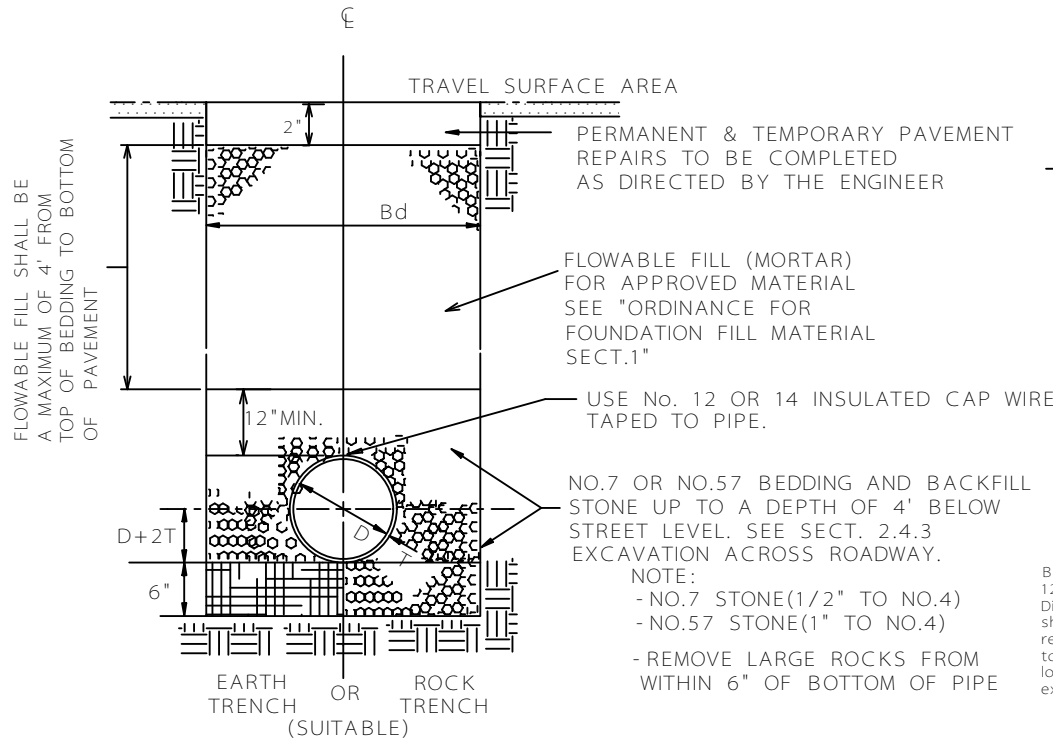
TRENCH DETAIL FOR SEWER PIPE (FOR TRAVELED AREA INSIDE CITY LIMITS) FOR P.V.C., P.E. & D.I. PIPE.



200 - 30

WATER LINE DETAILS FOR PVC PIPE
(TRAVELED AREA OUTSIDE CITY LIMITS) & D.I. PIPE 200 - 30

NOTE: SEE DETAIL 200-60
 "WATERLINE DEPTH REQUIRMENTS"

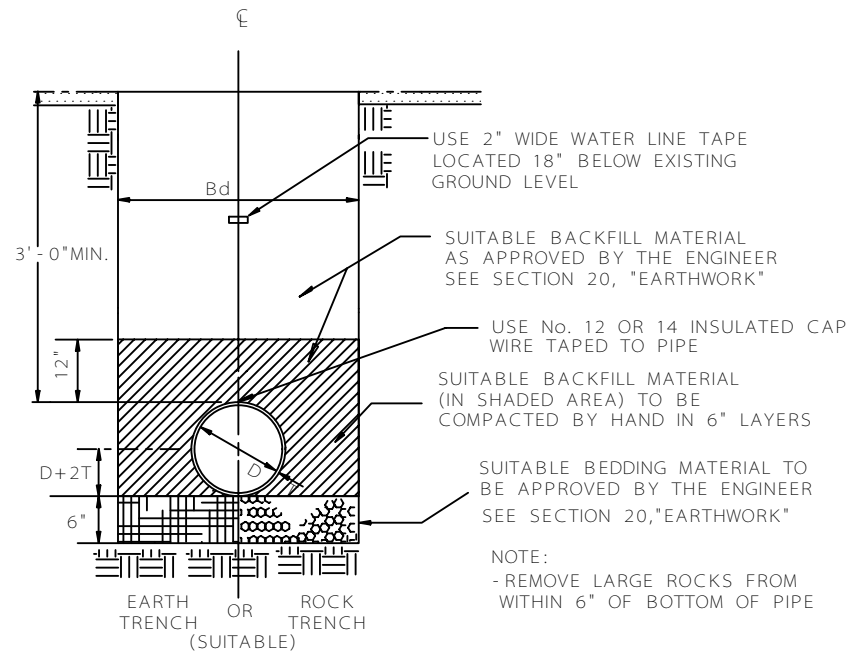


PIPE DIA. Inches	Bd TRENCH WIDTH TOP OF PIPE Feet
4"	2.00
6	2.00
8	2.33
10	2.50
12	2.67
15	3.00
18	3.25
21	3.54
24	3.83
27	4.08
30	4.42
33	4.75
36	5.67
42	6.25
48	6.83
54	7.42
60	8.00
66	8.58
72	9.17
78	9.75
84	10.33

Bd - Maximum Trench Width at 12" above top of Pipe if Ditch is cut wider than Bd shown the contractor will be required to increase bedding to compensate for additional load on pipe at his own expense.

200 - 35

WATER LINE DETAILS FOR PVC PIPE
(TRAVELED AREA INSIDE CITY LIMITS) & D.I. PIPE 200 - 35



PIPE DIA. Inches	Bd TRENCH WIDTH TOP OF PIPE Feet
4"	2.00
6	2.00
8	2.33
10	2.50
12	2.67
15	3.00
18	3.25
21	3.54
24	3.83
27	4.08
30	4.42
33	4.75
36	5.67
42	6.25
48	6.83
54	7.42
60	8.00
66	8.58
72	9.17
78	9.75
84	10.33

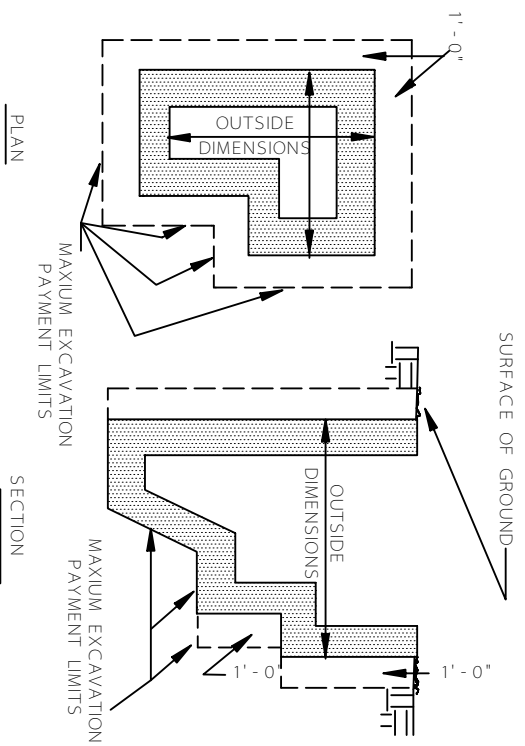
Bd - Maximum Trench Width at 12" above top of Pipe if Ditch is cut wider than Bd shown the contractor will be required to increase bedding to compensate for additional load on pipe at his own expense.

NOTE:
- REMOVE LARGE ROCKS FROM WITHIN 6" OF BOTTOM OF PIPE

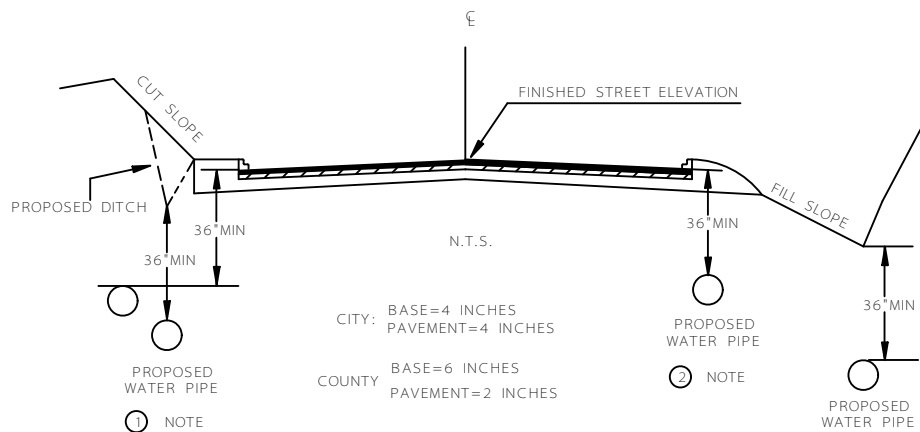
200 - 40

WATER LINE DETAILS FOR PVC PIPE
(OPEN AREAS) & D.I. PIPE

200 - 40

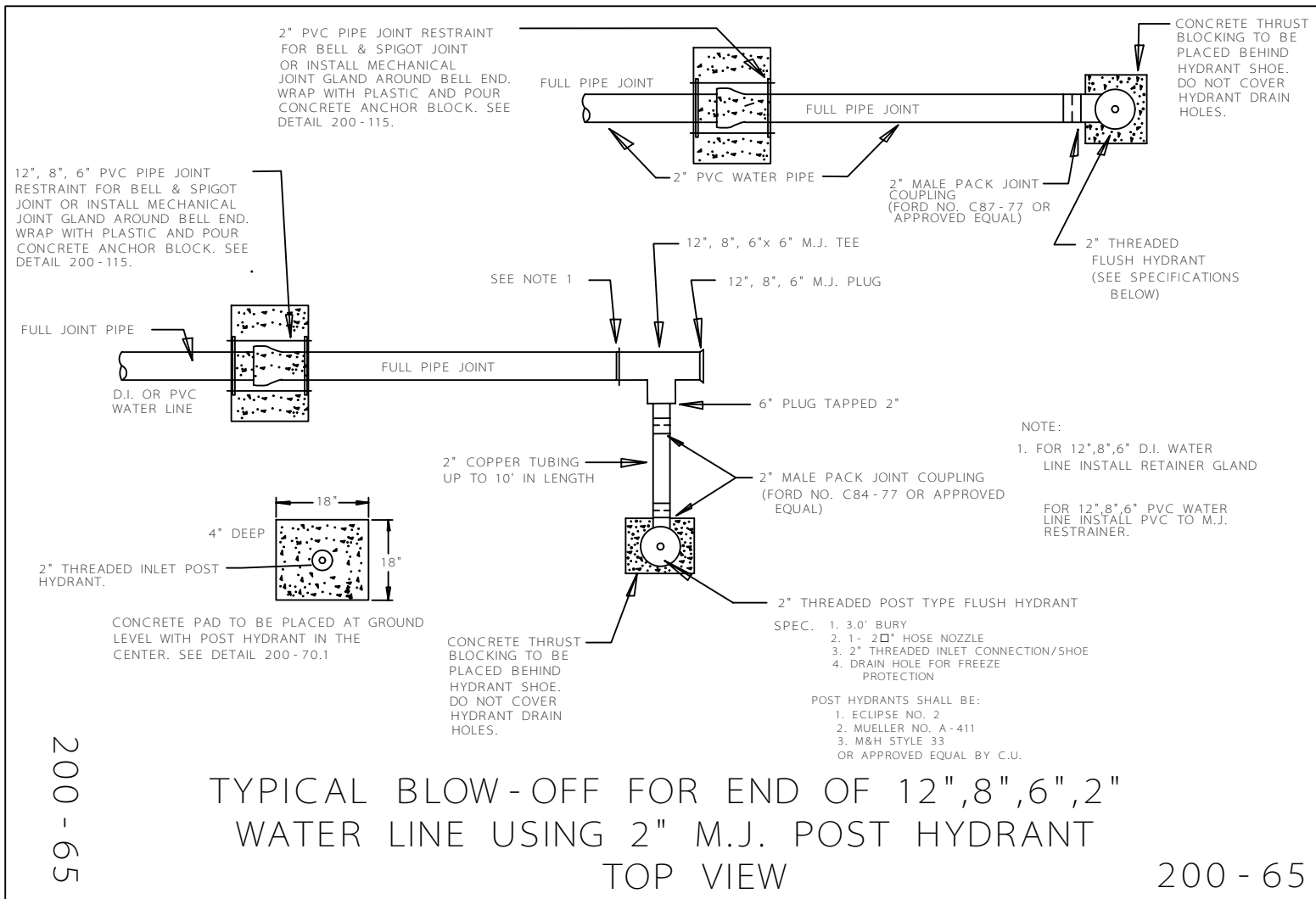


EXCAVATION PAYMENT LIMITS
FOR STRUCTURES



- ① PROPOSED WATER LINES SHALL HAVE A MINIMUM DEPTH OF 36 INCHES FROM FINISHED STREET ELEVATION AT EDGE OF PAVEMENT WHERE FINISHED CUT SLOPE ARE ABOVE FINISHED STREET ELEVATIONS, OR DITCHES THOUGH IT MAY BE BELOW FINISHED STREET ELEVATION.
- ② PROPOSED WATER LINES SHALL HAVE A MINIMUM DEPTH OF 36 INCHES FROM FINISHED FILL SLOPES OR DITCHES THOUGH IT MAY BE BELOW FINISHED STREET ELEVATION.

WATER LINE DEPTH REQUIREMENTS

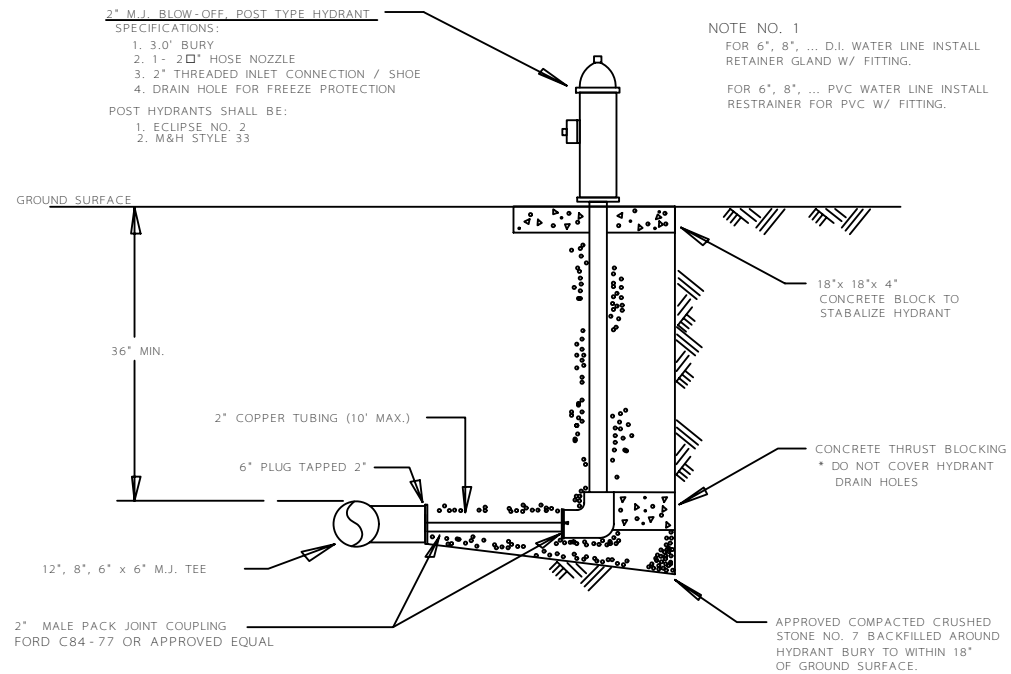


200-65

TYPICAL BLOW-OFF FOR END OF 12", 8", 6", 2" WATER LINE USING 2" M.J. POST HYDRANT TOP VIEW

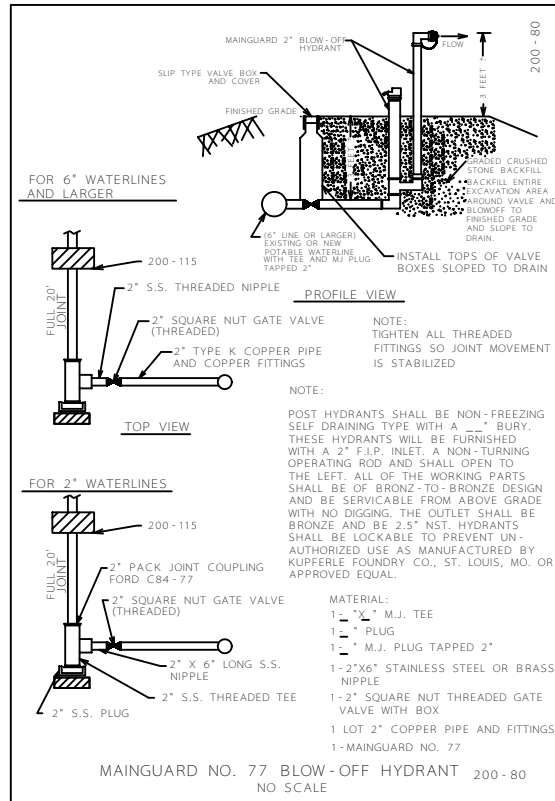
200-65

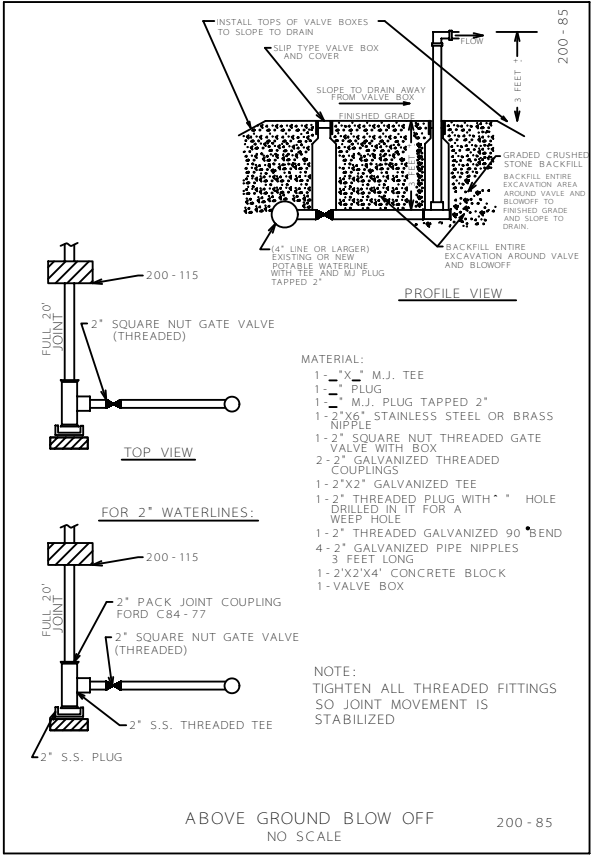
200 - 70

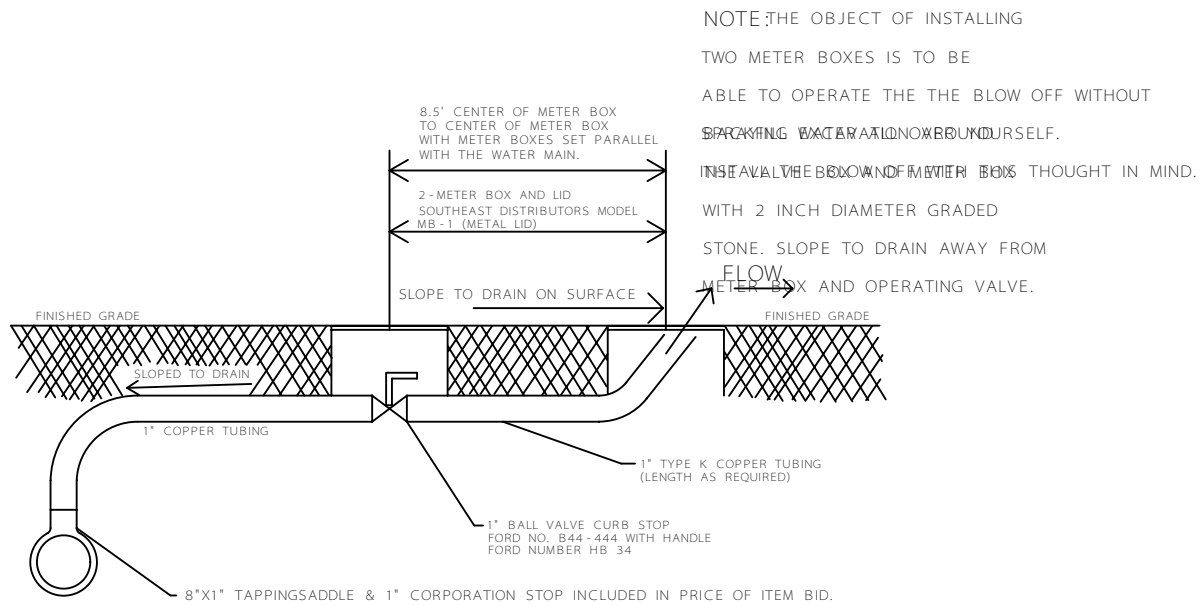


TYPICAL BLOW-OFF FOR END OF WATER LINE
USING POST HYDRANT
SIDE VIEW

200 - 70



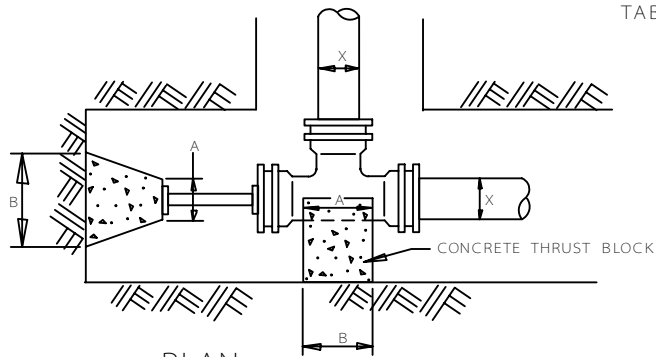




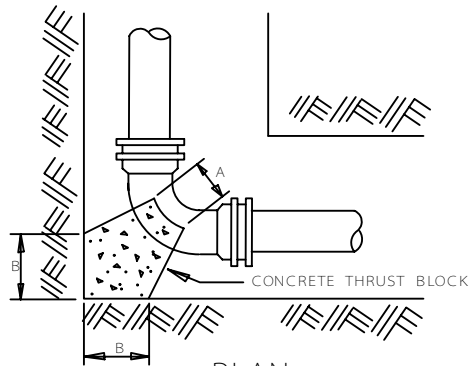
MANUAL BLOW-OFF STATION
SIDE VIEW

CU CONSTRUCTION
DETAIL # 200 - 86

CU CONSTRUCTION
DETAIL #200 - 86



PLAN
TYPICAL PLUG



PLAN
TYPICAL HORIZONTAL BEND

200 - 90

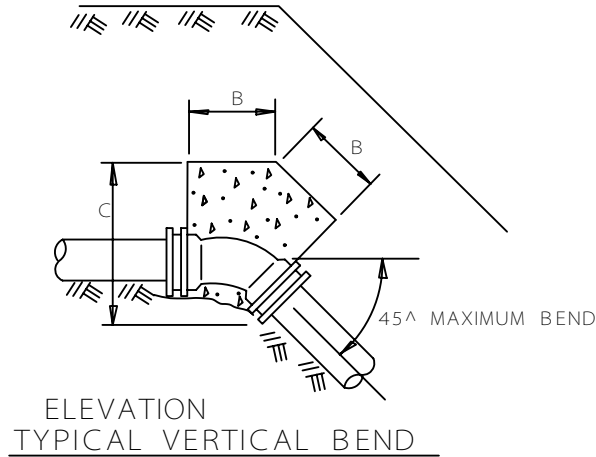
TABLE OF DIMENSIONS FOR HORIZONTAL & VERTICAL SAG BENDS

PIPE SIZE X	A	B	DEPTH C
90° BEND			
24"	2'-4"	4'-0"	5'-0"
20"	2'-4"	4'-0"	4'-6"
18"	2'-0"	3'-6"	4'-0"
16"	1'-9"	3'-4"	3'-6"
14"	1'-9"	2'-6"	3'-0"
12"	1'-6"	2'-0"	3'-0"
10"	1'-4"	2'-0"	2'-6"
8"	1'-0"	1'-6"	2'-0"
6"	1'-0"	1'-0"	2'-0"
4"	0'-9"	1'-0"	1'-0"
45° BEND			
24"	1'-4"	4'-6"	3'-0"
20"	1'-4"	3'-3"	3'-0"
18"	1'-0"	4'-0"	2'-0"
16"	1'-0"	4'-3"	1'-6"
14"	1'-0"	3'-6"	1'-4"
12"	1'-0"	3'-4"	1'-0"
10"	0'-9"	2'-6"	1'-0"
8"	0'-9"	1'-6"	1'-0"
6"	0'-9"	1'-0"	1'-0"
4"	0'-6"	1'-0"	1'-0"
22 1/2° BEND			
24"	1'-4"	3'-0"	2'-0"
20"	1'-4"	2'-6"	2'-0"
18"	1'-0"	2'-9"	1'-6"
16"	1'-0"	2'-4"	1'-4"
14"	1'-0"	2'-0"	1'-2"
12"	1'-0"	1'-9"	1'-0"
10"	0'-9"	1'-6"	0'-10"
8"	0'-9"	1'-0"	0'-8"
6"	0'-9"	1'-0"	0'-6"
4"	0'-6"	1'-0"	0'-4"

PIPE SIZE X	A	B	DEPTH C
11 1/4° BEND			
24"	1'-4"	1'-6"	2'-0"
20"	1'-4"	1'-3"	2'-0"
18"	1'-0"	1'-4"	1'-6"
16"	1'-0"	1'-2"	1'-4"
14"	1'-0"	1'-0"	1'-2"
12"	1'-0"	1'-0"	1'-0"
10"	0'-9"	1'-0"	0'-10"
8"	0'-9"	1'-0"	0'-8"
6"	0'-9"	1'-0"	0'-6"
4"	0'-6"	1'-0"	0'-4"
UNBALANCED TEE & PLUG			
24"	3'-0"	7'-0"	5'-0"
20"	3'-0"	5'-0"	5'-0"
18"	2'-0"	5'-6"	3'-6"
16"	2'-0"	5'-6"	3'-0"
14"	2'-0"	4'-0"	3'-0"
12"	2'-0"	4'-6"	2'-0"
10"	1'-0"	3'-0"	2'-0"
8"	1'-0"	2'-9"	1'-6"
6"	1'-0"	1'-0"	1'-0"
4"	1'-0"	1'-0"	1'-0"
TEE			
24"	2'-6"	7'-0"	5'-0"
20"	2'-6"	5'-0"	5'-0"
18"	2'-6"	5'-6"	3'-6"
16"	2'-6"	5'-6"	3'-0"
14"	2'-4"	4'-0"	3'-0"
12"	2'-0"	4'-6"	2'-0"
10"	1'-9"	3'-0"	2'-0"
8"	1'-6"	2'-9"	1'-6"
6"	1'-0"	1'-0"	1'-0"
4"	1'-0"	1'-0"	1'-0"

200 - 90

TABLE OF DIMENSIONS FOR HORIZONTAL & VERTICAL SAG BENDS



PIPE SIZE X	A	B	DEPTH C
90° BEND			
24"	2'-4"	4'-0"	5'-0"
20"	2'-4"	4'-0"	4'-6"
18"	2'-0"	3'-6"	4'-0"
16"	1'-9"	3'-4"	3'-6"
14"	1'-9"	2'-6"	3'-0"
12"	1'-6"	2'-0"	3'-0"
10"	1'-4"	2'-0"	2'-6"
8"	1'-0"	1'-6"	2'-0"
6"	1'-0"	1'-0"	2'-0"
4"	0'-9"	1'-0"	1'-0"
45° BEND			
24"	1'-4"	4'-6"	3'-0"
20"	1'-4"	3'-3"	3'-0"
18"	1'-0"	4'-0"	2'-0"
16"	1'-0"	4'-3"	1'-6"
14"	1'-0"	3'-6"	1'-4"
12"	1'-0"	3'-4"	1'-0"
10"	0'-9"	2'-6"	1'-0"
8"	0'-9"	1'-6"	1'-0"
6"	0'-9"	1'-0"	1'-0"
4"	0'-6"	1'-0"	1'-0"
22 1/2° BEND			
24"	1'-4"	3'-0"	2'-0"
20"	1'-4"	2'-6"	2'-0"
18"	1'-0"	2'-9"	1'-6"
16"	1'-0"	2'-4"	1'-4"
14"	1'-0"	2'-0"	1'-2"
12"	1'-0"	1'-9"	1'-0"
10"	0'-9"	1'-6"	0'-10"
8"	0'-9"	1'-0"	0'-8"
6"	0'-9"	1'-0"	0'-6"
4"	0'-6"	1'-0"	0'-4"

PIPE SIZE X	A	B	DEPTH C
11 1/4° BEND			
24"	1'-4"	1'-6"	2'-0"
20"	1'-4"	1'-3"	2'-0"
18"	1'-0"	1'-4"	1'-6"
16"	1'-0"	1'-2"	1'-4"
14"	1'-0"	1'-0"	1'-2"
12"	1'-0"	1'-0"	1'-0"
10"	0'-9"	1'-0"	0'-10"
8"	0'-9"	1'-0"	0'-8"
6"	0'-9"	1'-0"	0'-6"
4"	0'-6"	1'-0"	0'-4"
UNBALANCED TEE & PLUG			
24"	3'-0"	7'-0"	5'-0"
20"	3'-0"	5'-0"	5'-0"
18"	2'-0"	5'-6"	3'-6"
16"	2'-0"	5'-6"	3'-0"
14"	2'-0"	4'-0"	3'-0"
12"	2'-0"	4'-6"	2'-0"
10"	1'-0"	3'-0"	2'-0"
8"	1'-0"	2'-9"	1'-6"
6"	1'-0"	1'-0"	1'-0"
4"	1'-0"	1'-0"	1'-0"
TEE			
24"	2'-6"	7'-0"	5'-0"
20"	2'-6"	5'-0"	5'-0"
18"	2'-6"	5'-6"	3'-6"
16"	2'-6"	5'-6"	3'-0"
14"	2'-4"	4'-0"	3'-0"
12"	2'-0"	4'-6"	2'-0"
10"	1'-9"	3'-0"	2'-0"
8"	1'-6"	2'-9"	1'-6"
6"	1'-0"	1'-0"	1'-0"
4"	1'-0"	1'-0"	1'-0"

200 - 100

200 - 100

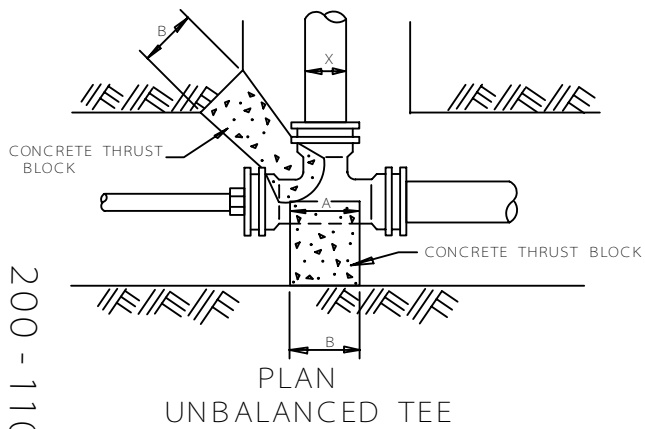
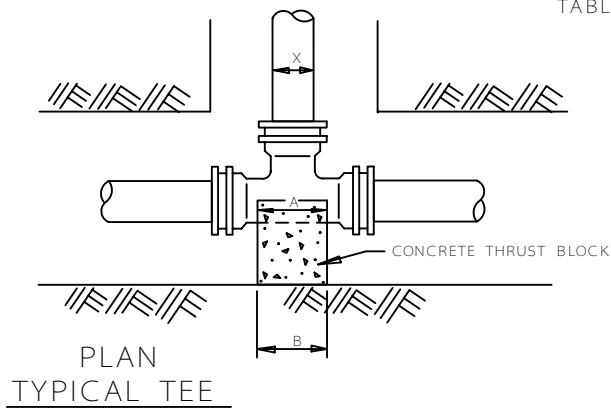


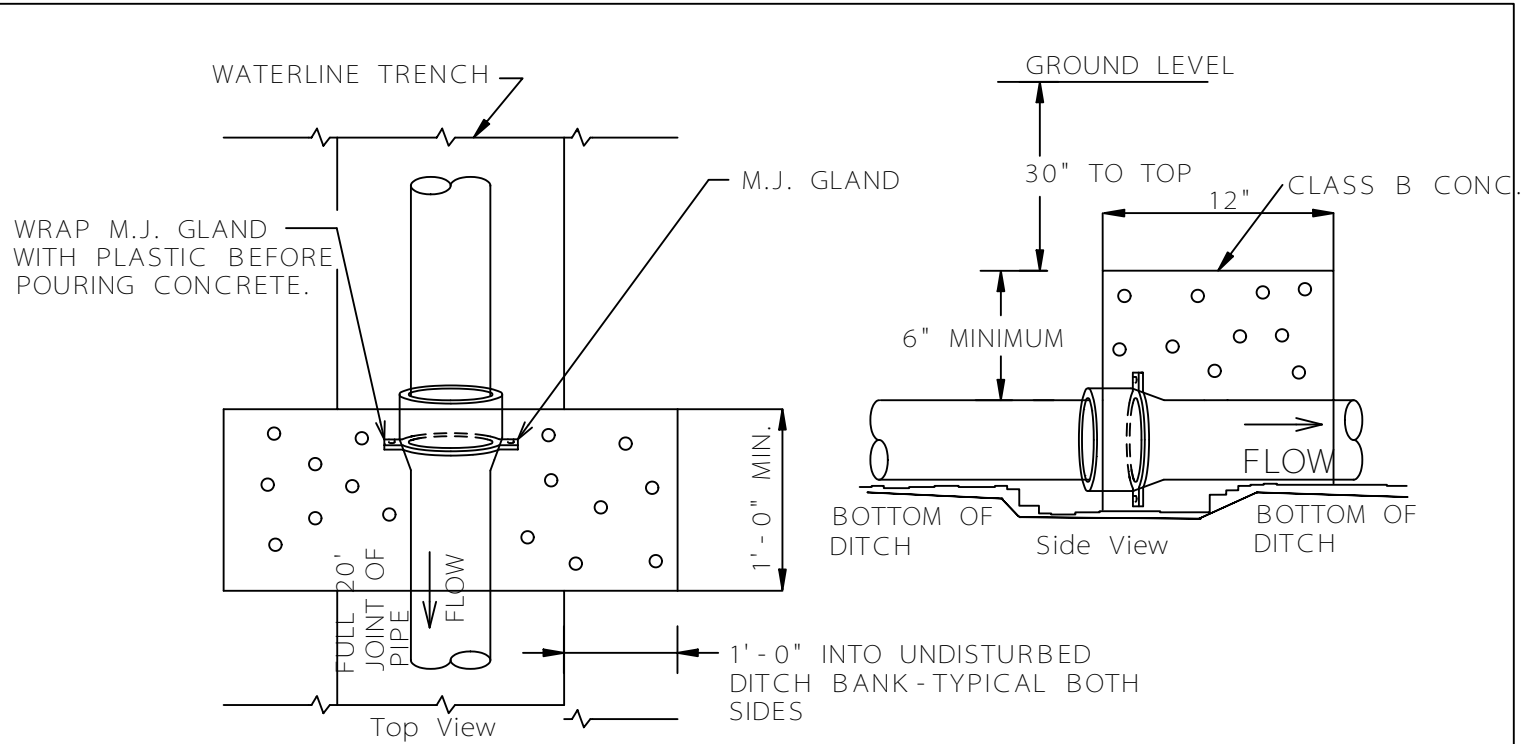
TABLE OF DIMENSIONS FOR HORIZONTAL & VERTICAL SAG BENDS

PIPE SIZE X	A	B	DEPTH C
90° BEND			
24"	2'-4"	4'-0"	5'-0"
20"	2'-4"	4'-0"	4'-6"
18"	2'-0"	3'-6"	4'-0"
16"	1'-9"	3'-4"	3'-6"
14"	1'-9"	2'-6"	3'-0"
12"	1'-6"	2'-0"	3'-0"
10"	1'-4"	2'-0"	2'-6"
8"	1'-0"	1'-6"	2'-0"
6"	1'-0"	1'-0"	2'-0"
4"	0'-9"	1'-0"	1'-0"
45° BEND			
24"	1'-4"	4'-6"	3'-0"
20"	1'-4"	3'-3"	3'-0"
18"	1'-0"	4'-0"	2'-0"
16"	1'-0"	4'-3"	1'-6"
14"	1'-0"	3'-6"	1'-4"
12"	1'-0"	3'-4"	1'-0"
10"	0'-9"	2'-6"	1'-0"
8"	0'-9"	1'-6"	1'-0"
6"	0'-9"	1'-0"	1'-0"
4"	0'-6"	1'-0"	1'-0"
22 1/2° BEND			
24"	1'-4"	3'-0"	2'-0"
20"	1'-4"	2'-6"	2'-0"
18"	1'-0"	2'-9"	1'-6"
16"	1'-0"	2'-4"	1'-4"
14"	1'-0"	2'-0"	1'-2"
12"	1'-0"	1'-9"	1'-0"
10"	0'-9"	1'-6"	0'-10"
8"	0'-9"	1'-0"	0'-8"
6"	0'-9"	1'-0"	0'-6"
4"	0'-6"	1'-0"	0'-4"

PIPE SIZE X	A	B	DEPTH C
11 1/4° BEND			
24"	1'-4"	1'-6"	2'-0"
20"	1'-4"	1'-3"	2'-0"
18"	1'-0"	1'-4"	1'-6"
16"	1'-0"	1'-2"	1'-4"
14"	1'-0"	1'-0"	1'-2"
12"	1'-0"	1'-0"	1'-0"
10"	0'-9"	1'-0"	0'-10"
8"	0'-9"	1'-0"	0'-8"
6"	0'-9"	1'-0"	0'-6"
4"	0'-6"	1'-0"	0'-4"
UNBALANCED TEE & PLUG			
24"	3'-0"	7'-0"	5'-0"
20"	3'-0"	5'-0"	5'-0"
18"	2'-0"	5'-6"	3'-6"
16"	2'-0"	5'-6"	3'-0"
14"	2'-0"	4'-0"	3'-0"
12"	2'-0"	4'-6"	2'-0"
10"	1'-0"	3'-0"	2'-0"
8"	1'-0"	2'-9"	1'-6"
6"	1'-0"	1'-0"	1'-0"
4"	1'-0"	1'-0"	1'-0"
TEE			
24"	2'-6"	7'-0"	5'-0"
20"	2'-6"	5'-0"	5'-0"
18"	2'-6"	5'-6"	3'-6"
16"	2'-6"	5'-6"	3'-0"
14"	2'-4"	4'-0"	3'-0"
12"	2'-0"	4'-6"	2'-0"
10"	1'-9"	3'-0"	2'-0"
8"	1'-6"	2'-9"	1'-6"
6"	1'-0"	1'-0"	1'-0"
4"	1'-0"	1'-0"	1'-0"

200 - 110

200 - 110



NOTE: A single M.J. Gland should slide up on the bell end.

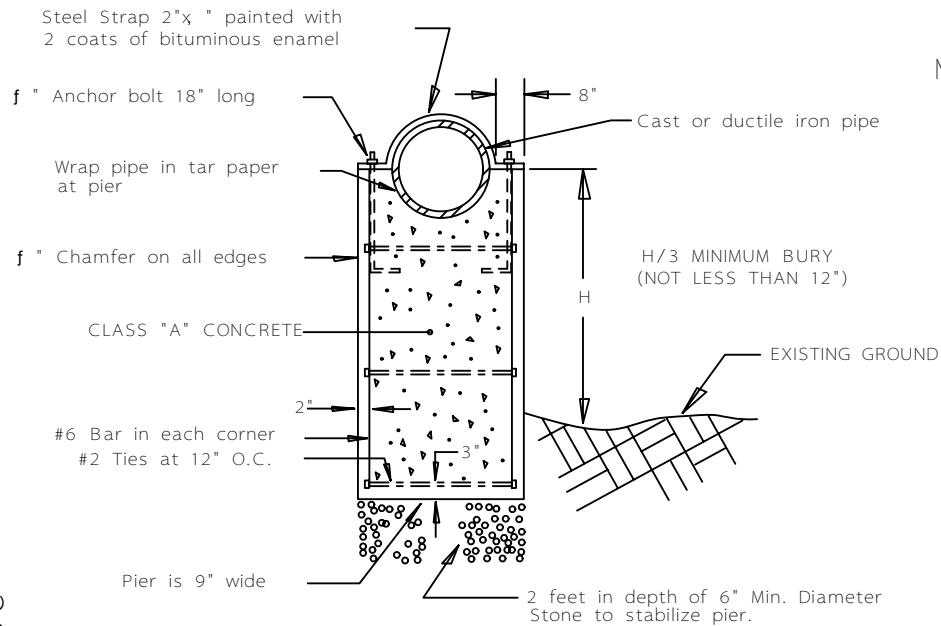
CONCRETE ANCHOR BLOCK DETAIL FOR WATERLINE INSTALLATION
 DETAIL 200 - 115

N.T.S.

200 - 115

200 - 115

200 - 120



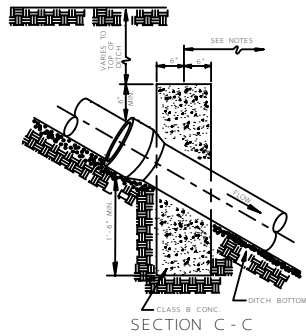
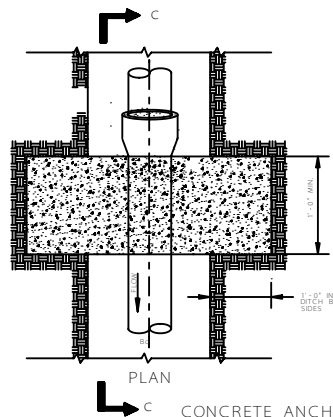
NOTE

1. One pier behind each exposed pipe bell at point where pipe enters the ground on each side of aerial crossing. Also at other locations called for on specific construction plans.
2. If required pier height is more than five feet high, then a footing one foot thick and four feet square shall be installed.
3. Specific construction plans may have piers designed with different shapes and footings.

TYPICAL PIER FOR DITCH AND CREEK CROSSING

N.T.S.

200 - 120

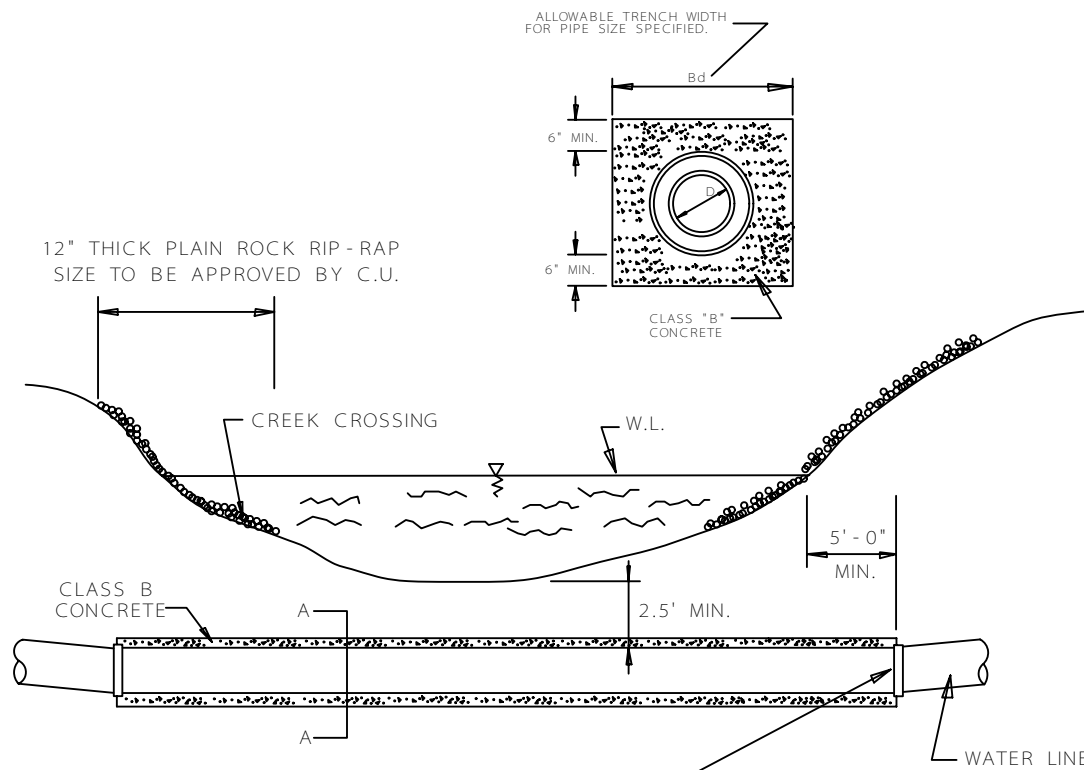


SEWERS ON 10% SLOPE OR GREATER SHALL BE ANCHORED SECURELY WITH CONC. ANCHORS OR EQUAL, AS FOLLOWS:
 A. NOT OVER 36" CENTER TO CENTER ON GRADES 10% & UP TO 25%
 B. NOT OVER 24" CENTER TO CENTER ON GRADES 25% & UP TO 35%
 C. NOT OVER 18" CENTER TO CENTER ON GRADES 35% & OVER.

CONCRETE ANCHOR BLOCK DETAIL FOR PIPES ON STEEP SLOPES
 N.T.S.

200 - 130

200 - 130



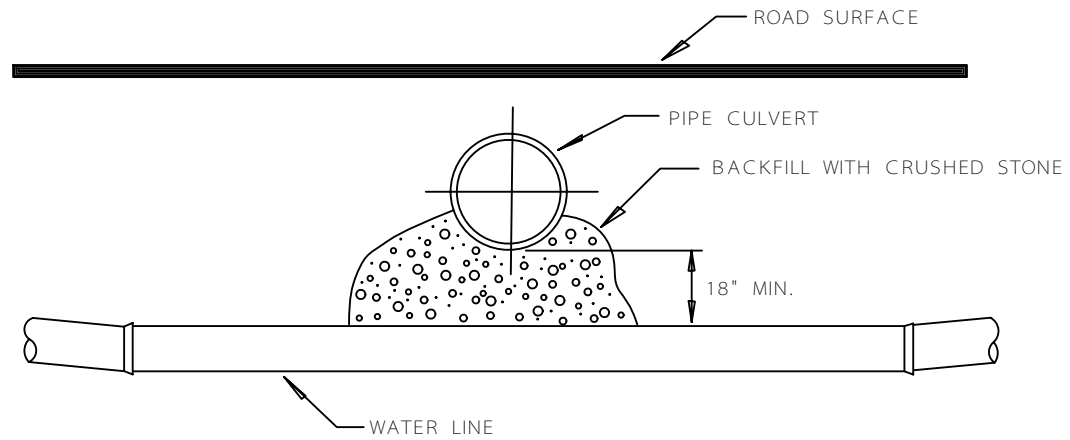
NOTE: CONCRETE ENCASEMENT TO BE PROVIDED WHEN DIRECTED BY THE ENGINEER.

USE RESTRAINED JOINTS AS APPROVED BY C.U. ON SHOP DRAWINGS SUBMITTALS IF CALLED FOR IN THE PROJECT BID SCHEDULE.

WATER LINE INSTALLED AT
TYPICAL CREEK CROSSING
N.T.S.

200 - 140

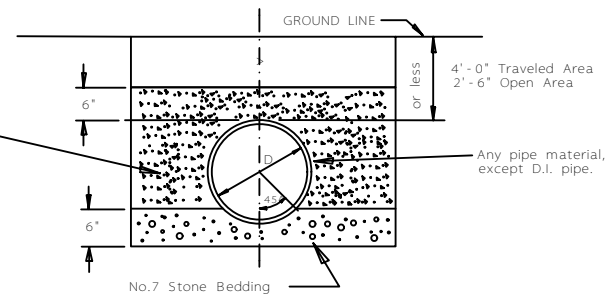
200 - 140



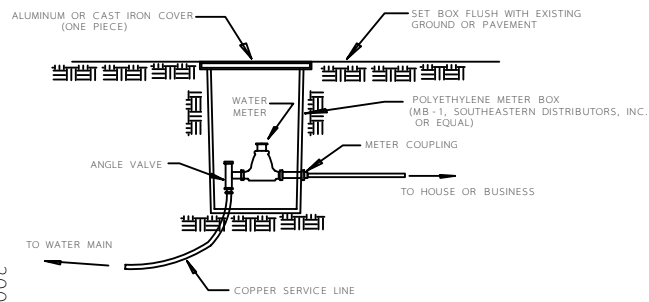
TYPICAL UNDER PIPE CULVERT
N.T.S.

Note: Where concrete encasement is required
extend Class "B" concrete under pipe
to depth & in manner shown for No. 7 Bedding Stone

Class "B" Concrete to be
poured 36 hours before
backfill is placed and in
such a manner as to prevent
pipe from floating



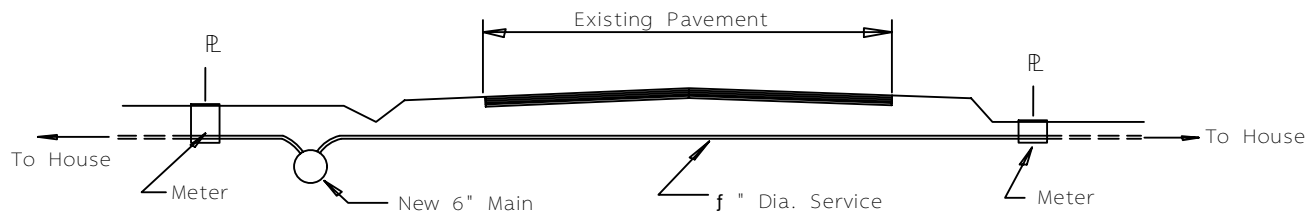
TYPICAL SECTION FOR CONCRETE PROTECTION
PIPE 4' - 0" (T.A.) & 2' - 6" (O.A.) DEEP
OR LESS



TYPICAL SERVICE INSTALLATION FOR 1" METERS
& SMALLER

200 - 170

200 - 170



1. CONNECT EXISTING METERED SERVICES TO NEW MAIN.
2. ON EXISTING UNMETERED SERVICES, REPLACE EXISTING SERVICE LINE FROM NEW MAIN TO NEW METER.
3. ON NEW SERVICES, SERVICE LINE TO BE INSTALLED FROM NEW MAIN TO NEW METER.

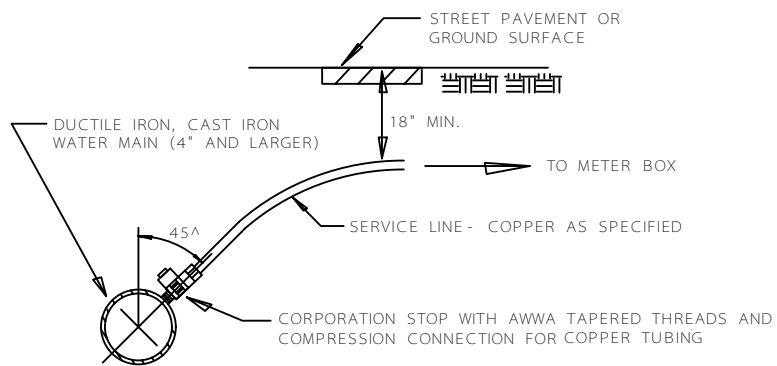
METER DETAIL

(CONNECTING SERVICES TO NEW WATER MAIN)

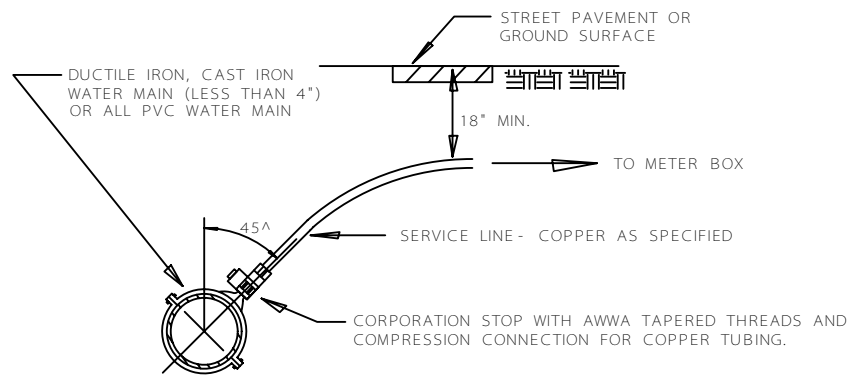
N.T.S.

200 - 180

200 - 180



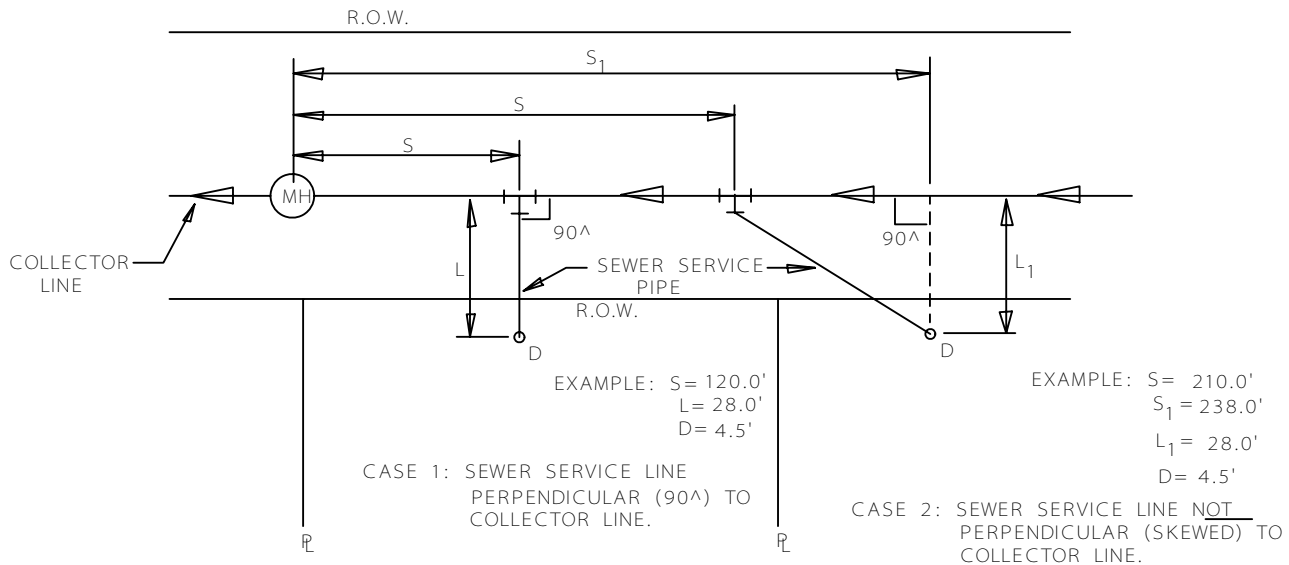
TYPICAL SERVICE LINE TAP (D.I. OR C.I., 4" & LARGER)



TYPICAL SERVICE LINE TAP (ALL PVC & D.I. OR C.I., LESS THAN 4")

200 - 190

200 - 190



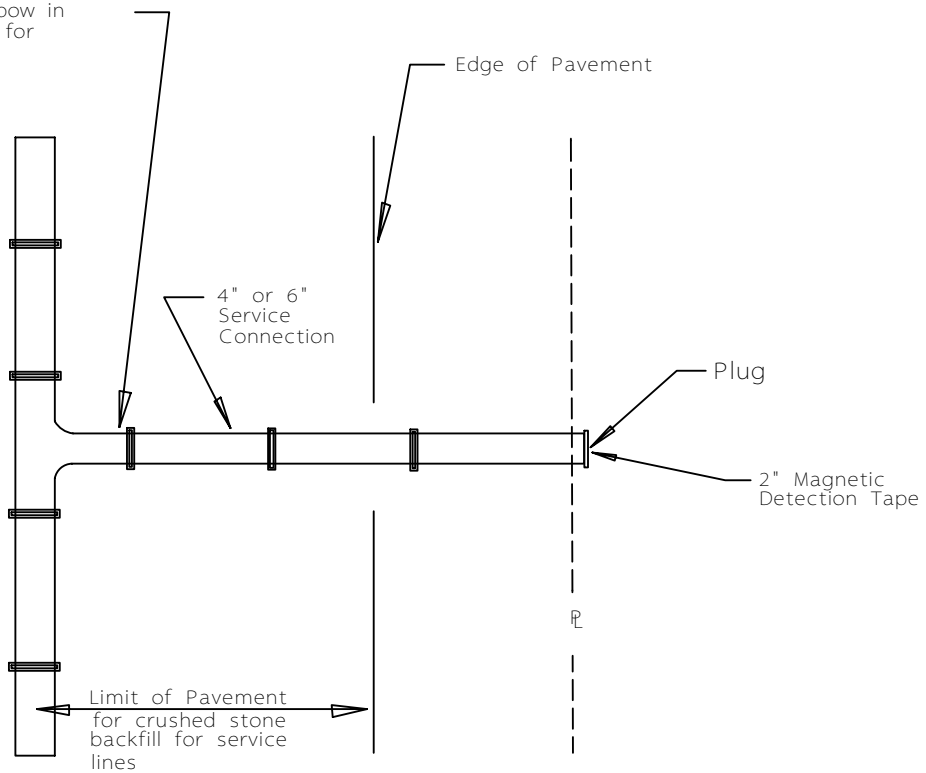
S = DISTANCE FROM TEE TO DOWNSTREAM M.H.
 S_1 = DISTANCE FROM END OF SERVICE PIPE TO DOWNSTREAM M.H.
 L = SEWER SERVICE LINE LENGTH
 L_1 = SEWER SERVICE LINE LENGTH FROM COLLECTOR LINE TO END OF SERVICE
 D = APPROXIMATE DEPTH OF END OF SERVICE PIPE

MEASUREMENT EXAMPLES FOR LOCATING
 SEWER SERVICE LINES - TO BE SHOWN ON
 RECORD AS - BUILT DRAWINGS

200 - 200

200 - 200

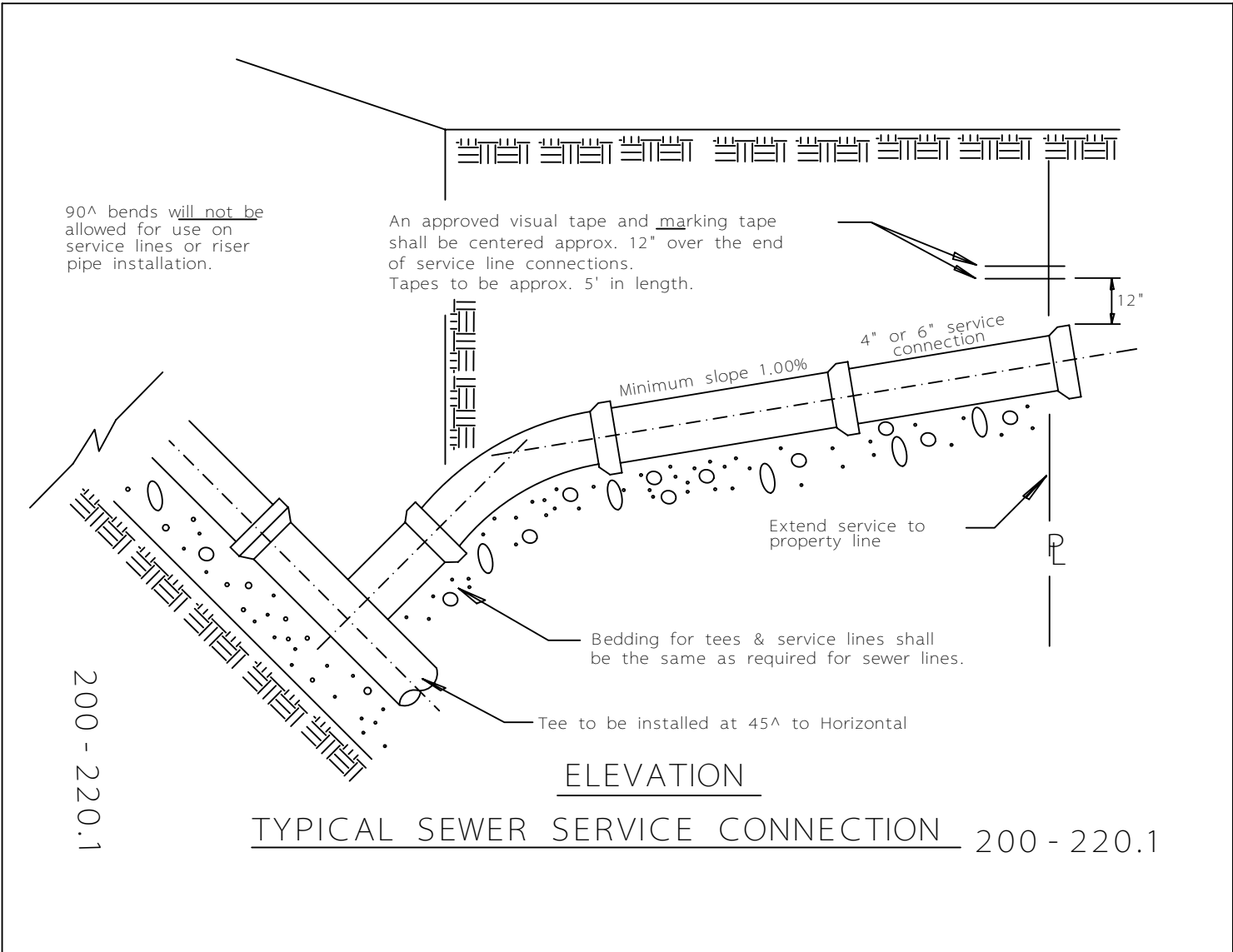
Include cost of elbow in price bid per L.F. for service line.



200 - 210

PLAN
TYPICAL SERVICE CONNECTION

200 - 210

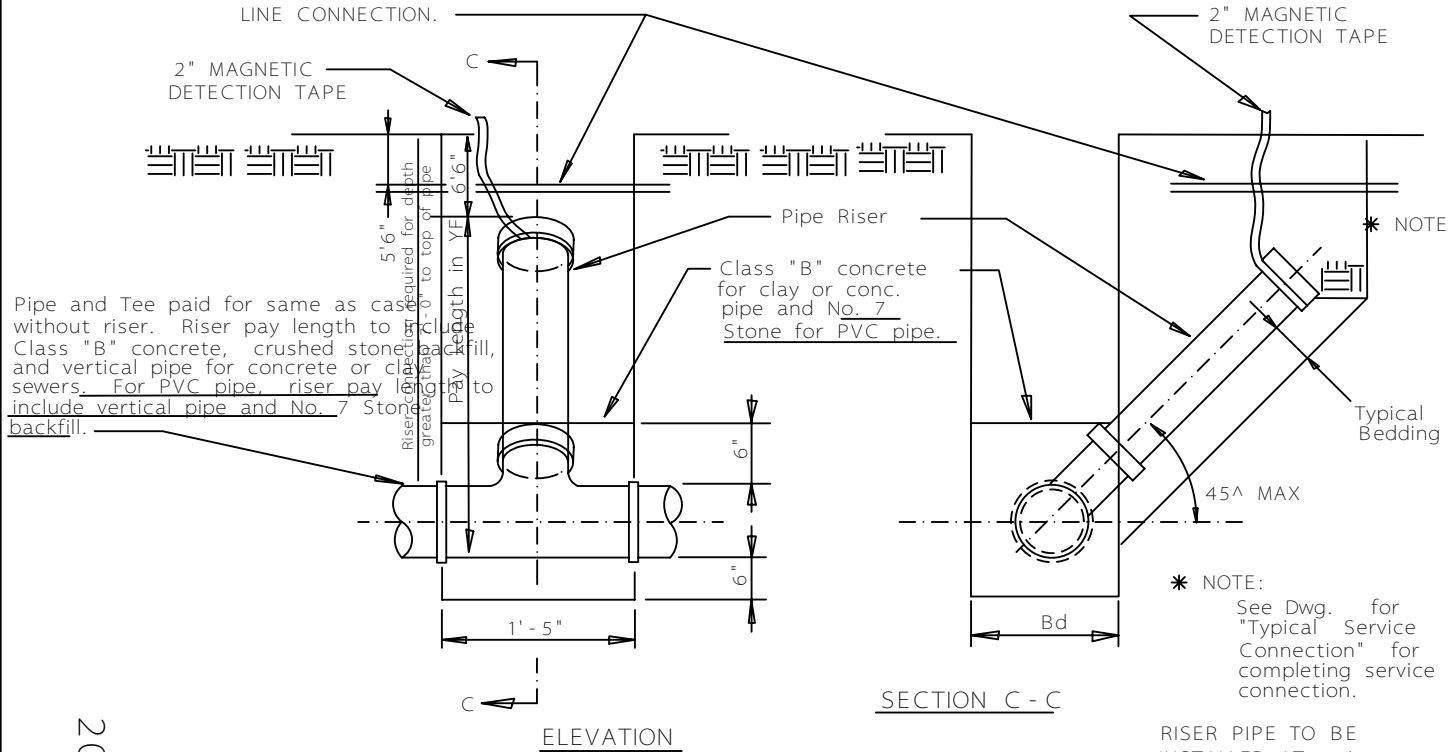


200 - 220.1

ELEVATION

TYPICAL SEWER SERVICE CONNECTION 200 - 220.1

AN APPROVED VISUAL AND A MAGNETIC MARKING TAPE SHALL BE CENTERED APPROX. 12" OVER END OF SERVICE LINE CONNECTION.

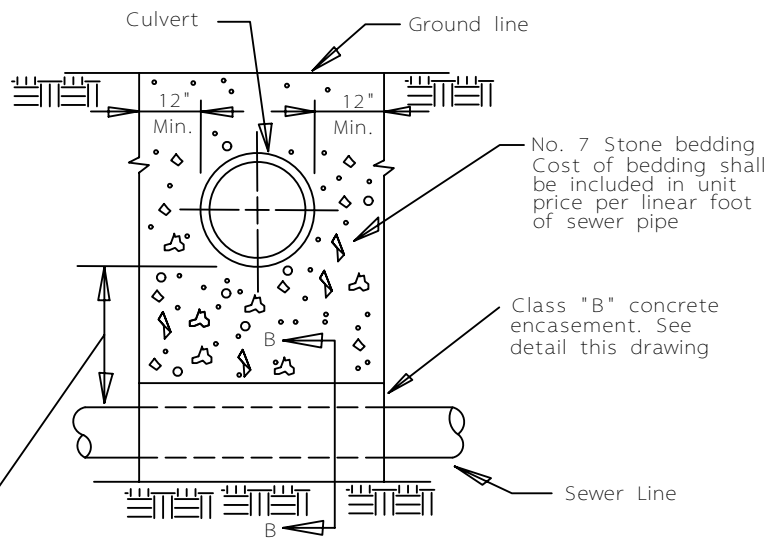


200 - 230.1

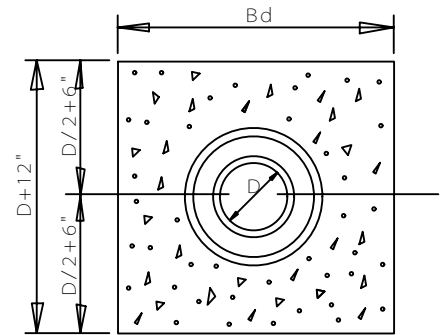
TYPICAL RISER FOR SERVICE CONNECTION

RISER PIPE TO BE INSTALLED AT 45° MAX OR LESS FROM HORIZONTAL. 90° BENDS WILL NOT BE ALLOWED FOR USE ON SERVICE LINES OR RISER PIPE INSTALLATIONS

200 - 230.1



When this dimension is less than 18", sewer line shall be encased



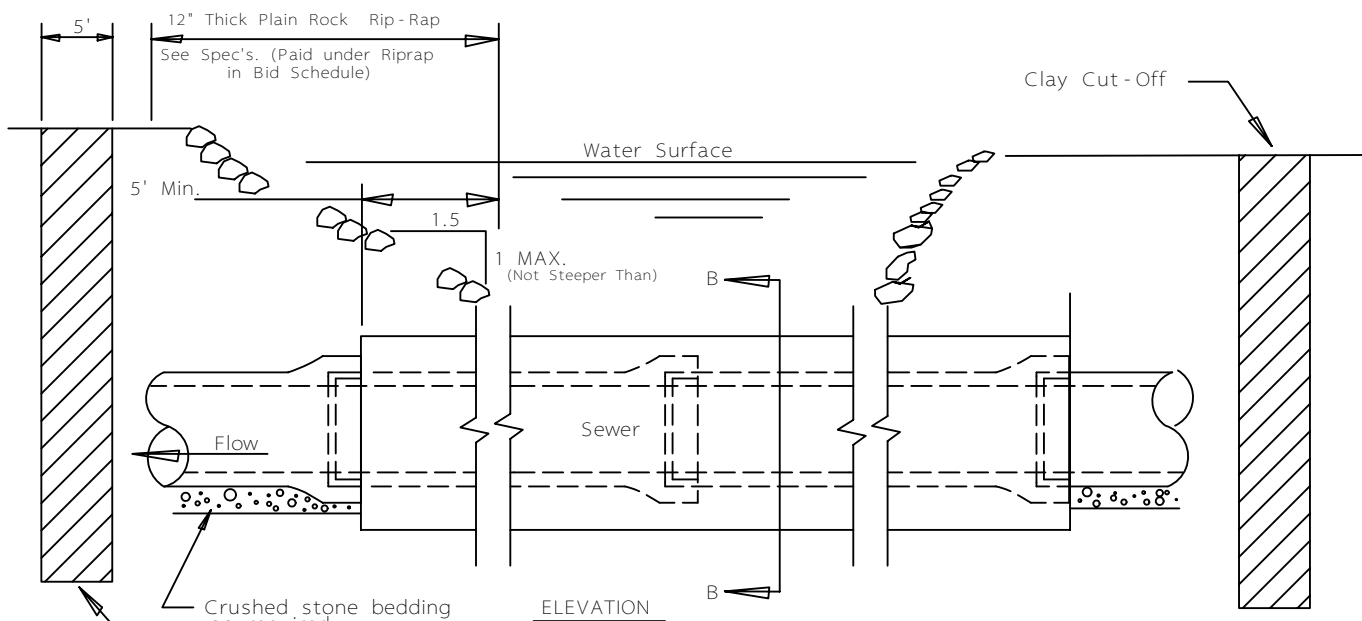
Class "B" Concrete

SECTION B - B

200 - 240

ENCASEMENT DETAIL
AT LINE CROSSING

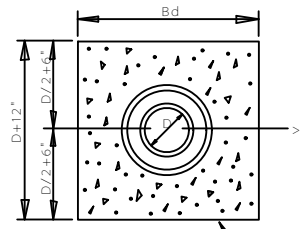
200 - 240



Clay Cut-Off
 (Reqd. Per Creek Crossing Down-
 stream & Upstream Side of Creek)
 Backfill with clay material (No
 organic material) (No separate
 payment allowed); From bottom
 of trench to top of ground.

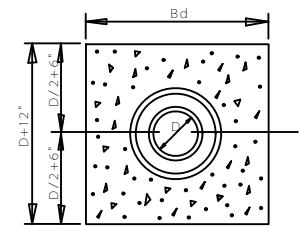
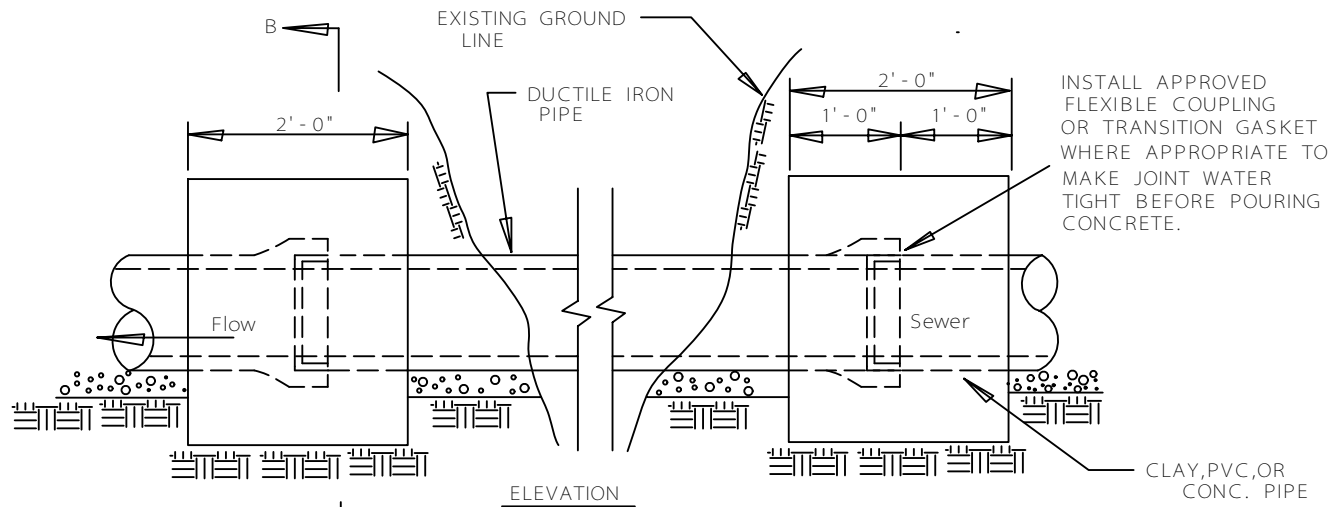
Note:
 An Aquatic Resource
 Alteration Permit Shall
 Be Obtained Before Any
 Creek Crossing Is Made.

TYPICAL CREEK CROSSING
 (REQ'D AT ALL CREEK CROSSING)



Class "B" Concrete
 SECTION B - B

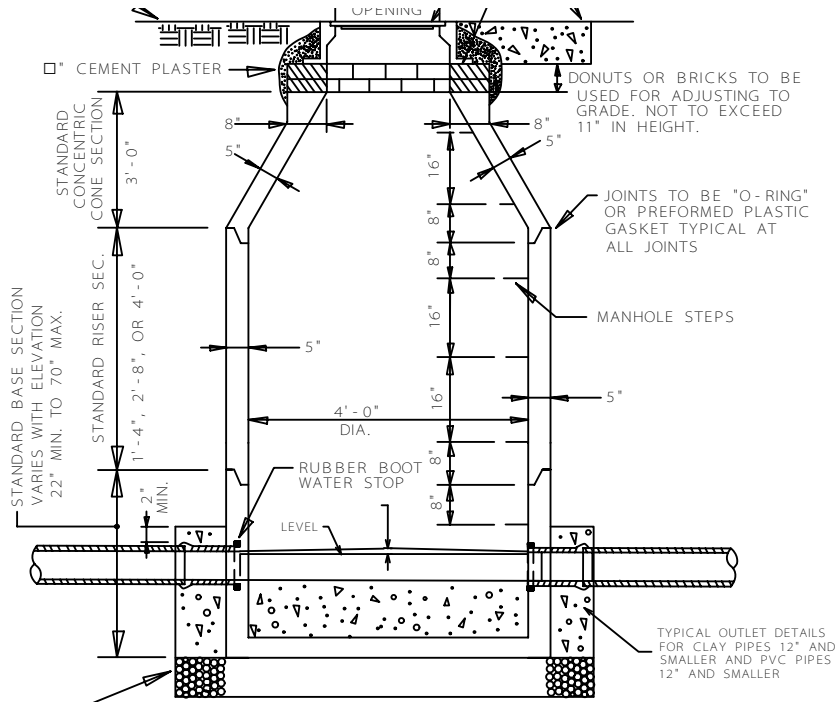
200 - 260



Class "B" Concrete

TYPICAL DITCH CROSSING
NOTE: THIS DETAIL SHALL ALSO APPLY WHEN CAST IRON OR DUCTILE IRON PIPE IS JOINED TO CLAY OR CONCRETE PIPE.

200 - 260

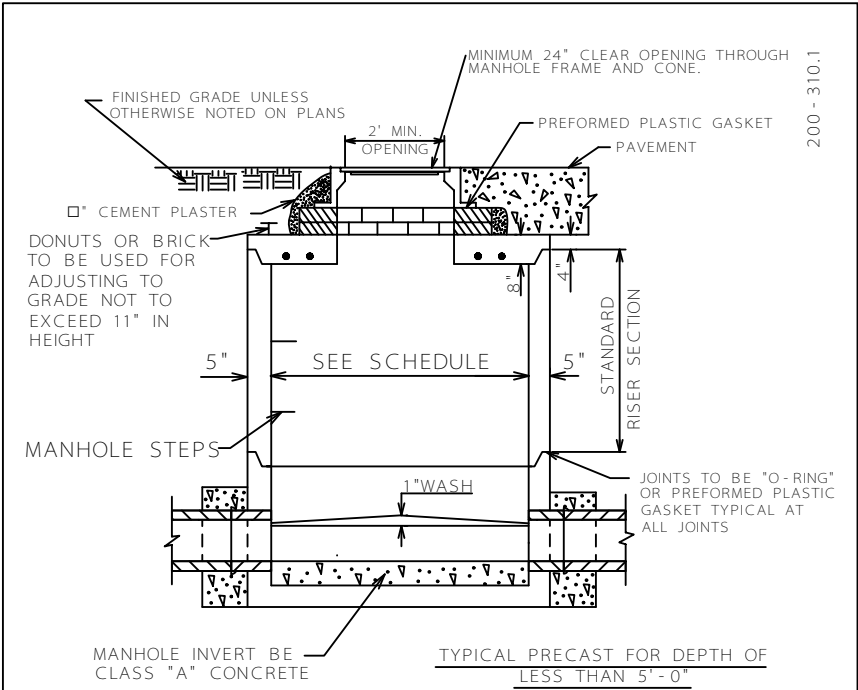


GENERAL NOTES:

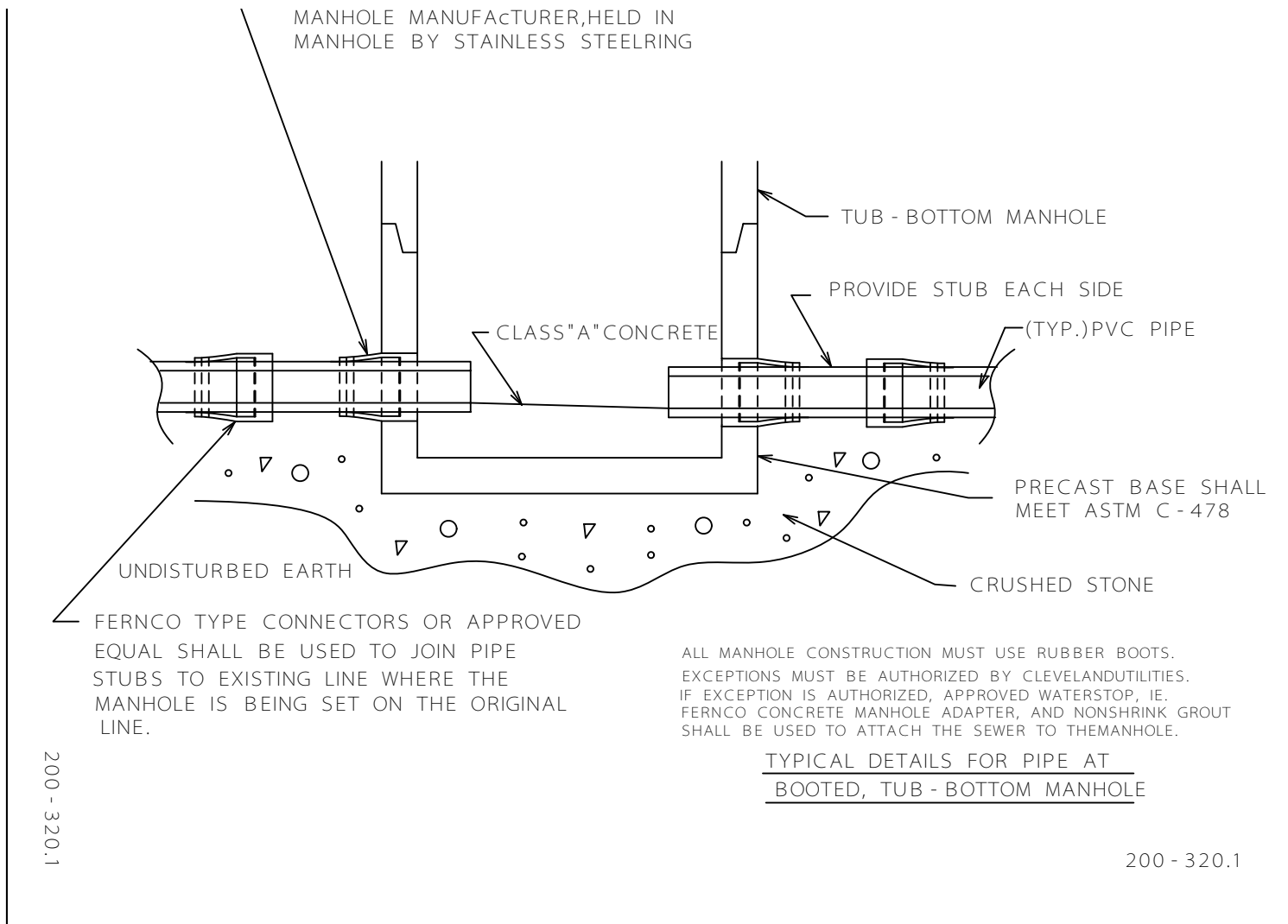
1. FOR PIPE SIZE 8" TO 12" INCL. PROVIDE JOINT AT OUTSIDE FACE OF MANHOLE AS SHOWN ON SECTIONS.
2. FOR PIPES LARGER THAN 12" PROVIDE A FLEXIBLE JOINT AS CLOSE TO THE OUTSIDE FACE AS THE SHORTEST LENGTHS AVAILABLE WILL PERMIT.
3. WHERE LATERAL SEWERS ARE SHOWN FOR FUTURE CONSTRUCTION, INSTALL A PLUGGED STUB OR DROP CONNECTION WITH PLUGGED STUB AS SHOWN ON PLAN - PROFILE DRAWINGS.
4. MANHOLE STEPS SHALL BE C-1090 AS MANUFACTURED BY RUSSEL PIPE & FOUNDRY CO. OR APPROVED EQUAL.
5. ALL ELEMENTS SHALL CONFORM TO PRECAST SPECIFICATION ASTM C-478 LATEST REVISIONS.
6. ADJUST MANHOLE FRAME TO GRADE BY USING BRICKS OR DONUT RING. NOT TO EXCEED 11" IN HEIGHT.

SECTION B - B

TYPICAL PRECAST 4'-0"
DIAMETER MANHOLE



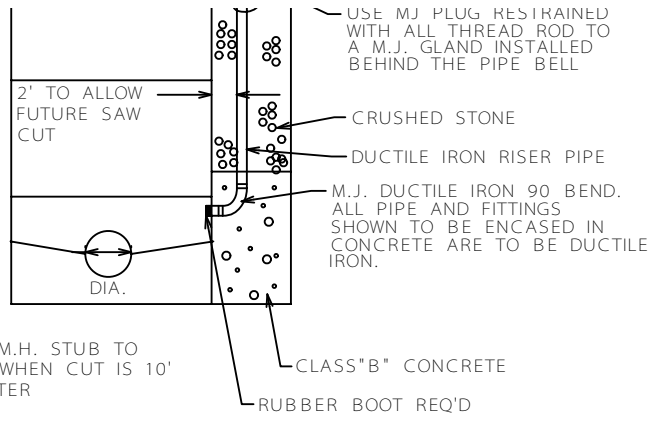
- GENERAL NOTES:**
1. FOR PIPE SIZE 8" TO 12" INCL. PROVIDE JOINT AT OUTSIDE FACE OF MANHOLE AS SHOWN ON SECTIONS.
 2. FOR PIPES LARGER THAN 12" PROVIDE A FLEXIBLE JOINT AS CLOSE TO THE OUTSIDE FACE AS THE SHORTEST LENGTHS AVAILABLE WILL PERMIT.
 3. WHERE LATERAL SEWERS ARE SHOWN FOR FUTURE CONSTRUCTION, INSTALL A PLUGGED STUB OR DROP CONNECTION WITH PLUGGED STUB AS SHOWN ON PLAN-PROFILE DRAWINGS.
 4. MANHOLE STEPS SHALL BE C-1090 AS MANUFACTURED BY RUSSEL PIPE & FOUNDRY CO. OR APPROVED EQUAL.
 5. ALL ELEMENTS SHALL CONFORM TO PRECAST SPECIFICATION ASTM C-478 LATEST REVISIONS.
 6. ADJUST MANHOLE FRAME TO GRADE BY USING BRICKS OR DONUT RING. NOT TO EXCEED 11" IN HEIGHT.



200 - 320.1

ALL MANHOLE CONSTRUCTION MUST USE RUBBER BOOTS.
 EXCEPTIONS MUST BE AUTHORIZED BY CLEVELAND UTILITIES.
 IF EXCEPTION IS AUTHORIZED, APPROVED WATERSTOP, I.E.
 FERNCO CONCRETE MANHOLE ADAPTER, AND NONSHRINK GROUT
 SHALL BE USED TO ATTACH THE SEWER TO THE MANHOLE.

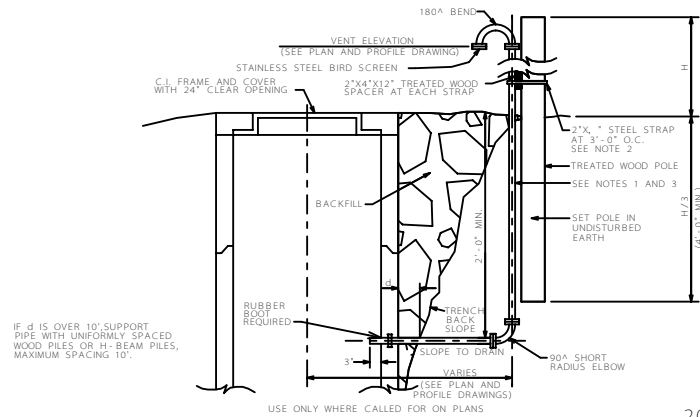
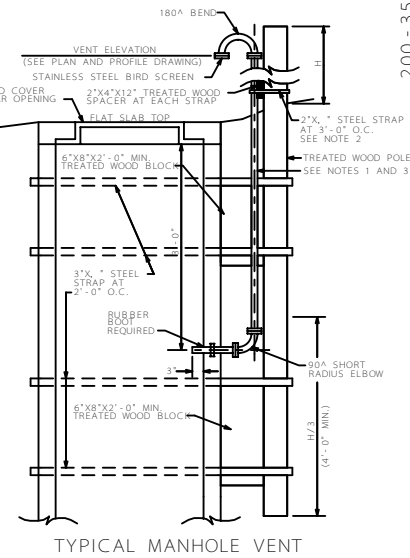
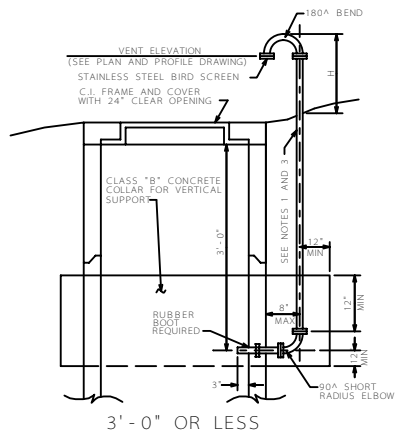
TYPICAL DETAILS FOR PIPE AT
BOOTED, TUB - BOTTOM MANHOLE



NOTE: SPECIAL M.H. STUB TO BE USED WHEN CUT IS 10' OR GREATER

SPECIAL M.H. STUB DETAIL
N.T.S.

- NOTES:
1. ALL PIPING SHALL BE 3" DUCTILE IRON (MIN.) WITH FLANGED JOINTS COATED INSIDE AND OUT.
 2. PAINT ALL STRAPPING WITH 2 COATS OF EPOXY SYSTEM PAINT.
 3. PAINT ALL EXPOSED PIPING WITH 2 COATS OF VINYL ACRYLIC SYSTEM PAINT, AS MANUFACTURED BY THE THE VALSPAR CORP. (SERIES 22 VINYL ACRYLIC) OR APPROVED EQUAL.
 4. ALL VENTED MANHOLES SHALL BE FLAT TOP MANHOLES.

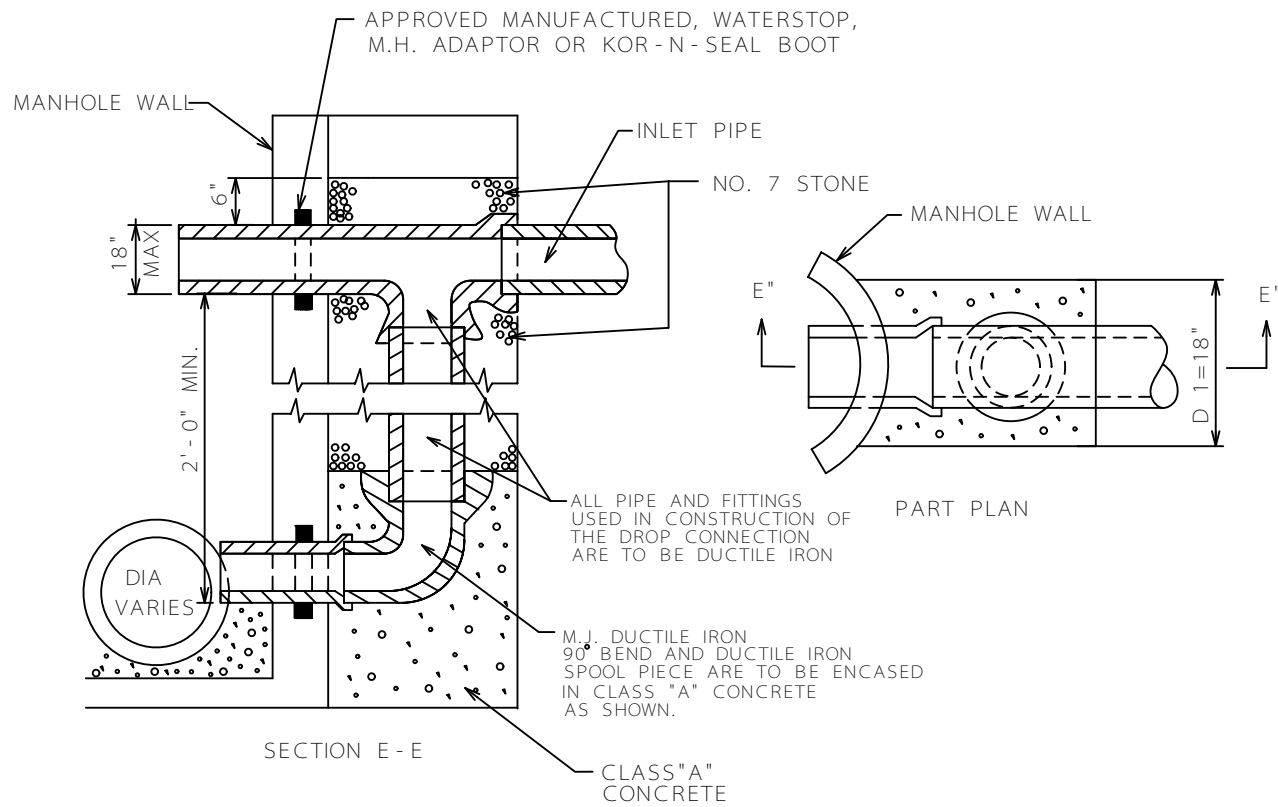


IF d IS OVER 10' SUPPORT PIPE WITH UNIFORMLY SPACED WOOD PILES OR H-BEAM PILES, MAXIMUM SPACING 10'.

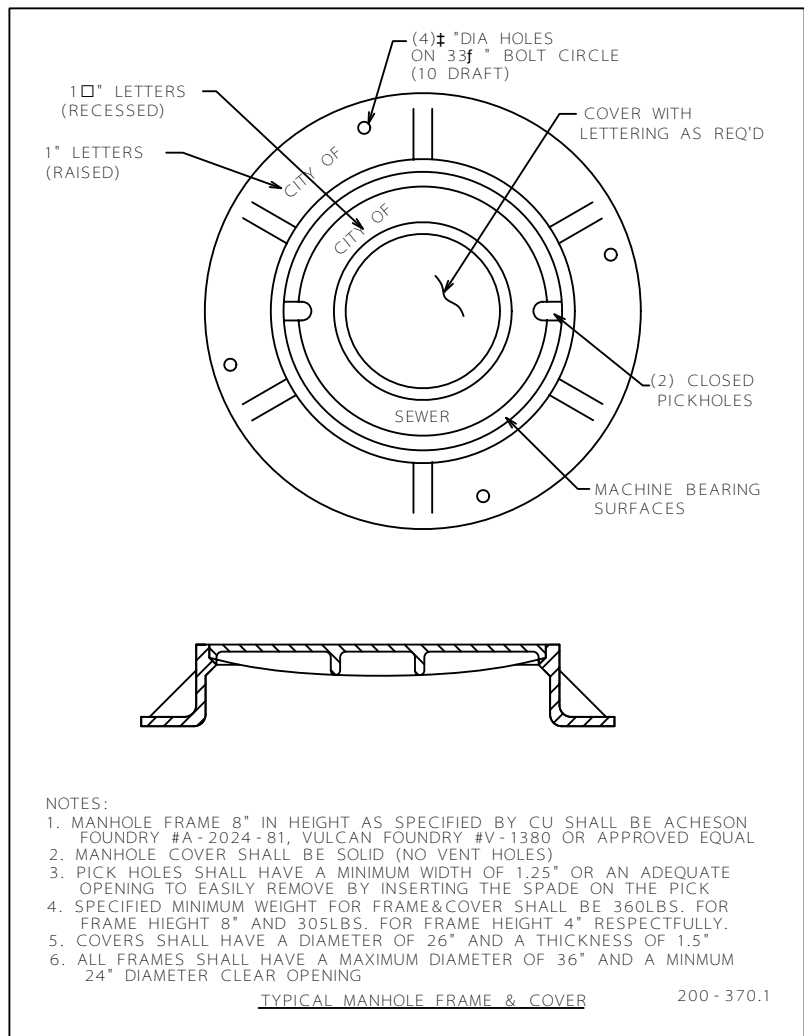
USE ONLY WHERE CALLED FOR ON PLANS

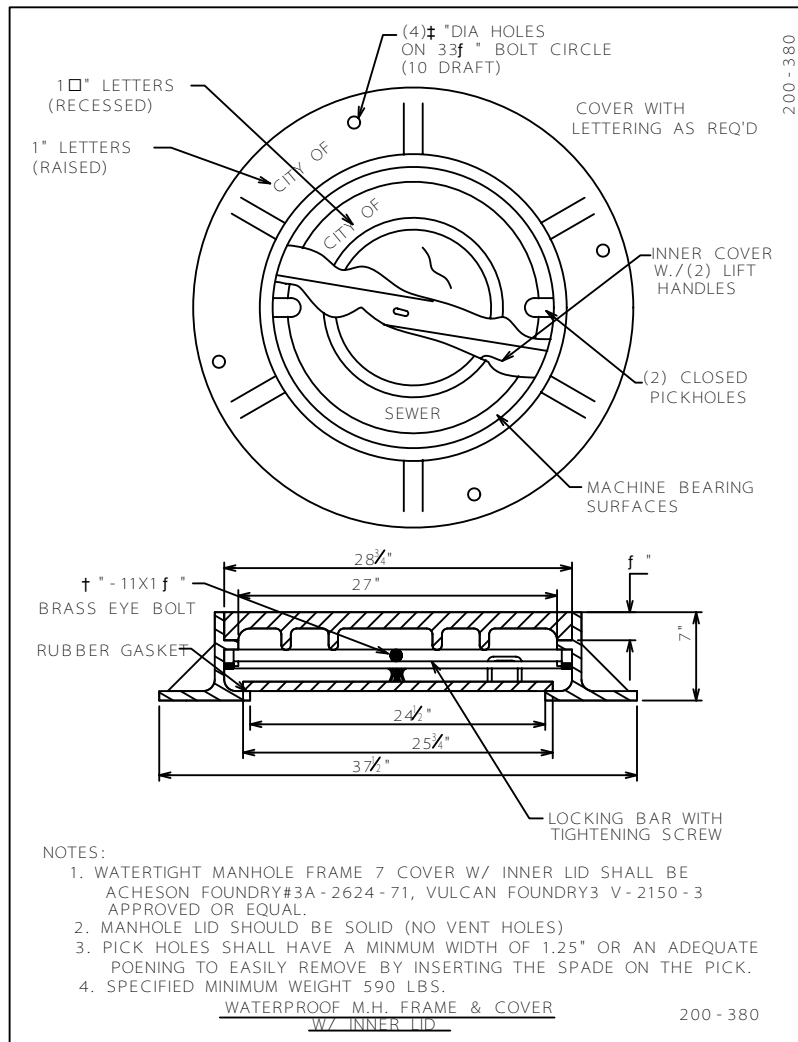
200 - 355

200 - 355

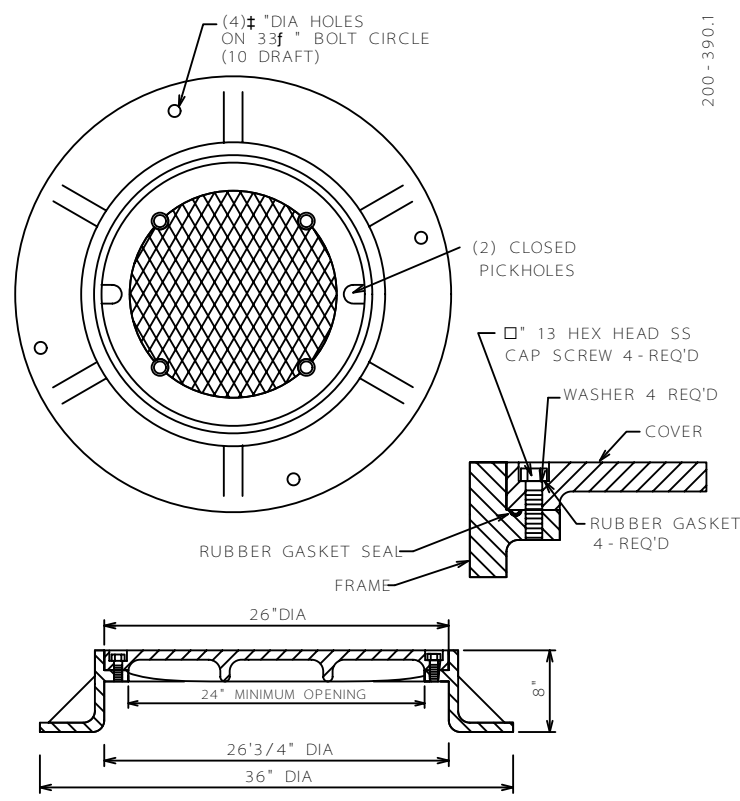


TYPICAL VERTICAL DROP INLET AT MANHOLE

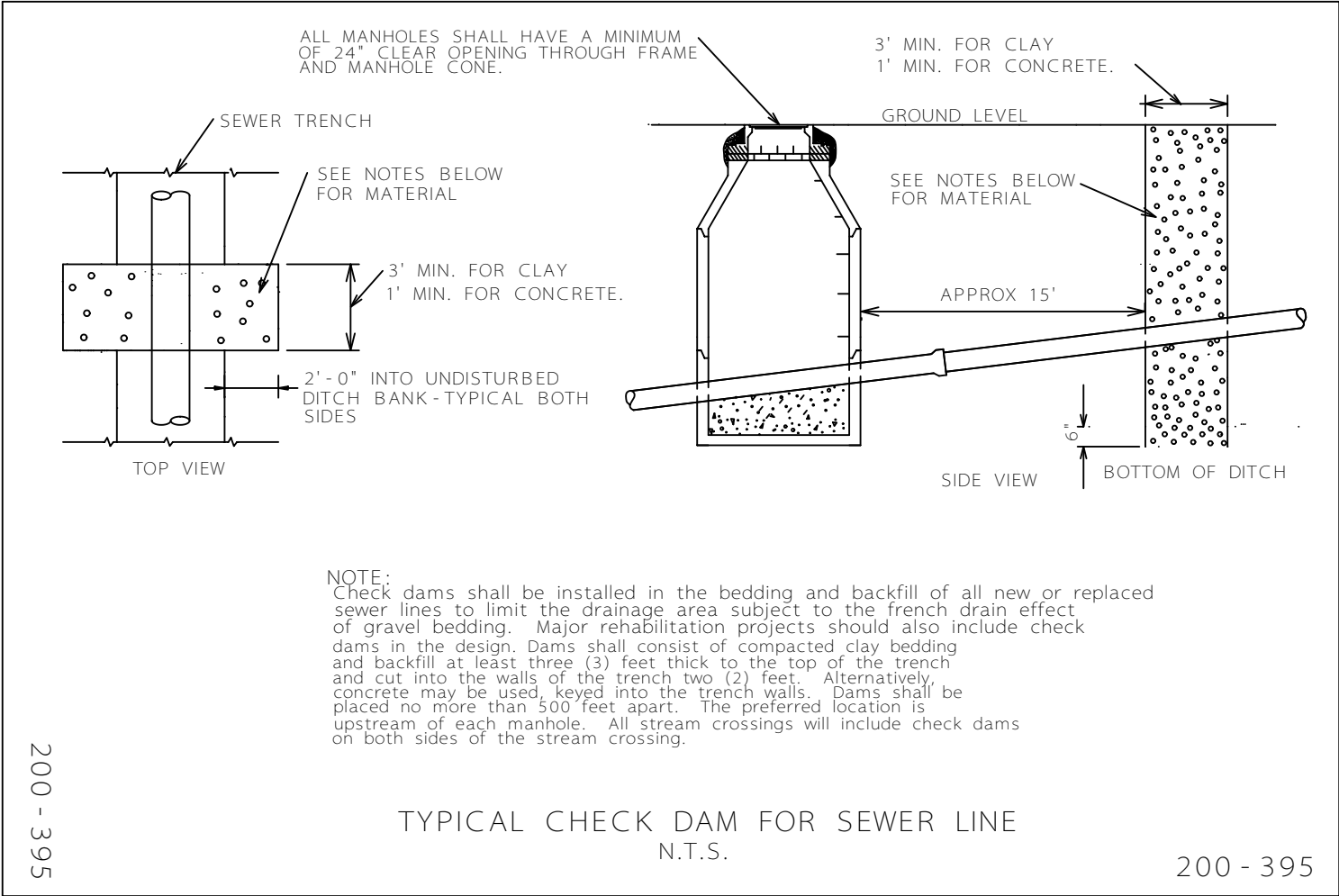


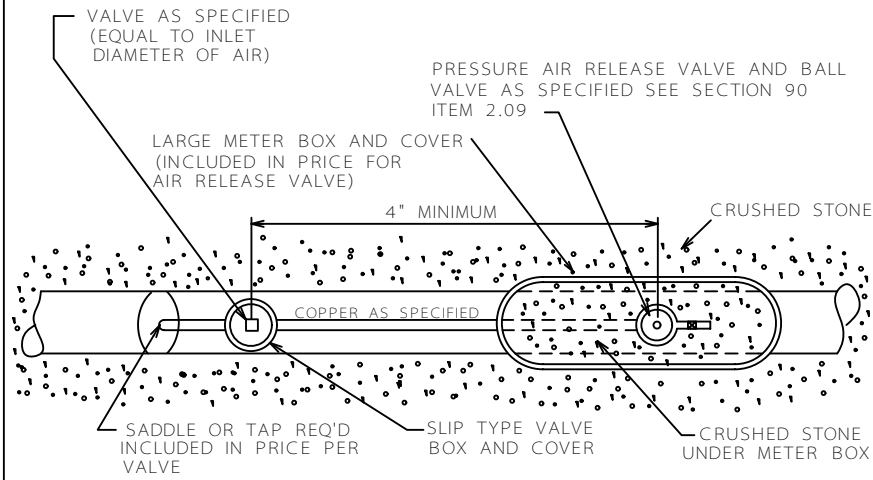


200 - 390.1



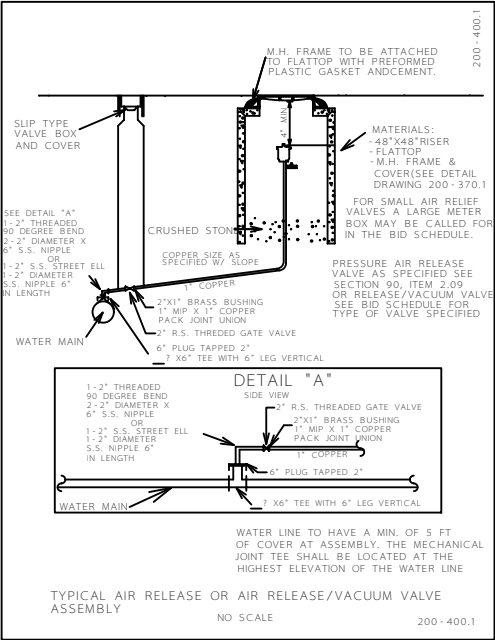
- NOTE:
1. WATERTIGHT MANHOLE FRAME & COVER(BOLT DOWN COVER) SHALL BE ACHESON FOUNDRY #A - 2524 - 81, VULCAN FOUNDRY # V - 2380
 2. MANHOLE LID SHALL BE SOLID (NO VENT HOLES)
 3. PICK HOLES SHALL HAVE A MINMUM WIDTH OF 1.25" OR AN ADEQUATE OPENING TO EASILY REMOVE BY INSERTING THE SPADE ON THE PICK
 4. SPECIFIED MINIMUM WEIGHT 330LBS.



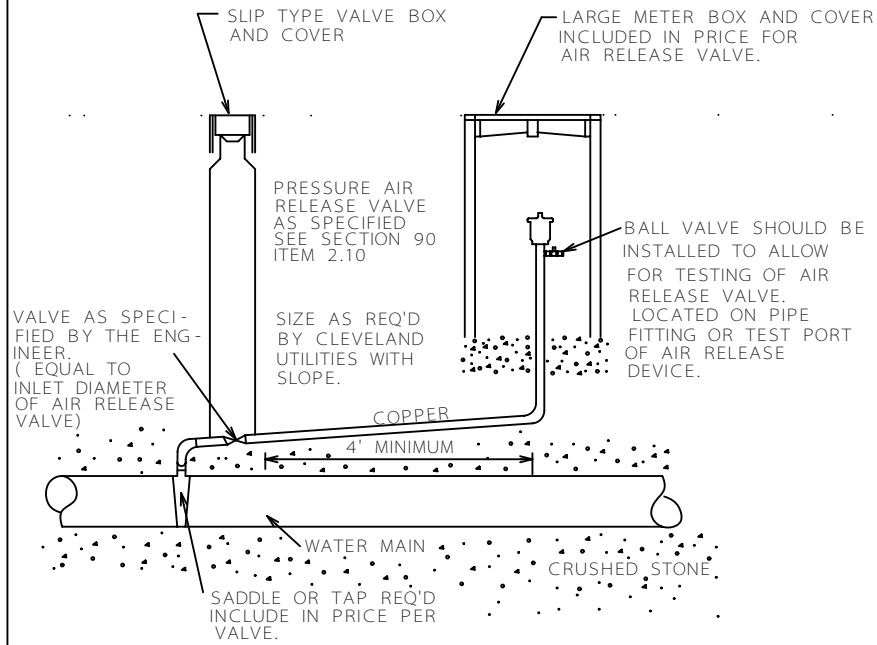


CAUTION:
CONTRACTOR SHOULD INSTALL WATERLINE AT
SUFFICIENT DEPTH TO MEET THE SLOPE TO
DRAIN REQUIREMENTS OF THIS DRAWING.

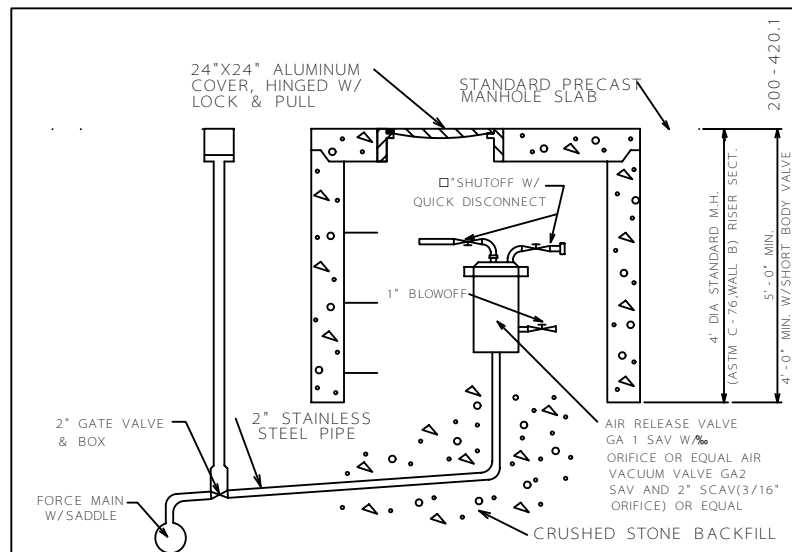
TYPICAL AIR RELEASE VALVE
TOP VIEW NO SCALE



200-410



CAUTION:
CONTRACTOR SHOULD INSTALL WATERLINE AT SUFFICIENT DEPTH TO MEET THE SLOPE TO DRAIN REQUIRMENTS OF THIS DRAWING.



SEWAGE AIR RELEASE VALVE

NO SCALE

NOTES:

1. WHERE SEWER LINES CROSS IMPROVED, GRASSED, OR LAWN AREAS, ECT. ALL SOD, SHRUBS, FLOWERS, PLANTINGS, ECT., SHALL BE REPLACED IN ORIGINAL CONDITION AT CONTRACTORS EXPENSE. GRASSED AREAS SHALL BE RESTORED TO PRIOR CONDITIONS IN THE FOLLOWING MANNER
 AREAS LESS THAN 3:1 SLOPE SHALL BE RESEEDED AND MULCHED WITH GRASSES OR GROUND COVER AS OUTLINE IN THE SPECIFICATIONS. AREAS GREATER THAN 3:1 SLOPE SHALL BE RESEEDED AND MULCHED WITH A FIBROUS MATERIAL AS OUTLINE IN THE SPECIFICATIONS. PAYMENT SHALL BE INCLUDED IN THE APPLICATION UNIT PRICE BID FOR THE SEWER LINE.
2. WHERE LINES CROSS UNDER CURBS, THEY SHALL BE TUNNELED UNDER THE CURB. NO SEPARATE PAYMENT WILL BE ALLOWED FOR REPAIRING CURBS DAMAGED OR DESTROYED DURING SEWERLINE CONSTRUCTION.
3. PROMISCUOUS DESTRUCTION OF TREES ALONG SEWER LINE RIGHT-OF-WAY WILL NOT BE PERMITTED ALL REASONABLE EFFORTS WILL BE MADE BY THE CONTRACTOR TO PROTECT AND SAFEGUARD TREES.
4. ANY EXISTING FENCES, ROCK WALLS, GUARDRAILS, ECT., ALONG THE SEWER LINE RIGHT-OF-WAY ARE TO BE REMOVED AND REINSTALLED IN THEIR ORIGINAL CONDITION (OR BETTER) NO SEPARATE PAYMENT WILL BE ALLOWED. PAYMENT TO BE BID THE APPLICABLE UNIT PRICE BID FOR THE SEWER LINE.
5. ALL FORCE MAIN LINES SHALL HAVE A MINIMUM COVER OF 30 INCHES, EXCEPT AS OTHERWISE NOTED.
6. THE COST FOR DIVERSION OF WATER IN DITCHES, CREEKS, OR RIVERS SHALL BE INCLUDED IN THE APPLICATION UNIT PRICE BID FOR SEWER LINE IN THE BID SCHEDULE. NO SEPARATE PAYMENT SHALL BE ALLOWED.
7. WHEN BLASTING FOR EXCAVATION OF WORK ADEQUATE PRECAUTION SHALL BE USED TO PREVENT DAMAGE TO SURROUNDING PROPERTY.

200 - 420.1

GROUND SURFACE

2 - PIECE SLIP - TYPE VALVE BOX

LID MARKED "WATER"

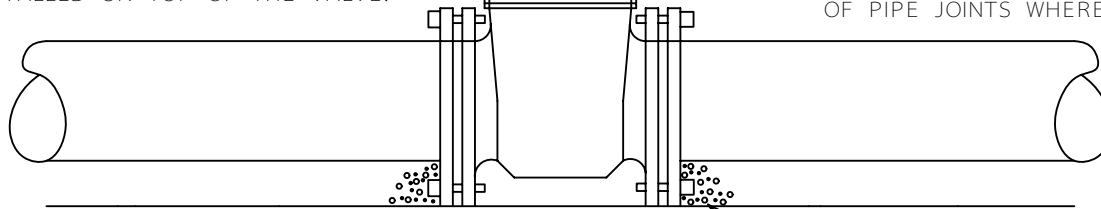
SEE ITEM 2.11 SECTION 90

SEE DETAIL 200 - 435 FOR DIMENSIONS OF VALVE KEY EXTENSION TO "TRANSFER" THE HEIGHT OF THE VALVE OPERATING NUT TO 1' - 6" BELOW FINISHED GRADE.

NOTE:
WHERE VALVE DEPTHS DICTATE, A P.V.C. EXTENSION FOR BRINGING C.I. SLIP TYPE VALVE BOXES TO FINISHED GRADE SHALL BE USED. SEE SECTION 90, ITEM 2.11(C). THE PVC EXTENSION SHALL BE SET ON A SHORT VALVE BOX BOTTOM INSTALLED ON TOP OF THE VALVE.

MINIMUM TENCH DEPTH	
VALVE SIZE	"D"
2	38"
3	39"
4	40"
6	42"
8	44"
10	56"
12	58"

TRENCH DEPTH SHALL BE INCREASED BY DEFLECTION OF PIPE JOINTS WHERE POSSIBLE



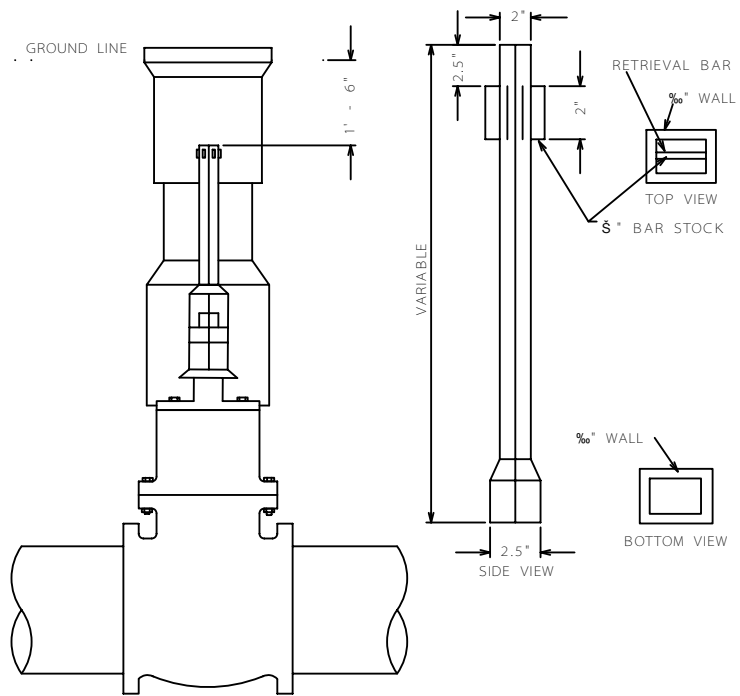
TYPICAL VALVE BOX
GATE VALVES 12" & SMALLER

N.T.S.

CRUSHED STONE BEDDING

200 - 430.1

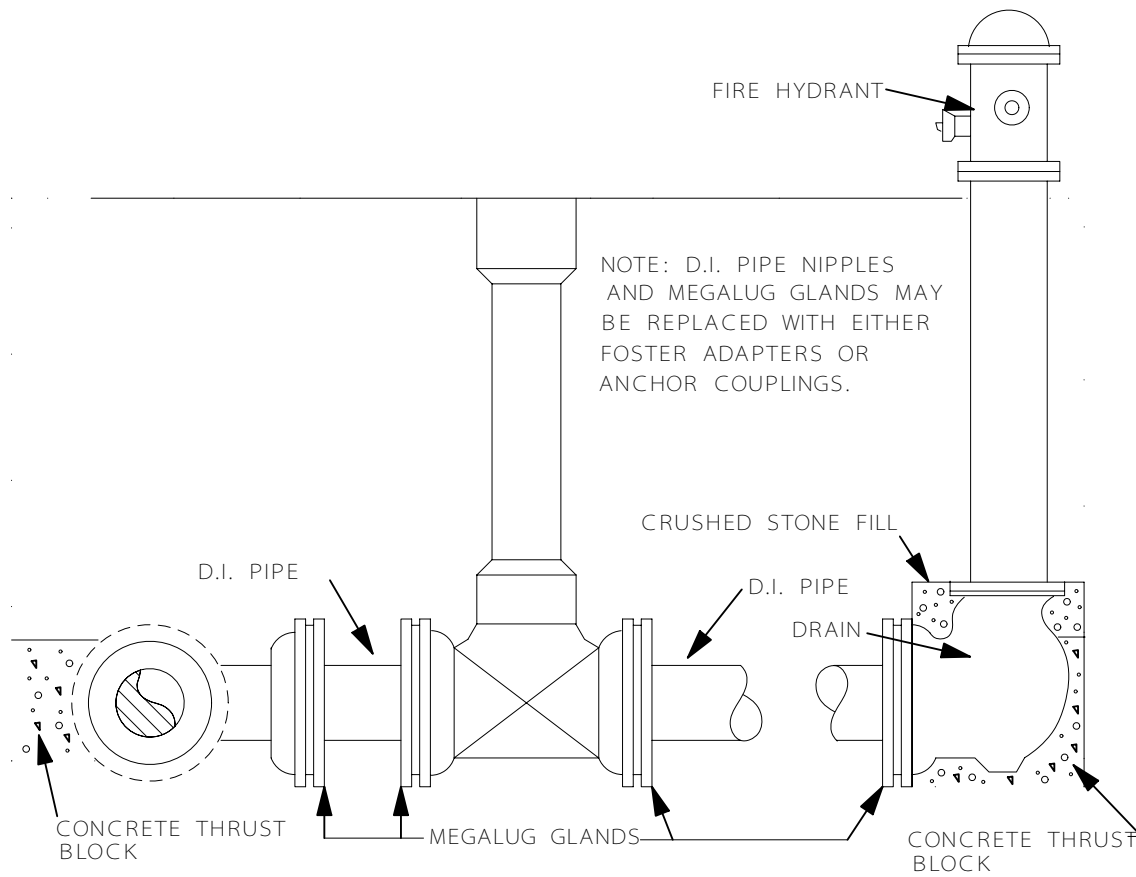
200 - 430.1



VALVE KEY
EXTENSION

200 - 435

200 - 435

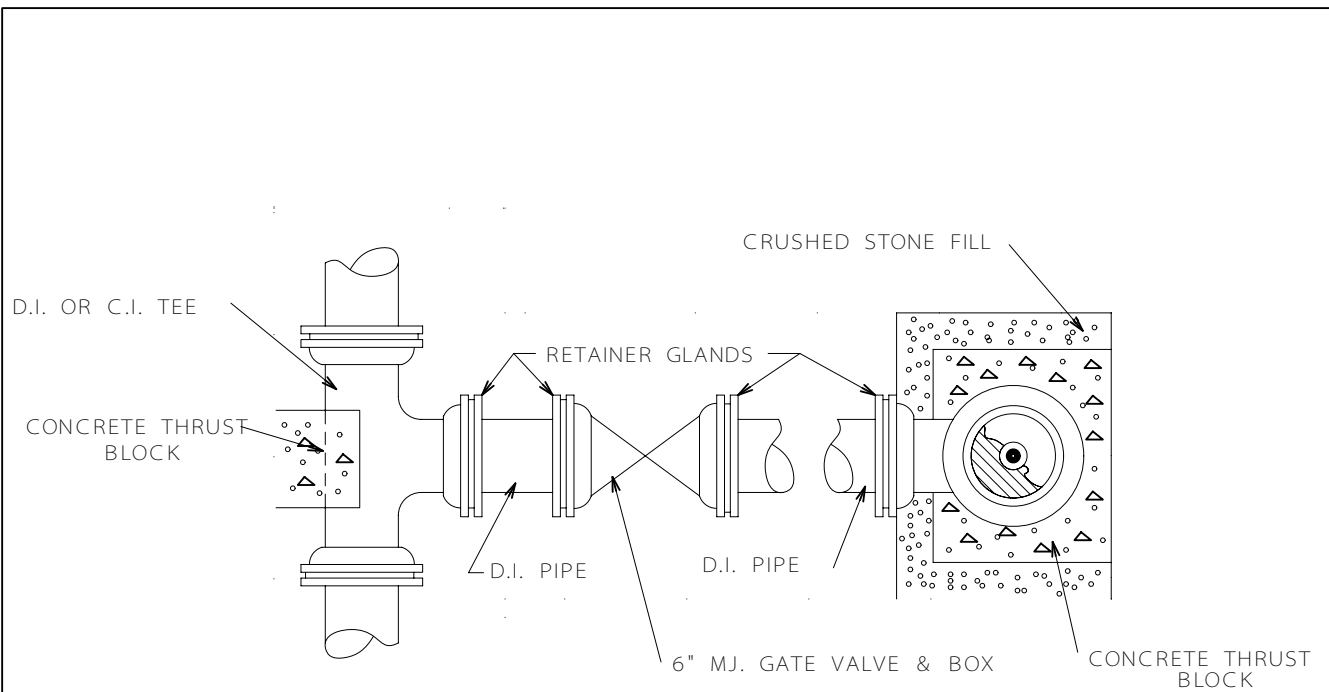


ELEVATION FIRE HYDRANT

- NOTE:
1. USE D.I. PIPE WITH MEGALUG GLANDS TO SECURE ALL FITTINGS
 2. FIRE HYDRANTS SHALL BE EITHER:
 - A: AMERICAN DARLING B - 84 - B
 - B: MUELLER CENTURION
 - C: U.S. PIPE METROPOLITAN 250

200 - 440

200 - 440



IF FIRE HYDRANT IS AT END OF LINE
 USE TEE WITH M.J. TO PVC RESTRAINER
 ALSO PLACE CONCRETE BLOCKING BEHIND
 PLUGGED TEE.

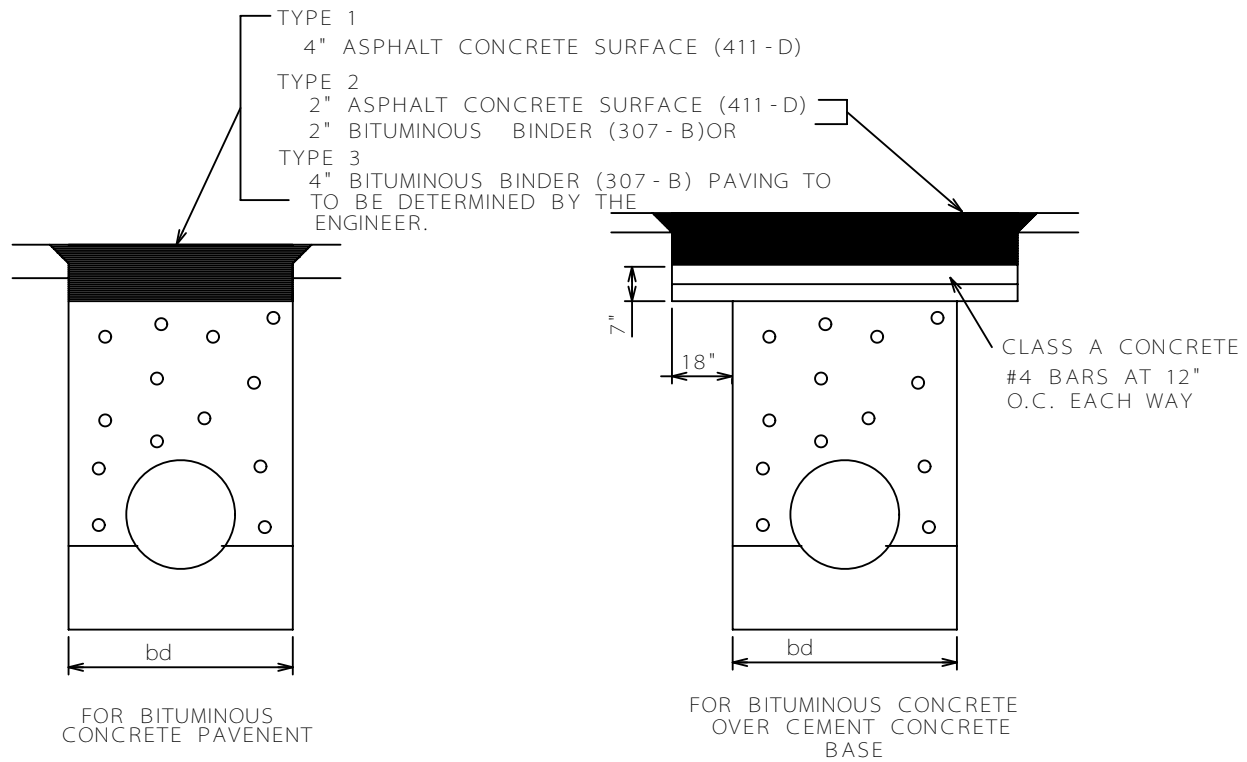
PLAN
FIRE HYDRANT

NOTE:

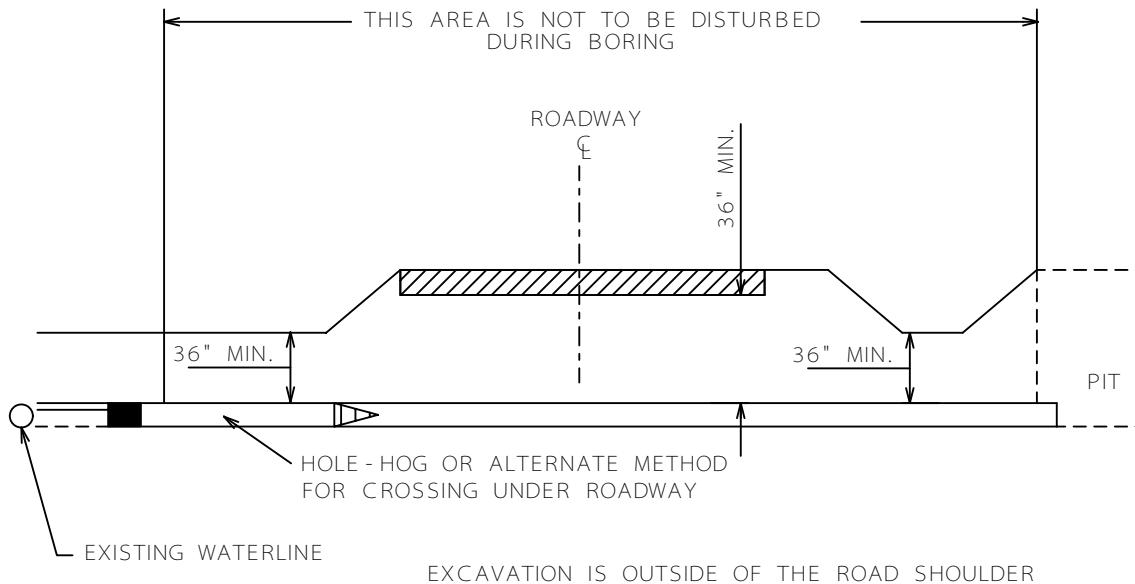
1. USE D.I. PIPE WITH RETAINER GLANDS, FOSTER ADAPTERS, OR ANCHOR COUPLINGS TO SECURE ALL FITTINGS
2. FIRE HYDRANTS SHALL BE EITHER:
 - A: AMERICAN DARLING B - 84 - B
 - B: MUELLER CENTURION
 - C: U.S. PIPE METROPOLITAN 250

200 - 450.1

200 - 450.1



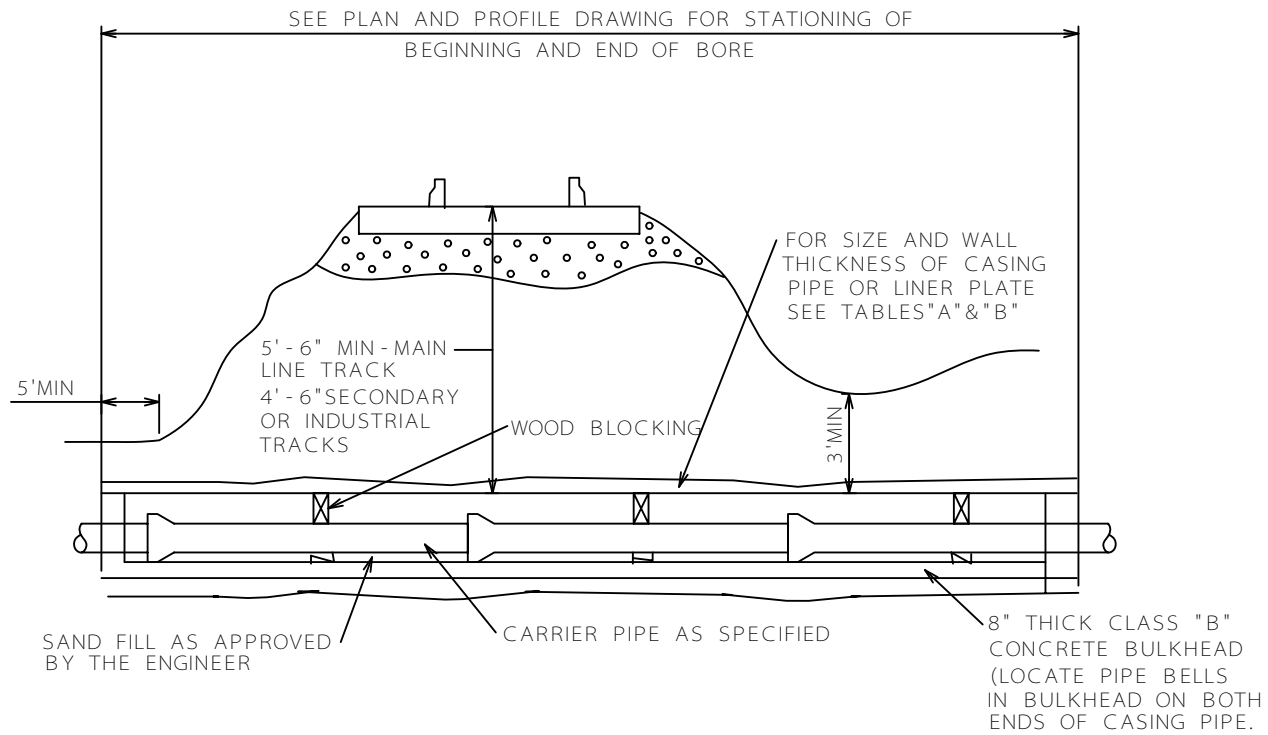
TYPICAL PAVING REPLACEMENT
N.T.S.



TYPICAL ROADWAY CROSSING/PUNCHING METHOD

200 - 470.1

200 - 470.1

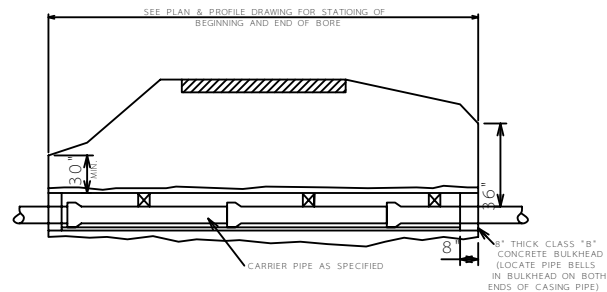


TYPICAL RAILROAD CROSSING - BORING METHOD
NOT TO SCALE

NOTES:

1. FOR CARRIER PIPE SIZE SEE PLAN AND PROFILE DRAWING

200 - 480.1



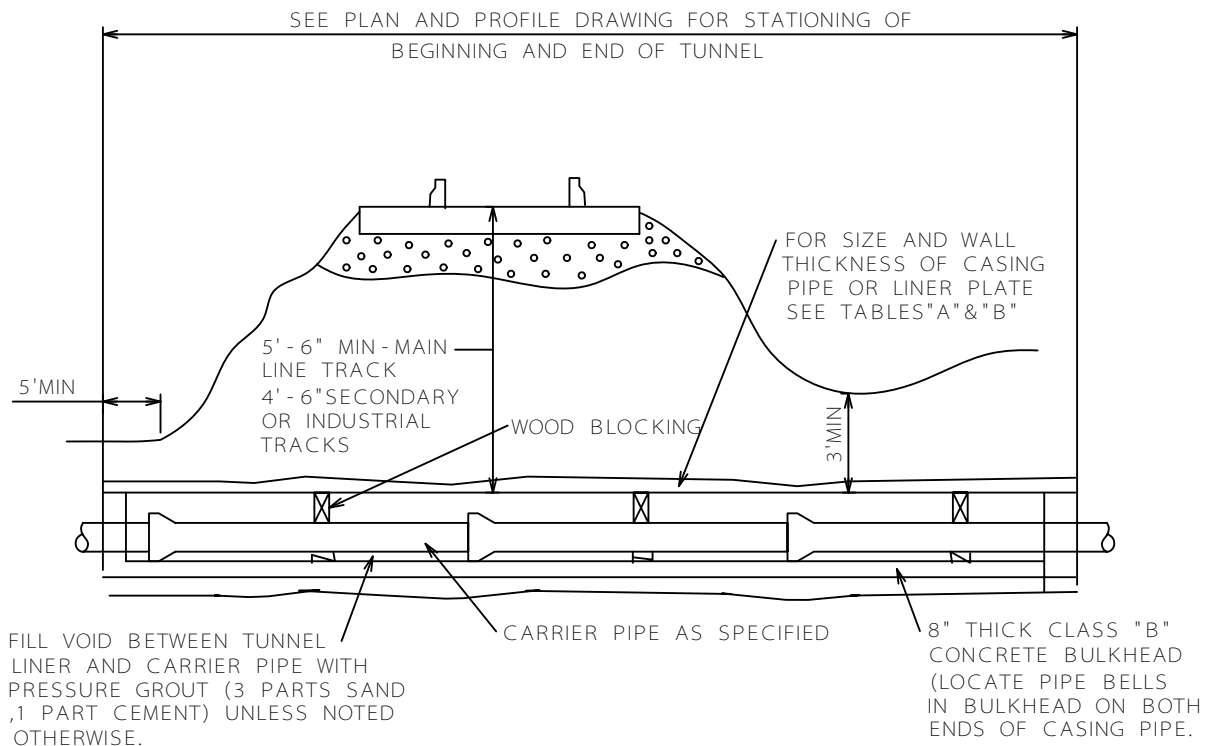
TYPICAL HIGHWAY CROSSING - BORING METHOD
NOT TO SCALE

HIGHWAY CROSSING NOTES

1. WATER LINES CROSSING UNDER PAVED ROADS AND PAVED CROSSROADS WITHIN THE DESIGNATED CITY STREETS, STATE AND U.S. HIGHWAY RIGHT-OF-WAY SHALL BE ENCASED AND PLACED BY BORING, JACKING, OR TUNNELING. BORING, JACKING, OR TUNNELING SHALL EXTEND FROM TOE OF SHOULDER SLOPE TO TOE OF SHOULDER SLOPE. ON LINES CROSSING THE ENTIRE WIDTH OF RIGHT-OF-WAY, THE LENGTH OF CASING SHALL BE DETERMINED BY THE STATE HIGHWAY DIVISION ENGINEER OR THE ENGINEER. ALL WORK SHALL BE COMPLETED AS SHOWN ON THIS DRAWING.
2. ALL WATER LINES SHALL HAVE A MINIMUM COVER OF 36" EXCEPT WHERE DEEPER COVER IS INDICATED ON THE DRAWINGS. ALL TRENCH EXCAVATION WITHIN RIGHT-OF-WAY BUT NOT UNDER PAVEMENT SHALL BE BACKFILLED BY TAMPING IN 6" LAYERS. ALL SURPLUS MATERIAL SHALL BE REMOVED FROM THE RIGHT-OF-WAY AND THE EXCAVATION FINISHED FLUSH WITH SURROUNDING GROUND.
3. CASING PIPE SHALL BE EITHER SPIRAL WELDED STEEL PIPE OR STEEL LINER PLATE APPLICABLE AND SUITABLE TO METHOD OF INSTALLATION EMPLOYED PER TABLE "A" ALL CASING PIPE SHALL BE COATED INSIDE AND OUT PER SPECIFICATIONS.
4. ALL INSTALLATION SHALL BE DONE IN A MANNER WHICH WILL NOT OBSTRUCT STORM WATER PIPES, CULVERTS OR SURFACE WATER DRAINAGE FACILITIES OF THE HIGHWAY, STREET, OR CONNECTION.
5. WHERE SOODING IS DISTURBED BY EXCAVATION OR BACKFILLING OPERATIONS SUCH AREAS SHALL BE REPLACED BY SEEDING AND MULCHING ON ALL SIDE SLOPES OF 5% OR LESS. ALL DRAINAGE AND SWALES AND ALL SLOPES OVER 5% SHALL BE REGRASSED WITH BLOCK SOODING. NO SEPERATE PAYMENT SHALL BE MADE FOR SEEDING AND MULCHING OR SOODING. SAID COST SHALL BE INCLUDED IN THE BID PRICES FOR INSTALLATION OF PIPE.
6. THE INSTALLATION OF SAID FACILITY SHALL BE DONE UNDER THE SUPERVISION AND CONTROL OF THE STATE HIGHWAY DIVISION ENGINEER OR CITY ENGINEER.
7. THE CONTRACTOR SHALL MAKE NECESSARY ARRANGMENTS FOR HIGHWAY TRAFFIC CONTROL DURING THE WORK AND SHALL PROVIDE NECESSARY BARRICADES, WARNING SIGNS, SIGNALS, LIGHTS, AND NECESSARY FLAGMEN FOR THE TRAVELING PUBLIC.

FOR HIGHWAY AND RAILROAD CROSSING THE FOLLOWING SHALL APPLY

1. CROSSING INSTALLED BY JACK AND BORE METHODS:
 - A. DUCTILE IRON PIPE WITH "GRIP RING" TYPE GASKETS INSTALLED IN SLIP JOINT BELLS SHALL BE USED AS THE CARRIER PIPE.
 - B. CASING INSIDE DIAMETER SHALL BE SIZED TO BE TWO INCHES MORE OR LESS GREATER THAN THE OUTSIDE DIAMETER OF THE BELLS OF THE DUCTILE IRON PIPE TO BE SUPPLIED FOR THE PRESCRIBED CROSSING.
 - C. PIPE IN CASING SHALL BE RESTRAINED WITHIN THE CASING BY INSTALLING A MECHANICAL JOINT SET SCREW GLAND ON THE DUCTILE IRON PIPE ON EACH END OF THE CASING AND ATTACHING TO A MINIMUM OF (2) TWO DIAMETER ALL THREAD RODS WELDED TO THE CASING. THE LENGTH OF EACH WELD SHALL BE TWO FEET.
2. CROSSING INSTALLED BY THE TUNNEL METHOD (LARGE DIAMETER PIPE).
 - A. LINER PLATE GAGES SHALL BE SPECIFIED.
 - B. VOID SPACES BEHIND LINER PLATES SHALL BE ELIMINATED BY PRESSURE GROUTING DAILY.
 - C. WHEN ALL LINER PLATES ARE INSTALLED CLASS B CONCRETE INVERT SHALL BE PROVIDED TO SUPPORT THE CARRIER PIPE WHEN AT PLANS GRADE.
 - D. EACH PRICE OF CARRIER PIPE SHALL BE INSTALLED INDIVIDUALLY AND SHIMMED TO GRADE. A BRICK AND MORTAR BULKHEAD SHALL BE INSTALLED AROUND THE PIPE BELL AND THE SPACE BETWEEN THE LINER PLATE AND CARRIER PIPE SHALL BE ELIMINATED BY PRESSURE GROUTING WITH SAND/CEMENT GROUT. ALLOW GROUT TO "SET" BEFORE PROCEEDING TO STEP E.
 - E. REPEAT STEP D UNTIL ALL PIECES OF THE CARRIER PIPE HAVE BEEN INSTALLED.
3. CROSSING INSTALLED BY THE TUNNEL METHOD (SMALL DIAMETER PIPE).
 - A. LINER PLATE GAGES SHALL BE AS SPECIFIED.
 - B. VOID SPACES BEHIND LINER PLATES SHALL BE ELIMINATED BY PRESSURE GROUTING DAILY.
 - C. WHEN ALL LINER PLATES ARE INSTALLED, THE CARRIER PIPESPECIFIED SHALL BE SHIMMED TO GRADE AND CHAIN AND TURNBUCKLES USED TO RESTRAIN EACH JOINT OF PIPE.
 - D. SAND / CEMENT GROUT SHALL BE PUMPED INTO THE CASING TO A DEPTH OF TWO INCHES ABOVE THE TOP OF EACH PIPE BELL. THE DEPTH OF GROUT SHALL BE UNIFORM THROUGHOUT THE CASING.
 - E. A CONCRETE BLOCK OR BRICK BULKHEAD, ONE FOOT THICK SHALL CONSTRUCTED AT BOTH ENDS OF THE TUNNEL.



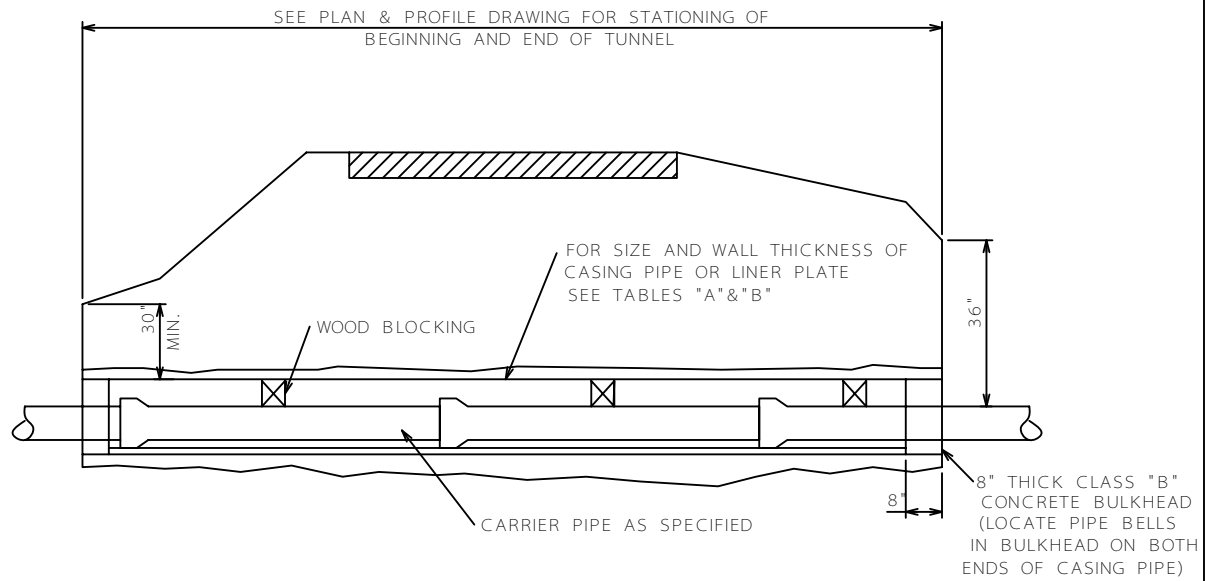
TYPICAL RAILROAD TUNNEL CROSSING
NOT TO SCALE

NOTES:

1. CONTRACTOR SHALL INSTALL 3 GROUT NIPPLES IN EVERY LINER PLATE INSTALLED. FOR LOCATION OF NIPPLES SEE SECTION "A-A"
2. CONTRACTOR SHALL PRESSURE GROUT BEHIND EVERY RING OF LINER PLATE AS IT IS INSTALLED.
3. FOR CARRIER PIPE SIZE SEE PLAN AND PROFILE DRAWINGS

200-500.1

200-500.1



TYPICAL HIGHWAY TUNNEL CROSSING

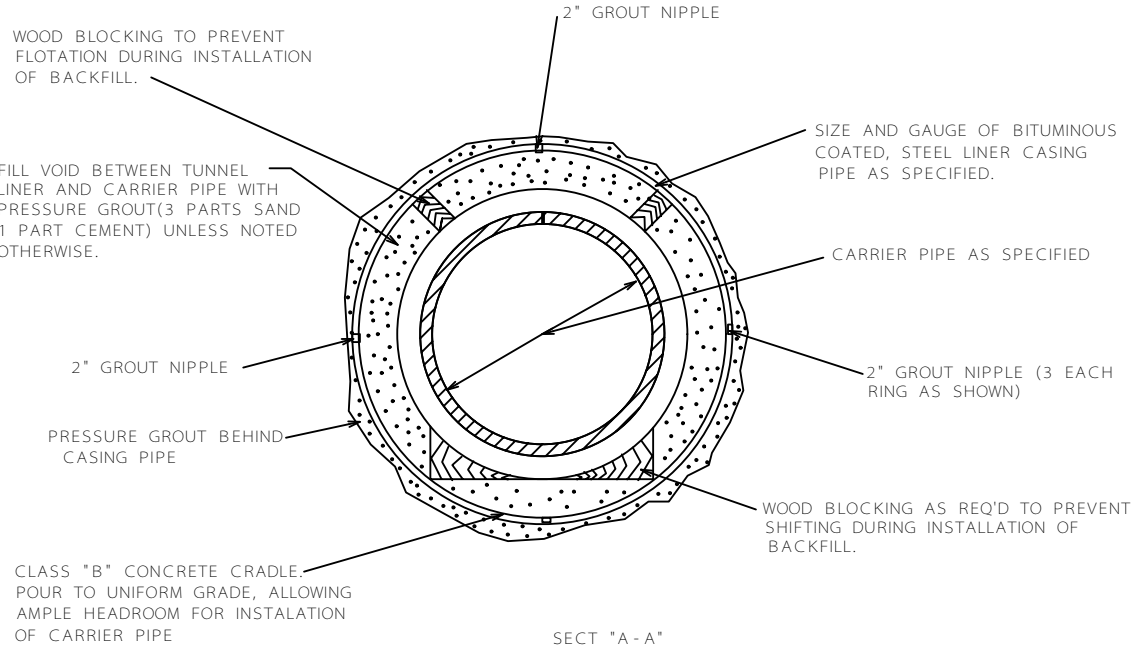
NOT TO SCALE

NOTES:

1. CONTRACTOR SHALL INSTALL 3 GROUT NIPPLES IN EVERY LINER PLATE INSTALLED. FOR LOCATION OF NIPPLES SEE SECTION "A-A"
2. CONTRACTOR SHALL PRESSURE GROUT BEHIND EVERY RING OF LINER PLATE AS IT IS INSTALLED.
3. FOR CARRIER PIPE SIZE SEE PLAN AND PROFILE DRAWINGS

200 - 510.1

200 - 510.1



- NOTES:
1. CONTRACTORS SHALL INSTALL 3 GROUT NIPPLES IN EVERY LINER PLATE INSTALLED. FOR LOCATION OF NIPPLE SEE SECTION "A-A"
 2. CONTRACTOR SHALL PRESSURE GROUT BEHIND EVERY RING OF LINER PLATE AS IT IS INSTALLED.

200 - 520.1

TABLE "A"		
PIPE SIZE		
CARRIER PIPE (INCHES)	CASING PIPE	
	DIA (INCHES)	STEEL PIPE WALL THICKNESS
6 & 8	16	.
10	20	§
12	24	□
14 & 16	30	□
18	36	□
24	36	□
30	54	SEE TABLE "B"
36	54	┆
42	66	┆
48	72	┆
54	78	┆
60	84	┆
66	96	┆
72	108	┆
84	120	┆
96	144	┆

DUCTILE IRON
OR CAST IRON

R.C.P.

SPIRAL WELDED STEEL

LINER PLATE

200 - 530.1

CARRIER AND CASING PIPE SIZE REQUIREMENTS

200 - 530.1

TABLE "B"									
GAGES OF LINER PLATE FOR CONTINUOUS LOAD - CARING STRUCTURES									
NOMINAL DIA. (INCHES)	HEIGHT OF COVER (FEET)								
	2 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35	36 - 40	40 - 45
48	12	12	12	12	12	12	12	12	10
54	12	12	12	12	12	12	12	10	8
60	12	12	12	12	12	12	10	8	7
66	12	12	12	12	12	10	8	8	5
72	12	12	12	12	12	10	8	7	5
78	12	12	12	12	10	8	7	5	5
84	12	12	12	10	10	8	5	5	5
96	12	10	10	10	10	8	5	5	5
108	10	10	10	10	8	7	5	5	5
120	10	10	10	8	8	7	5	5	3
144	8	8	8	8	5	5	3	1	1

CASING PIPE MIN. THICKNESS FOR LINER
PLATE IN RAILROAD CROSSING 10 GAGE

LINER PLATE GAGES FOR NOMINAL PIPE DIAMETERS

SEE DETAIL 200 - 370.1 FOR FRAME AND COVER DETAIL.

VARIES TO GRADE 11" MAX

FINISH GRADE

8" WALL THICKNESS

5" WALL THICKNESS

FOR MANHOLE JOINT SEE DETAIL 200 - 330.1

SECTIONS VARY

48" DIAMETER

SECTIONS VARY

SLOPE 1" PER FOOT

6" MIN.

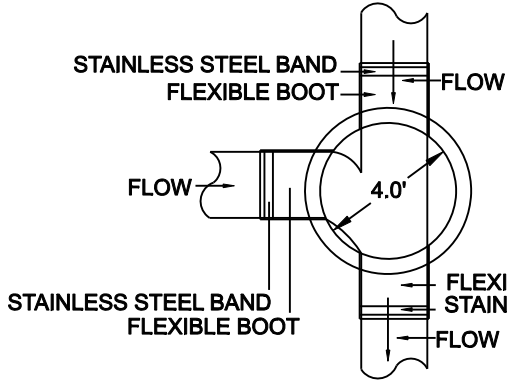
6" MINIMUM CRUSHED COMPACTED STONE

ECCENTRIC CONE PRECAST MANHOLE

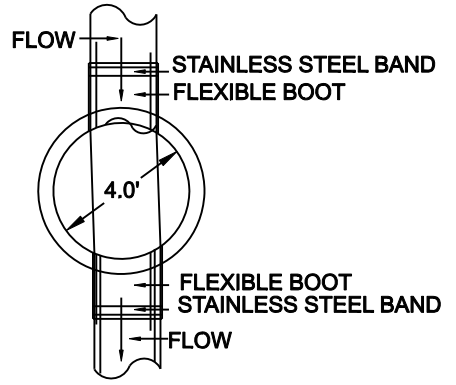
NOTES:

1. STEPS TO BE VERTICALLY ALIGNED.
2. THE FRAME AND COVER SHALL BE PROPERLY ALIGNED WITH THE 2 FOOT OPENING OF THE MANHOLE STRUCTURE AND BOLTED IN PLACE.
3. FLAT TOP MANHOLES MAY ONLY BE SUBSTITUTED WITH THE APPROVAL OF CLEVELAND UTILITIES. WHEN USED, THE ECCENTRIC OPENING MUST LINE UP WITH THE STEPS.
4. FLEXIBLE JOINT MANHOLE CONNECTION SHALL BE AS MANUFACTURED BY KOR-N-SEAL GASKET CORPORATION OR EQUIVALENT.
5. GROUT ANNULAR SPACE BETWEEN PIPE AND PRECAST MANHOLE ON INSIDE OF MANHOLE.
6. MANHOLES THAT ARE IN AN EASEMENT AREA (NOT IN THE ROAD) THE CASTINGS MUST BOLTED DOWN TO THE MANHOLE . UNLESS OTHERWISE NOTED.

INVERTS WILL BE THE SAME SIZE AS THE PIPE AND SUFFICIENT SIZE FOR PLUGS AND TESTING EQUIPMENT.



SECTION A-A
(WITH INTERSECTING MAIN LINE. SEE DETAIL 200-290)

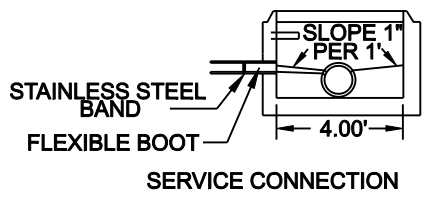


SECTION A-A

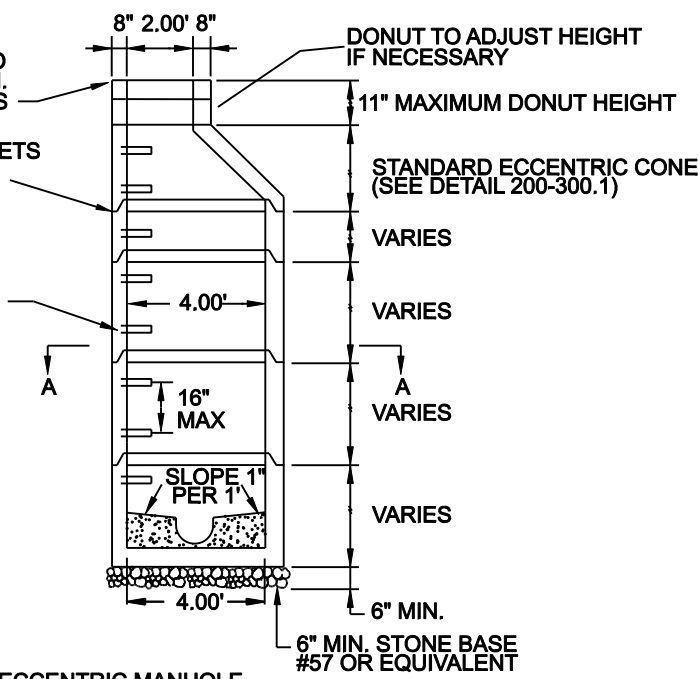
BUTYL MASTIC JOINT SEALER (NO MORTAR) BETWEEN F&C AND M.H. TOP AND BETWEEN GRADE RINGS

BUTYL MASTIC JOINT SEALER OR GASKETS MEETING ASTM C443 AND ASTM C1244 TESTING STANDARD (NO MORTAR)

STEPS SHALL BE VERTICALLY ALIGNED AND SHALL BE NO MORE THAN 16" APART. THERE SHOULD BE 8" OF VERTICAL SEPARATION BETWEEN THE MANHOLE STEP AND A MANHOLE JOINT. (SEE DETAIL 200-340.1)



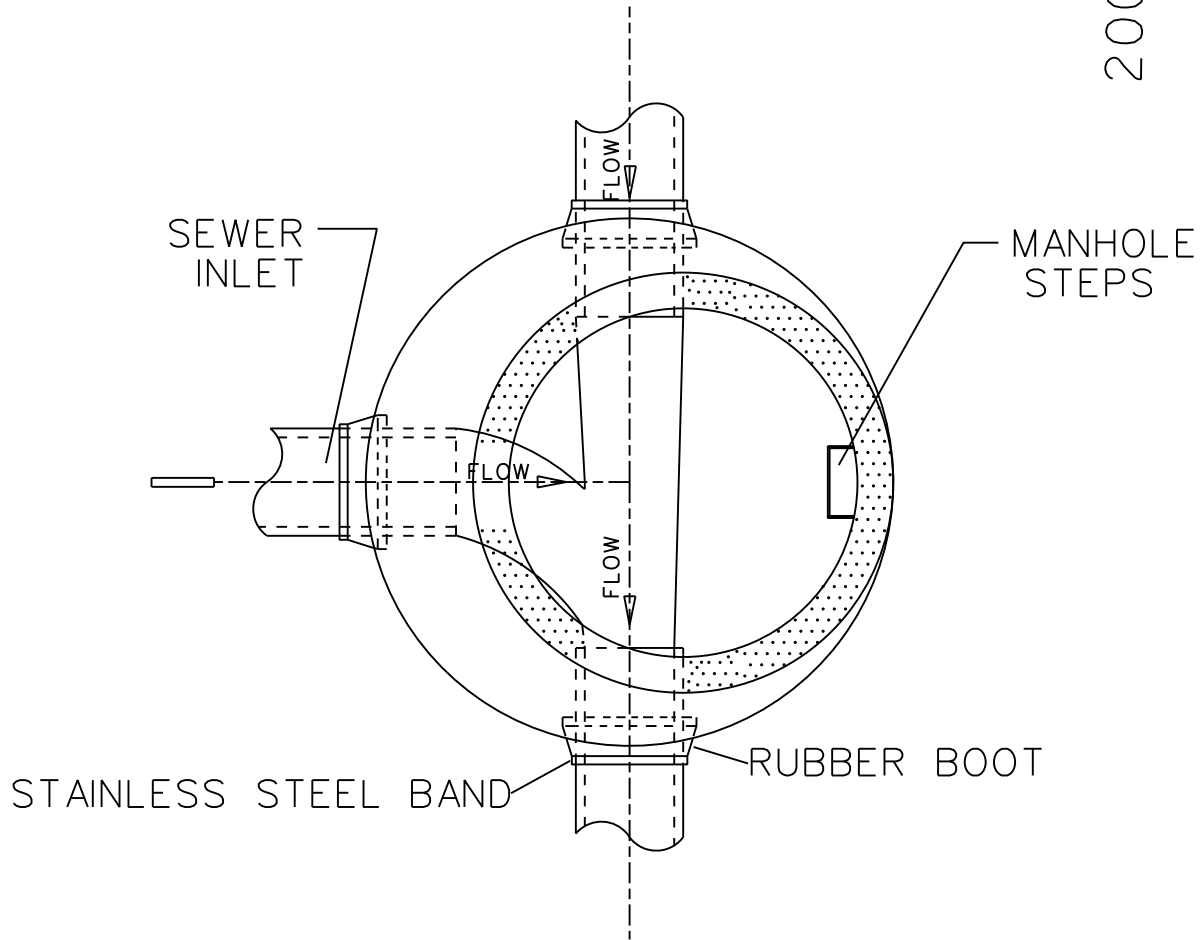
SERVICE CONNECTION



ECCENTRIC MANHOLE WITH PRECAST INVERT

REVISED 1-26-2010

200-290



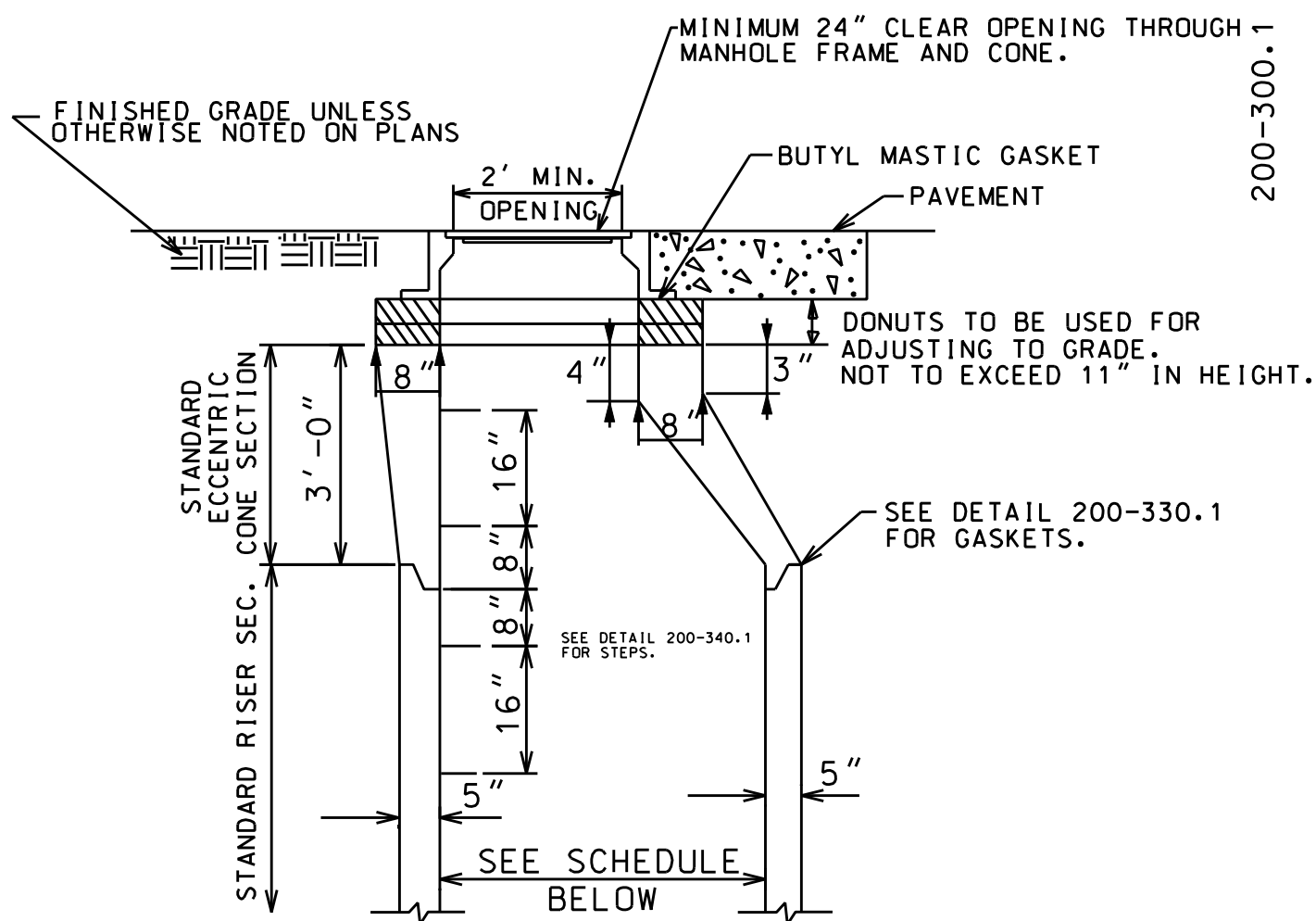
TOP VIEW

TYPICAL PRECAST 4'-0" DIAMETER MANHOLE

NOTE: 5'-0" DIAMETER MANHOLE MAY
BE SIMILAR DESIGN IF APPROVED
BY THE ENGINEER.

REVISED 1-26-2010

200-290

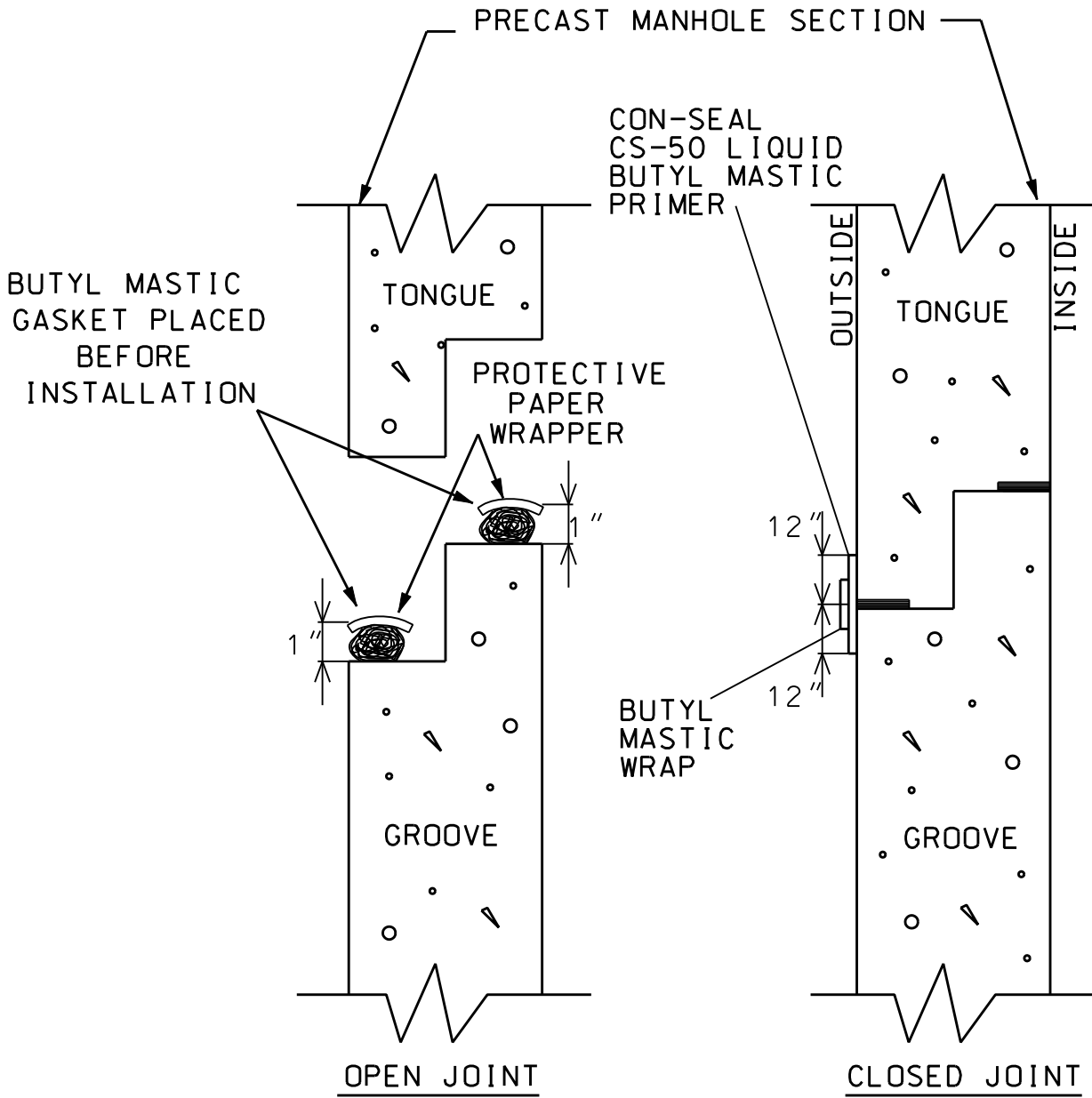


NOTE: DETAILS FOR RISER & BASE SECTION ARE SAME AS SHOWN IN DETAIL 200 - 270.1.

STANDARD ECCENTRIC CONE
FOR ALL DIAMETER MANHOLES

GENERAL NOTES:

1. FOR PIPE SIZE 8" TO 12" INCL. PROVIDE JOINT AT OUTSIDE FACE OF MANHOLE AS SHOWN ON SECTIONS.
2. FOR PIPES LARGER THAN 12" PROVIDE A FLEXIBLE JOINT AS CLOSE TO THE OUTSIDE FACE AS THE SHORTEST LENGTHS AVAILABLE WILL PERMIT.
3. MANHOLE STEPS SHALL BE AS MANUFACTURED BY M. A. INDUSTRIES, INC. OR APPROVED EQUAL.
4. ALL ELEMENTS SHALL CONFORM TO PRECAST SPECIFICATION ASTM C-478 LATEST REVISIONS.
5. ADJUST MANHOLE FRAME TO GRADE BY USING DONUT RING. NOT TO EXCEED 11" IN HEIGHT.
6. PAINT OUTSIDE WALL WITH TWO COATS OF BITUMINOUS PAINT APPLIED AT RIGHT ANGLES TO EACH OTHER.

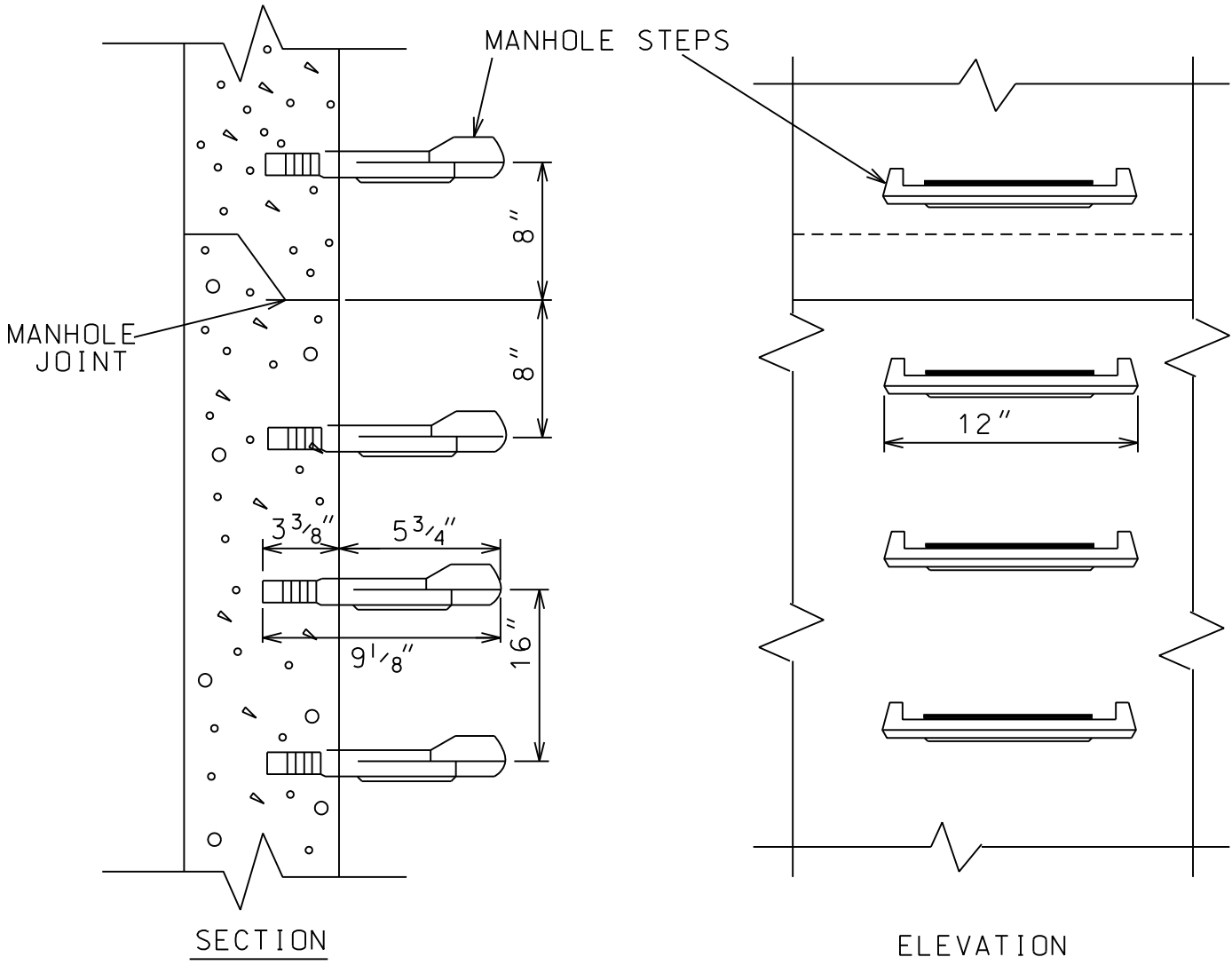


DETAIL OF BUTYL MASTIC GASKET FOR
PRECAST MANHOLE SECTIONS

1. TRIM PROTRUDING GASKET INSIDE AND OUTSIDE.
2. CLEAN ALL DEBRIS FROM JOINTS PRIOR TO GASKET APPLICATION.

NOTE: $\frac{3}{8}$ " STEEL REINFRCED ROD ENCAPSULATED
IN POLYPROPYLENE PLASTIC OR EQUAL.

200-340.1



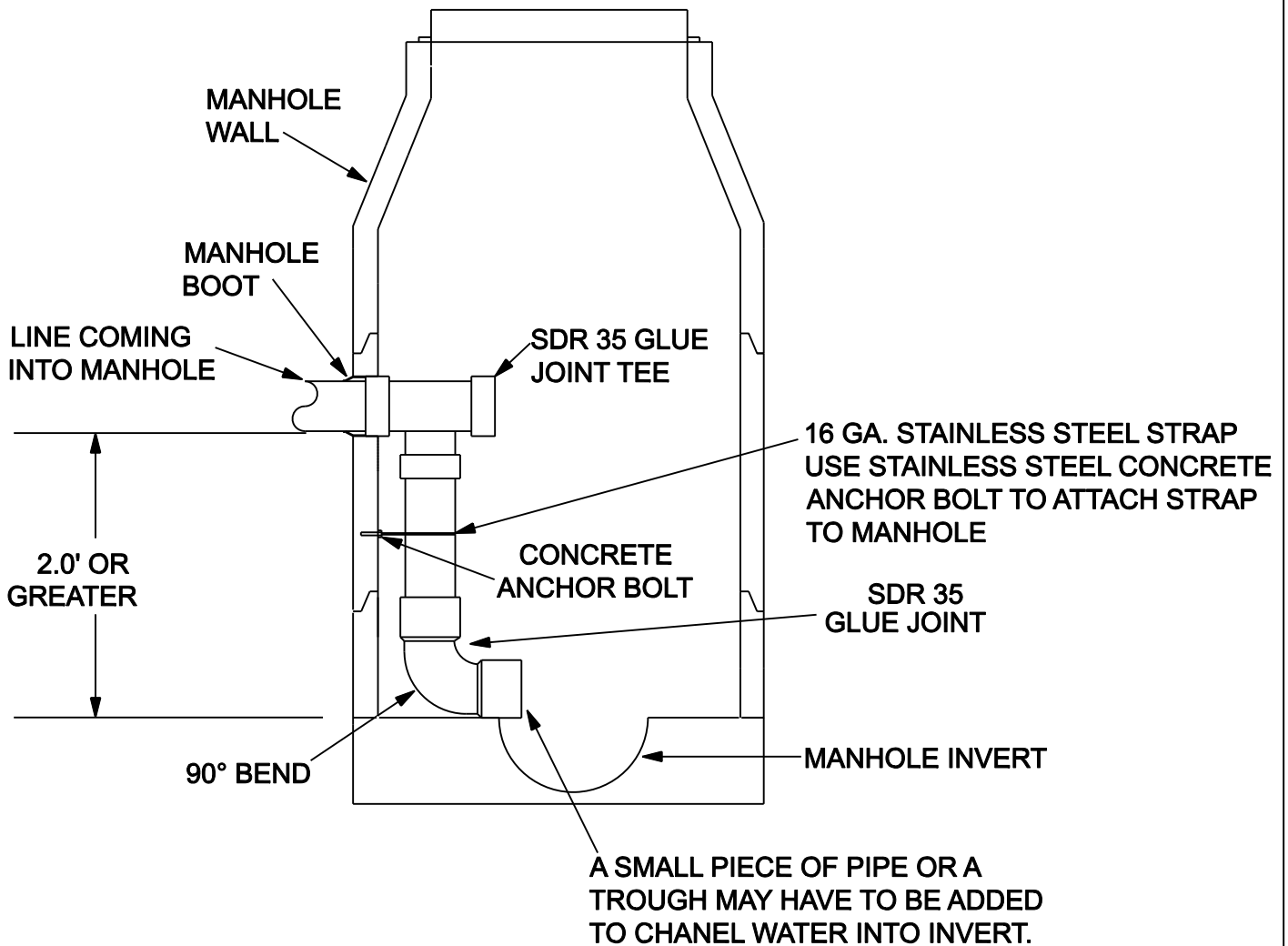
DETAIL OF STANDARD
LADDER BARS

REVISED: 1-26-2010

200-340.1

NOTES:

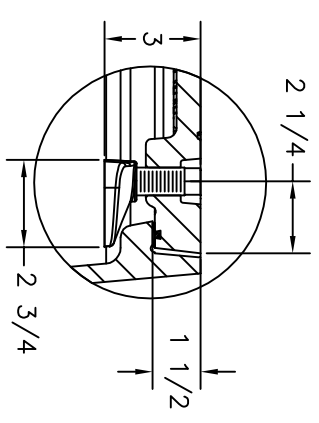
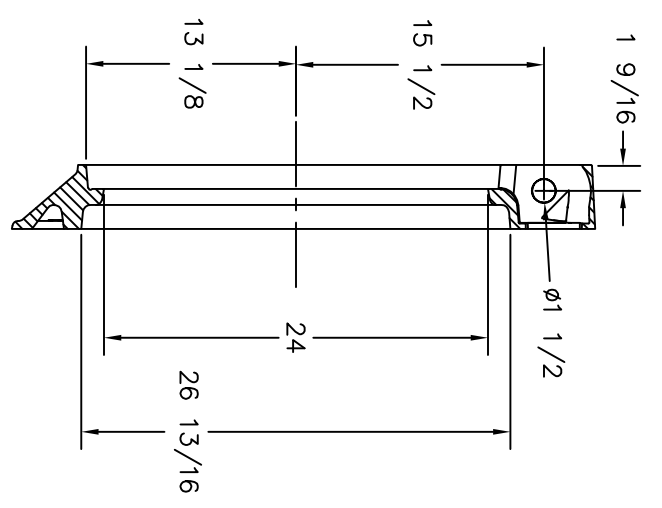
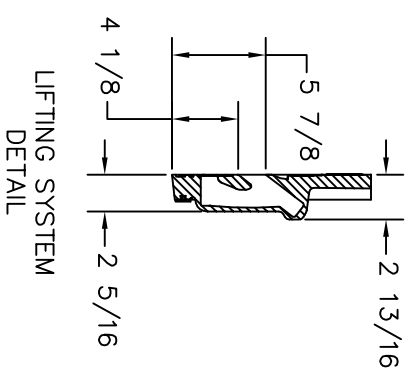
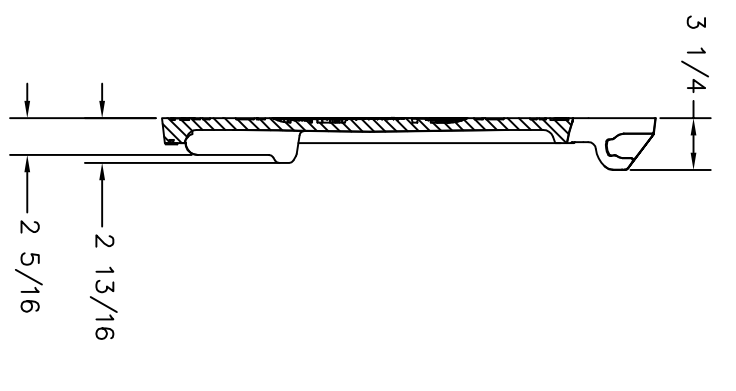
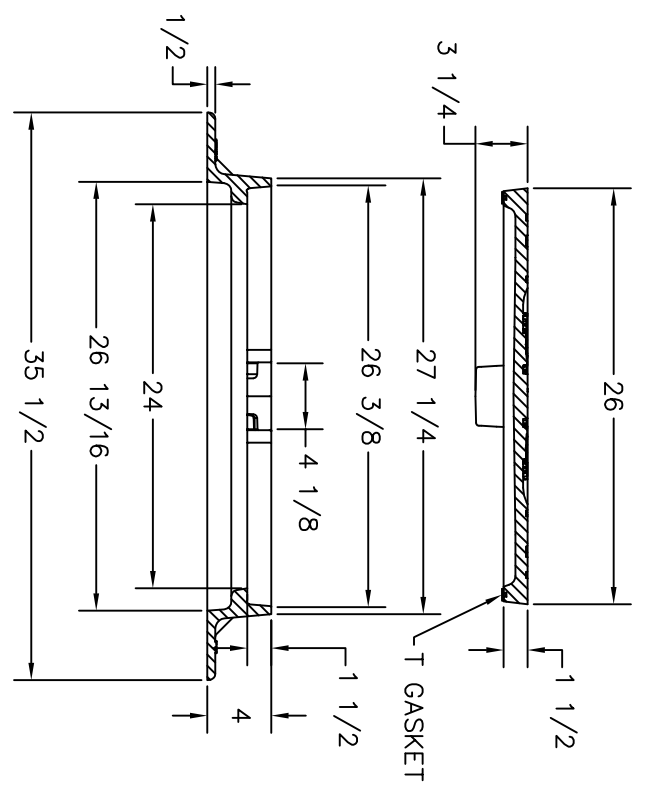
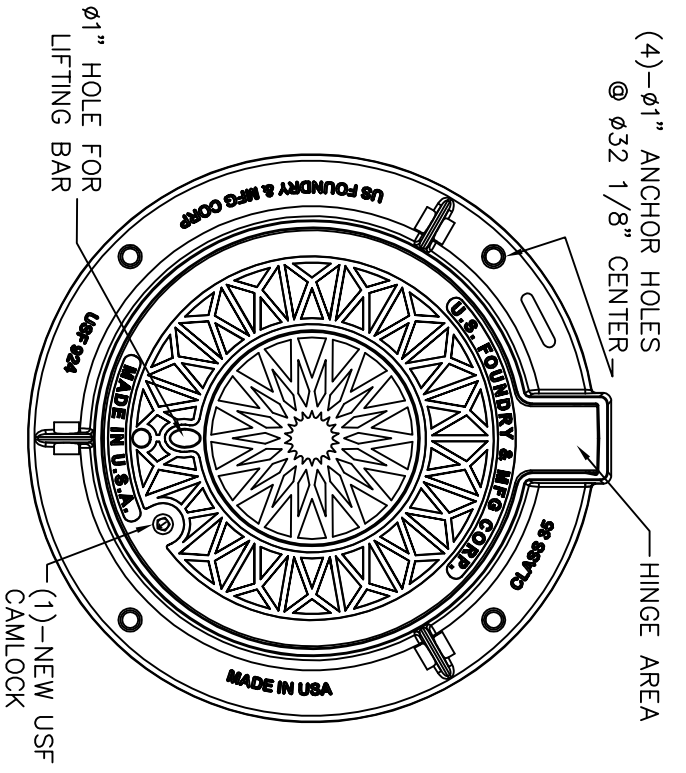
1. GROUT AROUND PIPE COMING INTO MANHOLE, TO FILL GAP BETWEEN MANHOLE WALL AND INCOMING PIPE.
2. STAINLESS STEEL STRAPS ARE TO BE USED EVERY 4 FEET ON PIPE GOING DOWN MANHOLE WALL.
3. PIPE USED FOR INSIDE DROP TO BE SDR 35 GLUE JOINT PIPE.
4. USE STAINLESS STEEL ANCHOR BOLTS TO ATTACH STRAPS TO THE MANHOLE WALL.



**MAINLINE OR LATERAL
INSIDE DROP MANHOLE**

ADDED: 1-26-2010

200 - 365



U.S. FOUNDRY & MFG. CORP.
 MEDLEY, FLORIDA

DESCRIPTION
USF 924 RING & US COVER

MATERIAL: ASTM-A48 GRAY IRON CLASS: 35B

RING WEIGHT: 135 COVER WEIGHT: 128

UNLESS OTHERWISE NOTED WEIGHT IS IN POUNDS AND APPROXIMATED

DWG. BY: ULS SCALE: 1"=1' ITEM No. 8015092 DWG. DATE: 10-02-09

CHK. BY: REV. 8015092 DWG. No. REV.

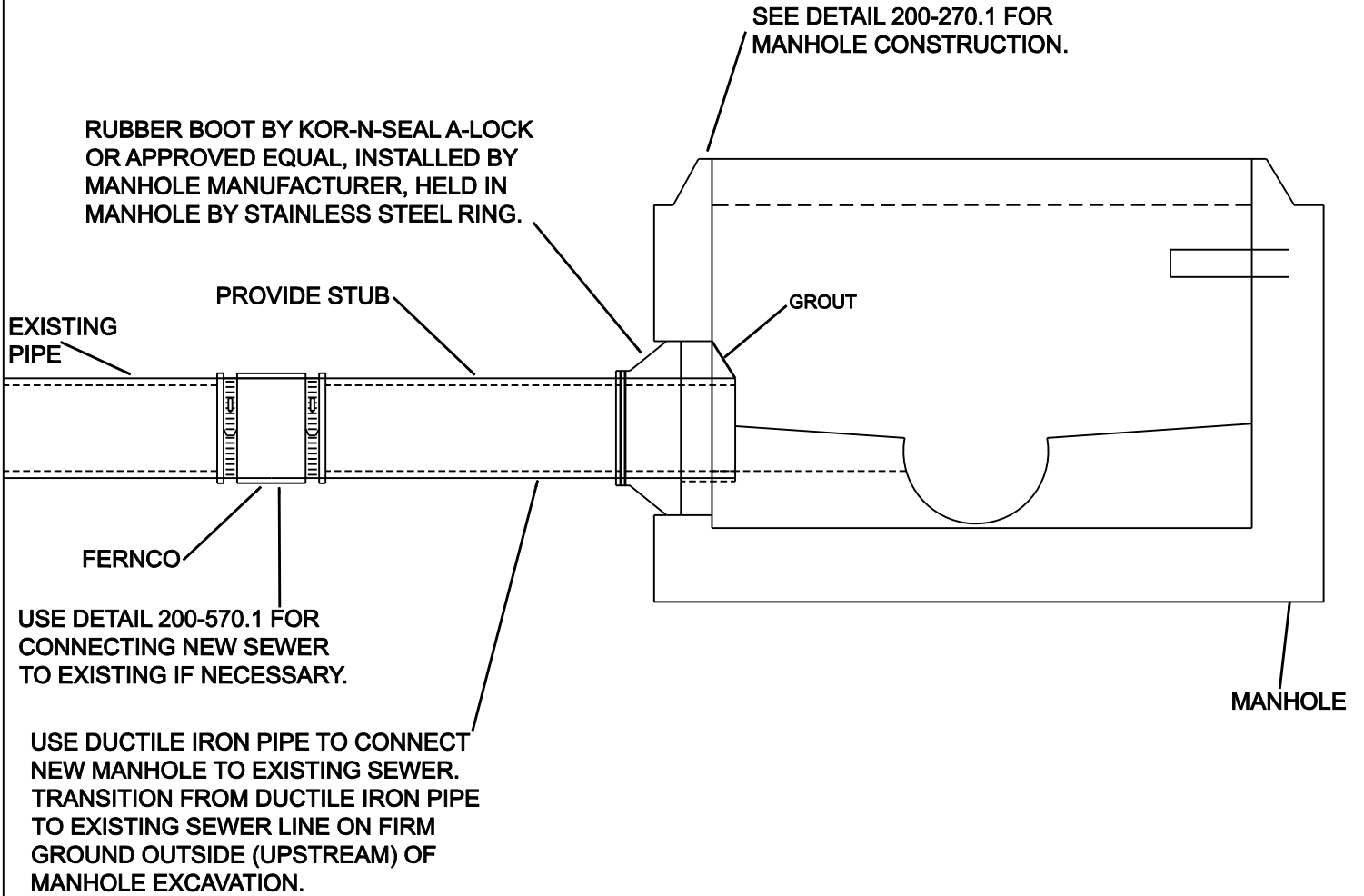
200-375

REV: DATE:

DESCRIPTION:

REV BY:

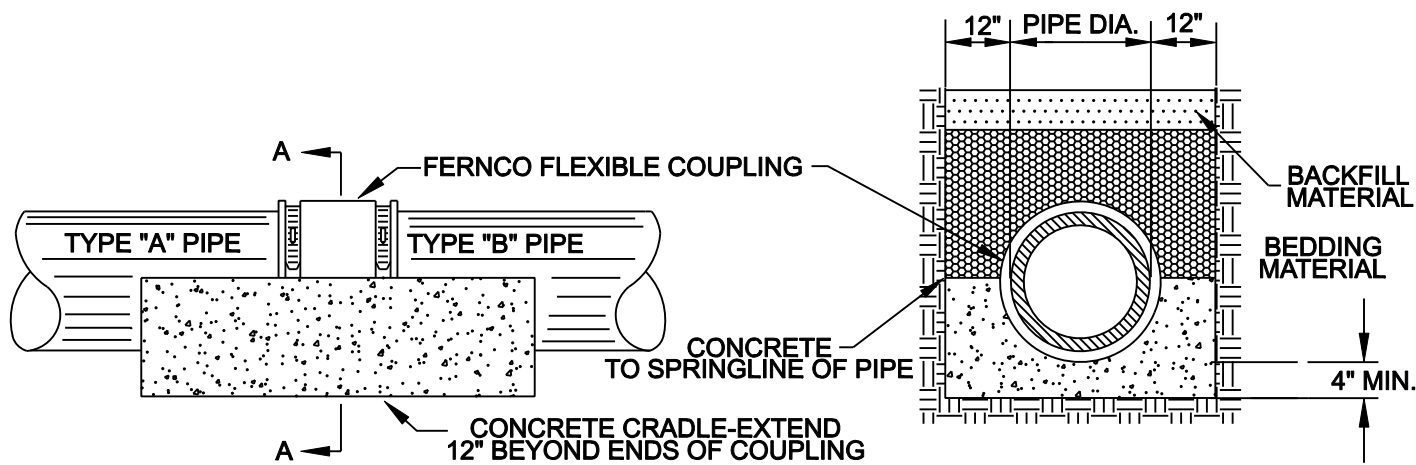
200-560.1



DETAIL CONNECTION OF EXISTING
LINE TO NEW MANHOLE

ADDED: 2-17-10

200-560.1



JOINING DISSIMILAR PIPE FOR USE WITH EXISTING PIPE

ADDED: 2-17-10

200-570.1