

WORCESTER COUNTY

DEPARTMENT OF PUBLIC WORKS
WATER AND WASTEWATER DIVISION



NOVEMBER 1, 2017

(As amended upon adoption on February 20, 2018)

STANDARD SPECIFICATIONS
AND DETAILS FOR
WATER MAINS & SEWER MAINS

RESOLUTION NO. 18 - 5

**RESOLUTION TO REPEAL AND REPLACE
DESIGN GUIDELINES AND STANDARDS FOR WATER AND WASTEWATER FACILITIES
IN WORCESTER COUNTY, MARYLAND**

WHEREAS, Section PW 5-307(c) of the Public Works Article of the Code of Public Local Laws of Worcester County, Maryland provides that the County Commissioners may, by resolution, adopt codes and standards for the construction, operation and use of sanitary facilities; and

WHEREAS, the County Commissioners of Worcester County, Maryland adopted, on March 8, 1994, a Resolution Adopting Worcester County Department of Water and Wastewater Design Guidelines; and

WHEREAS, the County Commissioners have determined the need to update the design guidelines and standards to include information on products and procedures that have been successfully implemented on other projects within the County and to provide a consolidated package of construction details and a listing of specific products approved for use when constructing water and wastewater facilities within Worcester County for turnover to the County Commissioners of Worcester County, Maryland for future operation and maintenance;

NOW, THEREFORE, BE IT RESOLVED by the County Commissioners of Worcester County, Maryland that the document entitled "Worcester County, Maryland Design Guidelines for Water and Wastewater Facilities" dated March 8, 1994 is hereby repealed and replaced by the document entitled "Worcester County Department of Public Works Water and Wastewater Division - Standard Specifications and Details for Water Mains & Sewer Mains" dated November 1, 2017, which shall hereafter guide all construction, operation and use of sanitary facilities in Worcester County.

AND, BE IT FURTHER RESOLVED that this Resolution shall take effect upon its passage.

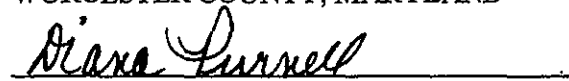
PASSED AND ADOPTED this 20th day of February, 2018.

ATTEST:



Harold L. Higgins
Chief Administrative Officer

COUNTY COMMISSIONERS OF
WORCESTER COUNTY, MARYLAND




Diana Purnell, President



Theodore J. Elder, Vice President



Anthony W. Bertino, Jr.



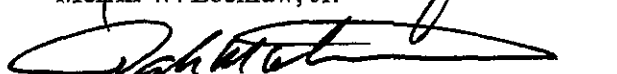
Madison J. Bunting, Jr.



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Merrill W. Lockfaw, Jr.



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WORCESTER COUNTY, MARYLAND

STANDARD SPECIFICATIONS AND DETAILS FOR

WATER MAINS AND SEWER MAINS

MARCH 7, 2018

All Water and Sewer construction projects shall be built in accordance with this document and any adopted revisions. All construction documents shall incorporate the latest revision.

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PART 1
GENERAL PROVISIONS

DIVISION 1
GENERAL PROVISIONS

**PART 1 – DIVISION 1
GENERAL PROVISIONS**

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GENERAL PROVISIONS**1.0 DEFINITIONS**

Whenever the words defined in this section, or pronouns used in their stead occur in the contract, they shall have the meanings here given:

- A. Whenever the words APPROVED, ACCEPTABLE, or words of like import are used in the drawings or specifications, it shall be understood that "Approved by or Acceptable to" the Director is intended, unless otherwise stated.
- B. BID - The offer of the bidder submitted on the prescribed bid form to perform the prescribed work and to furnish the prescribed labor and materials in accordance with a set of Contract Specifications and/or Documents, for the consideration of payment at the unit and/or lump sum price stated and submitted on the prescribed forms.
- C. BID ITEM - An item of work specifically described and for which a price, either unit or lump sum, is provided. It includes the performance of all work and furnishing of all labor, equipment and materials, described herein or described in any supplemental specifications or Special Provisions.
- D. BID SECURITY - The security designated in the Bid, to be furnished by the bidder as a guarantee of good faith to enter into a Contract with the OWNER, if the work of constructing the improvement is awarded to him. The Bid Security may be a bid bond or certified check.
- E. BIDDER - Any individual, firm or corporation submitting a bid for the prescribed work contemplated, acting directly or through a duly authorized representative.
- F. CHANGE ORDER - A written order to the Contractor, signed by the Director of Procurement on behalf of the Owner, ordering a change in the work from that originally shown by the plans and specifications that has been found necessary. If the work is of a nature involving an adjustment of unit price, a Supplemental Agreement shall be executed. Change Orders duly signed and executed by the Contractor and County constitute authorized modifications of the Contract.
- G. CONSTRUCTION EASEMENT - The area secured for temporary or permanent use and or modification for the purpose of facilitating work to be accomplished during construction.
- H. CONTRACT - The written agreement executed between the Owner and the successful bidder, covering the performance of the work and the furnishing of labor and materials, by which the Contractor is bound to perform the work and furnish the labor and materials, and by which the Owner is obligated to compensate him therefore at the mutually established and accepted rate or price.

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- I. CONTRACT BOND - The approved form of security executed by the Contractor and his Surety or Sureties, guaranteeing complete execution of the Contract and all supplemental agreements and changes pertaining thereto. Worcester County Government will accept insurance company Performance, Payment and/or Maintenance Bonds only from companies holding certificates of authority as acceptable sureties as published annually in the Federal Register, Department of the Treasurer, Fiscal Service, Department Circular 570.
- J. J. CONTRACT DOCUMENTS shall include the invitation for bids, instructions to bidders, bid contract and contract bond, these specifications, supplemental specifications, all general or special provisions, general and detailed plans, and notice to proceed; also, any written change orders, written mutual understandings and agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions thereof.
- K. CONTRACT DRAWINGS show the location, dimensions and sizes of the materials on the lines and slopes, at the depths with the connections and the manner in which they are to be placed as called for by the Specifications outlining the work and the materials to be provided for and placed under the contract, or in accordance with such changes as may be approved from time to time during the progress of work, as hereinafter provided.
- L. L. CONTRACT ITEM - The obligation of the Contractor, including the performance of all work and furnishing of all labor and the materials described in the respective articles or sections of the Specifications and Contract or in the Special Provision which are made a part thereof.
- M. CONTRACT TIME - The number of working days or calendar days shown in the bid, indicating the time allowed for the completion of the work contemplated in the contract and any modification thereto.
- N. CONTRACTOR shall mean the party of the second part, or the agent appointed to act for the said party, entering into the contract for the performance of the work required by it.
- O. COUNTY - See OWNER
- P. DIRECTOR shall mean the Director of the Worcester County Department of Public Works, acting for the Department or its duly authorized agents, said agent acting severally within the scope of the particular duties entrusted to him.
- Q. ENGINEER shall mean the Registered Professional Engineer or a duly authorized agent thereof, contracted by Worcester County to provide any engineering services that the County may require or authorize.
- R. ESTABLISHED GRADE - The profile grade as anticipated and approved for future construction in order to meet geometric criteria approved by established standards of construction.

- S. **FIXED-PRICE ITEMS** - These unit prices are established and prescribed by the County to compensate for the cost of work and materials that may be necessary for the proper completion of the contract, and the quantities of which are not amendable to reliable quantitative estimation prior to the construction. The fixed-price items are shown on the bid sheets with estimated quantities, fixed price, and the estimated total cost imprinted prior to the issuance of the contract documents to bidders.
- T. **NOTICE TO PROCEED** - A written notice to the Contractor of the date on which the contract period begins.
- U. **OWNER** shall mean the Worcester County Department of Public Works, Snow Hill, Maryland. Also referred to as County or Department.
- V. **PERPETUAL EASEMENT** - The area secured and reserved by the Owner for right-of-use in constructing and maintaining proposed work and appurtenances thereto.
- W. **SPECIAL PROVISIONS** - Special clauses supplemental to these specifications, setting forth requirements peculiar to the specific work included in the contract documents and right-of-way agreements.
- X. **SPECIFICATIONS** - The direction, provisions and requirements contained in these Standard Specifications, together with all written agreements made and/or to be made, pertaining to the method and manner of performing the work, or to the quantities and qualities of the materials to be furnished under the contract.
- Y. **SUB-CONTRACTOR** - Any individual firm or corporation undertaking the engineering or construction of a part of the work under the terms of the contract, by virtue of an agreement with the contractor, who, prior to such undertaking, received the consent of the Surety and the approval of the Owner.
- Z. **SURETY** - The corporate body approved by the Owner which is bound with and for the Contractor who is primarily liable and which engages to be responsible for his payment of all debts pertaining to and for his acceptable performance of the work for which he has contracted.

2.0 PROPOSAL REQUIREMENTS AND CONDITIONS**A. PREPARATION OF BID**

In completing bid forms bidders shall be governed by the following provisions:

1. Bids must be made on the blank forms provided by the Owner. The blank spaces in the bid form, except as otherwise noted, must be filled in, and no change shall be made in the phraseology of, or in the items mentioned in the bid form. Any such change shall be cause for rejection of the bid.
2. Bids must be signed in ink by the bidder with the signature in full. When an unincorporated business is a bidder, the agent who signs the business name to the bid shall state, in addition, the names and addresses of the individuals composing the firm. When a corporation is a bidder, the person signing shall state under the laws of what State the corporation is chartered and the names and titles of the officers having authority under the bylaws to sign contracts. The bid shall also bear the seal of the corporation, attested by its secretary. Anyone signing the bid as agent must file with it legal evidence of his authority to do so. Post Office address, county and state, and telephone number must be given after the signature of the person signing the bid.
3. Each bid shall specify a unit price or lump sum price, written with ink in both words and figures, for each of the separate items as called for. In case of discrepancy between the written words and figures, the sum denoted by written words shall be accepted. The bid may contain certain fixed price items which have been included merely for purpose of obtaining a contract price in the case that these items may be needed.

B. PRE-BID CONFERENCE

Bidders are not required, but are strongly encouraged to attend the Pre-Bid Conference but are invited to do so voluntarily.

C. INTERPRETATION OF APPROXIMATE ESTIMATE

Bidders are cautioned that the estimate of quantities contained in the bid will serve, as far as the Contract is concerned, only for the purpose of comparing bids. The basis of payment will be actual quantities of material supplied and of work performed and accepted, and if, upon the completion of the project the actual quantities should show either increase or decrease from the quantities shown in the approximate estimate, the unit prices bid in the Bid will still prevail.

D. BID SECURITY

No bid will be considered unless accompanied by a "Bid Security" of the character and amount indicated in the Bid Form, made payable to the Owner.

E. PUBLIC OPENING OF BIDS

Bids will be opened publicly and read at the hour and on the date set in the "Advertisement for Bids" or Notice to Contractors," in the office of the Owner. Bidders or their authorized agents are invited to be present.

F. EXAMINATION OF PLANS, SPECIFICATIONS AND SITE

It shall be the bidders responsibility to make a personal examination of the location of the proposed work and of the surroundings thereof, and their responsibility to thoroughly acquaint themselves with the details of the work to be done and all the conditions and obstacles likely to be encountered in the performance and completion of the work. It shall be the bidders further responsibility to inform themselves as to the facilities for the transportation, handling and storage of equipment and materials, and their responsibility to carefully study the plans, specifications and other contract documents and thoroughly satisfy themselves as to the conditions under which the work is to be done and as to the character, qualities and quantities of work to be performed and materials to be furnished, and be prepared to execute a finished job in every particular without any extra charge whatever, except as may be specifically provided for elsewhere in these contract documents. Test borings, rock profiles, rock classification, pipe or other underground objects where shown on the Contract drawings are approximation only and are not representations of the conditions that are actually present in the construction sites. Should the Contractor encounter quicksand, springs or any other materials or conditions not shown in the Contract Documents it shall be understood that the Owner has not warranted that such condition is or is not present. Therefore, claims arising from increase or decrease quantities, or otherwise, shall be disposed of in accordance with the requirements of the Specifications governing the particular question at issue.

G. DISQUALIFICATION OF BIDDERS

In addition to the causes stated in the County's Procurement Law, the following causes will be considered sufficient to disqualify any bidder:

1. Interest by the same person in more than one bid.
2. Collusion among or between bidders.
3. Unbalanced bids: That is, bids in which the prices bid for some items are out of all proportions to those bid for others. Whether or not such Bid is the lowest submitted.
4. Lack of responsibility on the part of bidders.

H. REJECTION OF IRREGULAR BIDS

Any Bid that has any omission, addition or item not called for in the Bid Form or that has irregularities of any kind, may be rejected. Any bid that does not contain prices set opposite each of the several items for which there is a quantity indicated or required in the Bid Form, or any bid which shall in any manner fail to conform to the conditions of the published notice inviting bids may be rejected.

3.0 AWARD AND EXECUTION OF CONTRACT

A. CONSIDERATION OF BIDS

Following the public opening of the Bids, they will be audited and studied for compliance with the Specifications. In the event of a discrepancy between the unit bid prices and the extensions (product of quantity and unit price), the unit price will govern.

B. AWARD OF CONTRACT

1. Contracts shall be awarded in accordance with the County Code in effect at the time of the award. The County reserves the right to waive or excuse any irregularities in awarding of contracts by taking curative action.
2. The Owner will hold bid securities submitted with the bids of the three (3) lowest responsible bidders until the execution and delivery of the contract documents, whereupon they shall be returned. All other bid securities will be returned following the opening and evaluation of bids.

C. CONTRACT BOND

The successful bidder will be required to be bonded to the Owner for a sum equal to 100% of the amount of his bid according to the form of bond attached to the Bid Form. All Contract Bonds submitted will be deemed to include all of the Conditions and Covenants stated in the Bond Forms provided by the County.

D. EXECUTION OF CONTRACT

The contract shall be signed by the Contractor and satisfactory contract Bonds furnished within ten (10) days after he has received notice of award. In case of failure on the part of the Contractor to enter into a contract and furnish the Contract Bonds as required, the guarantee accompanying his Bid will be forfeited to the Owner. Award may then be made to the next lowest responsible bidder, or the work re-advertised, or the Owner may proceed in any lawful manner it deems advisable to secure the accomplishment of the work.

E. SERVICE OF NOTICE

The mailing, in a United States post office box, of a written communication, notice or order, addressed to the Contractor at the business address filed with the Owner, or to this office at the site of the work, shall be considered as sufficient service upon the Contract of such communication, notice or order, and the date of service shall be the date of such mailing.

4.0 SCOPE OF WORK

A. INTENT OF WORK TO BE DONE

Any stated intent as to work or improvement is to prescribe that complete work or improvement which the contractor undertakes to do in full compliance with the Contract Documents, together with any authorized alteration, special provisions and supplemental agreements. The Contractor shall perform all items of work covered and stipulated in the Contract Documents, together with any authorized alterations, special provisions, extra work and supplemental agreements, all in accordance with the lines, grades, cross sections and dimensions shown on the plans in accordance with these Specifications.

B. SCHEDULE OF WORK TO BE DONE

Within fifteen (15) days after the award of the Contract, or as specified in the contract documents, the Contractor shall submit to the Director for approval a complete progress schedule for the work to be done in the form required by the Contract Documents. As a minimum, the schedule shall show the Notice to Proceed, the number of locations where work is proposed to be done concurrently, the kind of work so scheduled, and the dates the different kinds of work are scheduled to begin and to be completed. Allowance in the schedule shall be made for normal interruptions to operations due to repairs and maintenance of equipment and delays which are likely to be encountered due to weather conditions, material deliveries, and other similar interruptions that would affect the schedule. The schedule shall demonstrate that the Contractor will complete the work within the time specified, and the Contractor shall, if required, give evidence of his ability to carry out the work in accordance with the schedule. The schedule shall be used to monitor the Contractor's progress and shall be updated by the Contractor monthly as required by the Engineer.

C. MATERIAL TO BE FURNISHED BY THE CONTRACTOR

1. The Contractor shall do all the work and provide all labor tools, tackle, apparatus, machinery, equipment, transportation, pumping, insurance (both compensation and public liability) and materials, except as otherwise provided for, necessary to complete the work in all its parts, as shown or called for in, or as may be reasonably implied from, the Plans and Specifications. He shall complete the entire work, together with such extra work as may be required, at

the prices fixed therefore, to the satisfaction of the Owner and in accordance with the contract documents.

2. Within fifteen (15) days after the contract is awarded, the Bidder shall be required to furnish on forms provided by the Department of Public Works a complete statement of the origin, composition and manufacture of any or all materials to be used in the work, together with samples, as designated by the Owner, which samples may be subjected to the tests provided for in these specifications to determine their qualities and fitness for the work. All materials must be approved by the Director in writing before their delivery to the job site.
3. The Owner reserves the right to inspect pipe, joining material and all other material to be incorporated in the project at place of manufacture. Notice shall be given to the Director in sufficient time to allow for inspection of such materials at the place of manufacture.
4. If the Contractor makes claims regarding unavailability of material which would delay the progress of work, then the Contractor shall furnish satisfactory evidence to the Owner that all efforts have been made by him to procure the material on time.
5. Where any article is specified by proprietary name, trade name, and/or name of manufacturer, with or without the addition of such expressions as "or equal" or "or approved equal", it is to be understood that the article named and the quality thereof is intended to represent the minimum acceptable standard, which is subject to the approval of the Director; and it is distinctly understood; (1) that the Director is to use his own judgment in determining from time to time, whether or not any article or thing proposed to be substituted is the equal of any article or thing so specified; (2) that the decision of the Director on all questions of equality shall be final; (3) that, in the event of any adverse decision of the Director no claim of any sort shall be made or allowed against the County.
6. Contractor shall submit for approval shop drawings and/or material specifications/certifications of all material used in the project to the Owner, except for materials included in the current Approved List of Supplies and Materials for Water and Sewer Construction.

D. CONTRACT DRAWINGS

1. The contract drawings show the location, dimensions and sizes of the materials, on the lines and slopes, at the depths, with the connections and the manner in which they are to be placed as called for by the Specifications outlining the work and the materials to be provided for and placed under the contract, or in

accordance with such changes as may be approved from time to time during the progress of the work, as hereinafter provided.

2. The ground profiles shown on the drawings represent the grade elevations along the centerline of the structure or utility. Should the actual elevations of the profile over the structure differ from those shown in the drawings the Contractor shall be entitled to no additional compensation over the unit price bid for the actual depth classification encountered in the linear foot of pipe trenches, or the actual number of cubic yards excavated unless such difference exceeds two (2) feet. No additional payment, unless negotiated, will be made on lump sum bids where the actual elevations of the ground or surface over the structure differ from those shown on the profiles.

E. EXISTING UTILITIES SHOWN ON DRAWINGS

1. Water mains, storm drains, sanitary sewers, gas mains, and other utilities are shown on the drawings in accordance with the best information available for the information of the Contractor. The Owner assumes no responsibility for accuracy or completeness of information shown. It is the responsibility of the Contractor to verify the actual location of existing utilities prior to beginning work, and to maintain any utility location markings at no additional cost to the County.
2. Existing mains, services and their connections shall be carefully protected and any damage to them caused by the work, shall be immediately repaired using materials of the kinds damaged to the satisfaction of the Director by the Contractor at his expense.

F. REMOVAL AND DISPOSAL OF STRUCTURES AND OBSTRUCTIONS

1. All structures, materials, or resources within the right-of-way or construction area, which are not to remain in place or have not been designated for use in the construction, shall remain the property of the Owner, and shall be salvaged and stored or otherwise disposed of by the Contractor as hereinafter specified, indicated on the plans, or approved by the Director.
2. Materials resulting from work performed by the Contractor within the limits of construction and designated by the Director as unwanted will become the property of the Contractor and will be disposed of at the Contractor's expense off the job site.

G. MAKING CONNECTIONS TO EXISTING STRUCTURES

The Contractor shall, at his own cost and expense and as part of his work under the contract, furnish all labor, materials, tools and appliances, and do all work required for making connections to existing water or sewer structures, and the cost of making such connections shall be included in the prices bid for excavation and refill and refurnishing and laying pipe,

unless otherwise specified in the Bid or Special Provisions. Connections to existing structures shall be made only after all new lines are satisfactorily tested and approved by the Director. Actual dates and times of connection shall be approved by the Director.

H. CONSTRUCTION IN EASEMENTS AND RIGHTS-OF-WAY

Perpetual easements or rights-of-way will be secured by the County without cost to the Contractor. The County will also obtain permission from the owners of property to be occupied during construction, construction easements outside the limits of these perpetual easements or rights-of-way when authorized to do so by the Director. The Contractor shall confine his operations strictly within the limits of the perpetual easements and rights-of-way and construction easements, unless he has a written permission of the owner of the adjacent property to occupy additional ground. A copy of the written permission shall be furnished to the Director prior to the start of work. The Contractor must complete all the work required by the Forest Conservation Plan developed for the project. All trees located within the Maryland State Highway Administration Right-of-Way must be protected and saved from harm in accordance with the regulations of the Maryland State Department of Forestry (See Section 1000-6.0-J).

The Contractor shall so conduct his work in the easements and rights-of-way that there will be a minimum of disturbance of the properties crossed. Fences shall be disturbed as little as possible and if damaged or removed shall be replaced or restored at least equal to their original condition at the expense of the Contractor.

Upon completion of the work, the Contractor shall, at his own expense, clean up within the easements and rights-of-way and shall restore them at least to their original condition as part of the original Bid Contract Price. Any damage to property outside the limits of the easements or rights-of-way shall be repaired or replaced by the Contractor at his own expense.

No arrangements will be made for any means of access to the perpetual easements, rights-of-way or construction easements by the County; the Contractor shall therefore be required to make his own arrangements for access to the work within these points. Contractors are cautioned that only those areas designated on the Plans have been obtained for their Construction operations by the County. If they feel that these areas are insufficient for their needs they must account for the cost of additional easements or rights-of-way and/or special construction methods in their bidding of the work. Notification to the Director is required in writing of any additional easement acquired by the Contractor.

I. OWNER MAY INCREASE OR DECREASE QUANTITIES

1. The Owner reserves the right to increase or decrease the quantity of material to be furnished or work to be done under a unit price contract by not more than ten (10) percent of the original bid quantity of any item, except where items of indeterminate quantity

are involved such as Fixed Price Items in which a 25% increase, decrease or complete elimination of the original bid quantities shall be allowed. Such increase or decrease shall be allowed wherever the Director deems it advisable or necessary and such increase or decrease shall in no way violate the contract.

2. The Contractor will be paid for the actual quantity of authorized work done or material furnished under each item of the Bid, at the unit price stipulated for such item. In case the quantity of any item is increased as above provided, the Contractor shall not be entitled to compensation over and above the unit price bid for such item; and in case the quantity of any item is decreased as above provided, the Contractor shall have no claim for damages on account of loss of anticipated profits because of such decrease.

J. ADDITIONAL WORK

In instances where additional quantities of items noted in the Bid Form are required, the Contractor shall provide the necessary additional work, to fully complete the project regardless of the estimated quantities on the Bid Forms, and shall receive payment in full for such work at the prices shown in the Bid or supplemental agreement for similar classes of work in the same manner as if the quantities had been included in the original estimate of quantities.

K. EXTRA WORK

1. The Contractor shall do such extra work as may be ordered by the Director, in writing. No claim for extra work shall be considered or allowed unless the work has been ordered in writing by the Director. The Director and Contractor shall make every effort to come to a mutually agreed upon unit or lump sum price for the extra work. If a mutual agreement cannot be reached, the Director may require the Contractor to do such work on a force account basis to be compensated in accordance with the following:

Separate itemized statements and itemized bills, covering the extra work, shall be delivered to the Director before the fifteenth (15th) day of the following month. To all such bills shall be attached vouchers showing the cost of materials supplied by the Contractor that have actually been incorporated into such extra work. The Contractor shall permit such examination of his books, vouchers and accounts as the Director may require in checking bills for extra work. The amount to be paid the Contractor for extra work shall be made up of the following items:

- a. Wages of necessary day laborers and foreman actually employed on extra work, for such time as they are so employed plus forty-five (45) percent. This 45% shall include and cover all overhead, insurance, workmen's

compensation, etc. Superintendent's time will not be allowed.

- b. Actual purchase price, as paid by the Contractor, for materials actually incorporated into the extra work, to which costs shall be added an amount of equal to fifteen (15) percent. The Contractor shall review applicable tax laws related to sale and use taxes charged to Governmental Entities. Based upon that review, the Contractor shall include any applicable sales and use taxes in the bid price submitted.
 - c. Rental for vehicles, or heavy equipment or machinery while actually and actively used on the extra work. Rental rates shall be 100% of the current rates recommended by the Rental Rate Blue Book for Construction Equipment based on the following schedule:
 - i. If time of use is 3 days or less, figure hourly rates from the schedule of rates per day.
 - ii. If time of use is more than 3 days and less than 3 weeks figure the hourly rate from the schedule of rates per week. If time of use is 3 weeks or more, figure the hourly rate from the schedule of rates per month.
 - iii. To compute hourly rate use 8 hours per day, 40 hours per week, 176 hours per month.
 - d. Cost of work performed by an authorized subcontractor on extra work plus ten (10) percent.
2. Payment for extra work shall not include any allowance for the time of superintendents, timekeepers, water boys, or of any workmen or foremen not employed upon the extra work in question for a definitely and easily ascertainable period, nor for insurance of employees or for damage to the public, nor the use, maintenance or repair of tools, nor for the administrative expenses, nor for any rent, transportation, interest, depreciation or bonding cost or any other overhead, collateral or estimated expense, nor for any profit, all of which costs shall be deemed to be, and shall be, included in the allowance of forty-five (45) percent, and fifteen (15) percent, on labor and material items respectively.
3. All extra work shall be done as economically and expeditiously as possible, and under sufficient but not disproportionate supervision. Labor shall be furnished at the current rates and materials shall be charged at the lowest market prices. The Owner may, at its option, furnish any materials required for extra work and the Contractor shall not be entitled to any allowance or percentage on materials so furnished; and likewise the Owner may supply any necessary

machinery or equipment, and the Contractor shall not be entitled to any allowance thereupon.

4. The decision of the Director shall be final and binding upon all questions relating to extra work. If he shall deem that any extra work bill is unreasonable or improperly made up in any particular, he shall be empowered to require its revision and adjustment in accordance with such terms as he shall judge to be fair and reasonable.
5. The Director will certify for payment, proper bills made out as above provided and submitted before the prescribed date, upon each written order for extra work. Payment, as approved, for the work done under each extra work order completed under the contract during that month, and shall be subject to all the provisions of the contract relating to the payment of current estimates. Should the work under any extra work order remain uncompleted during any month, payment thereupon shall not be made until the current estimate is paid for the month during which the work under said extra work order is completed. The Contractor shall not be entitled to any claim for interest on any bill for extra work on account of delay in its approval.
6. All extra work shall be considered a part of the Contractor's responsibility to perform any required extra work, or to make satisfactory progress in its execution, the Contractor shall not interfere with the prosecution of such work by the Owners.
7. During the progress of extra work the Contractor shall continue with any or all parts of the work under the contract, or shall suspend any part of the work that may be necessary or required; and no claim by the contractor for extra compensation shall thereby be allowed. The Contractor, however, shall be entitled to an extension of time, to the extent that the Director shall certify that the work under the contract has been delayed by the performance of said extra work, provided that a request for such extension shall be submitted within the time prescribed for requests of this nature.

L. OMITTED ITEMS

In accordance with Section 1000-4.0-I, should any items contained in the bid be found unnecessary for the proper completion of the work contracted, the Director may, upon written order to the Contractor, eliminate such items from the contract and such action shall in no way invalidate the contract, and no allowance in payment to the contractor will be made for items so eliminated in making final payment to the Contractor except for such actual work as may have been done, materials actually purchased, and actual equipment costs prior to notification of the elimination of these items. However, material purchased but not used shall become the property of Worcester County, if payment is made under this subsection for such material.

M. UNAUTHORIZED WORK

1. Work done without lines and grades being given, work done without field stakeout and cut sheets, work done beyond the lines and grades shown on the plans or as given, except as herein provided, or any extra work done without written approval, will be considered as unauthorized and at the expense of the Contractor and will not be measured or paid for by the Owner. Work so done may be ordered removed and replaced at the Contractor's expense.
2. Borrow or any other materials shall not be obtained from areas adjacent to the work for incorporation therein without written approval by the Director, and in no event shall the removal of materials be such as to detract from the uniformity and neatness of the improvements.
3. All materials obtained contrary to the above restriction shall be considered unauthorized and shall not be measured or paid for, and further, upon order of the Director, in writing, all such materials shall be removed from within the limits of the work.
4. Where and when the Contractor requests and/or elects to perform work beyond the payment limits as specified, the Contractor will perform such work at his own expense.

N. RIGHTS IN AND USE OF MATERIALS FOUND ON THE WORK

Except as provided in preceding section, the Contractor, with the approval of the Director, may use in the proposed construction, suitable stone, gravel, top soil or sand found in the excavation, but he shall replace at his own expense with other suitable material all of that portion of the material so removed and used as was contemplated for use in the embankment, backfills, approaches or otherwise. No charge for material so used will be made against the Contractor except the replacement herein provided for, which item when deductible shall be made from the respective item of excavation used for its replacement. The Contractor shall not excavate or remove any material from within the limits of work which is not within the excavation, as indicated by the slope and grade lines, without written authorization from the Director.

O. PIPE LINES TO BE KEPT CLEAN

During the progress of the work and until the completion and final acceptance thereof, pipe lines and their appurtenances shall be kept thoroughly clean throughout. Obstructions or deposits, at any time discovered, shall be removed at once by the Contractor without extra compensation. After the completion of the work, the pipe lines and their appurtenances shall be left clean, free and in good order.

P. CLEANING UP

1. The Contractor shall, at his own expense, keep the site of his operations clean during the construction and remove all rubbish as it accumulates.
2. On or before the completion of the work, the Contractor shall, without charge therefore, tear down and remove all temporary structures built by him, shall remove rubbish of any kind from any grounds which he has occupied, and shall restore site of the work, curbs, drains, gutters, sidewalks, roadways and other surfaces to a clean and neat condition.

Q. WATER SUPPLY

The Contractor shall provide, at his cost and expense, such quantities of clean water as may be required for any and all purposes under the Contract. He shall take particular care to furnish his employees with potable drinking water. All sources of water supply shall be subject to the approval of the Director, and shall be indicated to the Director by the Contractor five (5) days before beginning work, so that examinations of said supplies can be made.

R. SANITARY ARRANGEMENTS

Approved sanitary conveniences for the use of laborers and others employed on the work, properly secluded from public observation, shall be constructed and maintained by the Contractor, at his own cost and expense, in such manner and at such points as shall be approved or directed and their use shall be strictly enforced. The collections in the same shall be disinfected and removed when and as directed.

S. CARE AND PROTECTION OF WORK

From the commencement of the work until its completion and acceptance by the Owner, the Contractor shall be solely responsible for the care of the work, and all injury or damage to the same, from whatever cause, shall be repaired or replaced at the Contractor's expense, before the final estimate is made. The County reserves the right to direct the Contractor to repair or replace. He shall provide suitable means of protection for all materials intended to be used in the work in progress, as well as for completed work.

T. ROCK SHOWN ON DRAWINGS

1. Where rock is shown on the plans or in boring logs it has been so shown from the best information available and it is shown for the information of all parties concerned; however, the Owner assumes no responsibility for the accuracy of such information and should any Bidder or Contractor rely on such information in preparing his bid or in the performance of the work, he does so at his own risk.

2. Whether or not rock is shown on the plans, the Contractor is not relieved of the responsibility of making his own investigations to determine for himself if rock is present. Where the bid is at unit prices, the presence or absence of rock or the increase or decrease in quantities of rock shall not entitle the Contractor to additional compensation beyond the unit prices stipulated or bid for rock excavation.

5.0 CONTROL OF WORK AND MATERIALS

A. SUPERVISION AND DIRECTION OF WORK

1. The contractor shall supervise and direct the work efficiently using his best skill and attention. He shall be solely responsible for the techniques and sequences of construction. The work shall be prosecuted by the Contractor in such a manner, and with sufficient materials, equipment and labor, as is considered necessary to insure completion on or before the time specified.
2. The contractor shall keep a competent supervisory staff on the work site at all times during its progress, that is acceptable to the Director. The superintendent shall not be changed except with the consent of the Director, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be his employee.
3. The Director shall not be responsible for the acts or omissions of the Contractor, or any subcontractor, or any of his or their superintendents, or employees.
4. The Contractor shall maintain a local telephone at which a competent representative can be reached at all times, 7 days a week, 24 hours a day. This authorized representative shall have the capability of responding with positive corrective action to emergency calls from local officials (Sheriff's Dept., State Police and Department of Public Works personnel).

B. NOTICES TO SUPERINTENDENTS

All notices and instructions to the superintendent shall be given by the Director. Important instructions and notices shall be confirmed in writing to the Contractor.

C. LINES, GRADES, ELEVATIONS, ETC.

1. The Contractor will furnish the field stakeout of all necessary lines, grades and elevations to complete the work as shown on the Plans and Specifications for all County Contracts. Horizontal and vertical control data will be furnished to the Contractor by the County. All field stakeouts must be performed by a licensed Professional Engineer or Professional Land Surveyor, registered in the State of Maryland. Stakeouts will include all services and house connections.

2. The Contractor shall preserve and maintain in proper condition all stakes, grade-boards and lines until authorized to remove them. Any stakes, grade boards, and lines disturbed during the project shall be reset at the Contractor's expense.
3. The Contractor shall furnish, when and as required, all necessary materials, labor and assistance for the setting of all stakes, grade-boards, lines, forms, etc., which may be required for the proper construction of the work.
4. Finished surfaces, in all cases, shall conform with the finished grade of the street, or as shown in the contract documents.

D. INSPECTION

1. The Director will appoint such persons as he may deem necessary to inspect the materials furnished or to be furnished, and the work done under the Contract and to see that the same is proceeding in accordance with the Contract Documents. Materials and workmanship shall be always subject to the approval of the Director, but no inspection, approval or acceptance of any part of the work contracted for, or of the materials used or any payment on account thereof, shall prevent the rejection of said work or materials at any time thereafter during the existence of the contract, should said work or materials be subsequently found to be defective, or not in accordance with the requirements of the contract.
2. Work and material will be inspected promptly, but, if for any reason, delay should occur, the Contractor shall have thereby no claim for damages or extra compensation.
3. The Contractor shall furnish the Director with every reasonable facility for ascertaining whether or not the work performed and materials used are in accordance with the requirements and intent of the Specifications and Contract. If the Director requests it, the Contractor shall, at any time before acceptance of the work, remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the Specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed shall be paid for as extra work, but should the work so exposed or examined prove unacceptable, the uncovering or removing, the replacing of the covering or making good of the parts removed, shall be at the Contractor's expense. No rework under this provision shall be done nor materials used without inspection by the Owner.
4. The Contractor shall pay for all inspection costs necessary to complete the work that are incurred by any other agency than the

Owner or its duly authorized representatives, such as any railroad, or any public service utility company, or any governmental agency or any other agency whose jurisdiction affects the work in any manner unless otherwise specified herein, or in the Contract.

5. For privately funded projects or developer projects, the Developer shall pay the cost of all inspection costs necessary to complete the work.
6. For County capital projects, the Contractor shall notify the Director in writing of his intended working hours and will obtain approval of the Director before revising these hours. The inspector will be paid for all work hours other than during normal County working hours. The billing rate will be noted in the contract documents or at a rate of one and a half (1 1/2) times the current inspection fee, and this payment will be subtracted from the monthly payment due the Contractor. The following times are to be considered hours other than normal working hours.
 - a. Contractor work performed on Saturday and Sunday; and
 - b. County Holidays; and
 - c. Special No-work Days as designated by the County; and
 - d. Hours of a Contractor's work day in which he work in excess of eight (8) hours.

E. AUTHORITY AND DUTIES OF INSPECTORS

1. Inspectors shall be authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials to be used. The Inspector is not authorized to revoke, alter or waive any requirements of the Contract, nor is he authorized to approve or accept any portion of the complete project. He is authorized to call the attention of the Contractor to any failure of the work or materials to conform to the Specifications and Contract. He shall have the authority to reject materials or suspend the work until any questions at issue can be referred to and decided by the Director. Inspectors shall perform their duties at such times and in such manner as will not unnecessarily impede progress under the contract.
2. The Inspector shall in no case act as foreman or perform other duties for the Contractor, nor interfere with the management of the work by the Contractor. Any advice which the Inspector may give the Contractor shall not be construed as binding the Director in any way, or releasing the Contractor from fulfilling all of the terms of the Contract, or complying with these regulations or other applicable laws.
3. Where there is disagreement between the Contractor (or his representative) and the Inspector, such as, refusal by the Contractor to use properly approved materials; for performing

work not in compliance with Plans and Specifications; and/or refusing to suspend work until problems at issue can be referred to and decided by the Director, the Inspector will immediately notify the Director as to the issue of disagreement and if the Contractor still refuses to make corrections, comply or suspend work, the Director will prepare and deliver in writing to the Contractor, by mail or otherwise, a written order suspending the work and explaining the reason for such shutdown. As soon as the Inspector is advised of the delivery of the shutdown order, the Inspector shall immediately leave the site of the work and any work performed during the Inspector's absence will not be accepted or paid for.

F. OFFICE SPACE FOR INSPECTOR

1. When required by the Director, the Contractor shall provide a suitable field office in an approved location in the immediate vicinity of the site for the exclusive use of the Resident Inspector. The office shall be a trailer or suitable building set up, equipped and made ready for use (including all utilities) prior to the beginning of work on the project and shall remain operative until all field records pertinent to the project have been completed. It shall be separated from any buildings used by the Contractor. The Contractor shall, within the price bid and without extra cost to the Owner, pay all costs of providing, operating and maintaining the field office including but not limited to charges for electrical and local telephone service (excluding long distance telephone calls), sanitary facilities, heating, fuel oil, etc.
2. The office shall be weather-tight, secured, heated or air conditioned as the season requires, adequately lighted by 110 volt 60 cycle electric lights, and as a minimum, have the following furnishings: desk, chair, plan rack, telephone, and file cabinet with an approved lock.

G. DEFECTIVE WORK AND DEFECTIVE MATERIALS

1. No inspection and no failure to inspect, nor the presence of any employees of the Owner during the execution of the work, and no approval or acceptance of any part of the work herein contracted for or of the materials and equipment used therein shall relieve the Contractor of any of his obligations to fulfill his Contract, or shall prevent the rejection of said work, materials and equipment, in whole or in part, at any time thereafter, should said work, materials and equipment be subsequently found by the Director to be defective or not in accordance with the requirements of the contract documents.
2. All materials not conforming to the requirements of the Contract Documents shall be considered as defective and all such materials, whether in place or not, shall be rejected and shall be removed immediately from the site of the work, unless otherwise

permitted by the Director. No rejected material, the defects of which having been subsequently corrected, shall be used until approval has been given. Upon failure on the part of the Contractor to comply with any order of the Director made under the provisions of this article, the Director shall have authority to remove and replace defective materials and to deduct the cost of removal and replacement from any monies due the Contractor.

3. The Contractor shall furnish the Director with adequate documentation to show that the work performed and materials used are in accordance with the requirements and intent of the Contract Documents. At the request of the Director, the Contractor shall, at any time before acceptance of the work, remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the Contract Documents. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed shall be paid for as extra work, but should the work so exposed or examined prove unacceptable to the Director, the uncovering or removing, the replacing of the covering or making good of the parts removed, shall be at the Contractor's expense. No rework under this provision shall be done nor materials used without inspection by the Owner.

H. FAILURE TO REMOVE AND RENEW DEFECTIVE MATERIALS AND WORK

1. Should the Contractor fail or refuse to remove and renew any defective materials used, or work performed previously, or to make any necessary repairs in an acceptable manner and in accordance with the requirements of these Specifications within the time indicated in writing, the Director shall have authority to cause the unacceptable or defective materials or work to be removed and renewed or such repairs to be made or defects corrected at the Contractor's expense.
2. Failure or refusal on the part of the Contractor to make any or all necessary repairs promptly, fully and in an acceptable manner, shall be sufficient cause for the Owner to declare the contract forfeited, in which case the Owner may purchase materials, tools and equipment, and employ labor, or may contract with any other individual, firm or corporation to perform the work. Any and all cost or expense incurred by the Owner in making these removals, renewals or repairs, which the Contractor has failed or refused to make, shall be charged against the defaulting Contractor and the amount thereof deducted from any monies due or which may become due him under the contract. Any work performed, as described in this paragraph, shall not relieve the Contractor of his responsibility for the work performed by him.

I. SUSPENSION OF WORK

The Owner may suspend the whole or any part of the work under the Contract, if in its judgment such action is necessary or advisable. Any claim for damages from such action shall be subject to the terms of the paragraph entitled "CLAIMS FOR DAMAGE" in Section 1000-6.0-E, GENERAL PROVISIONS. No allowances, however, will be made for minor interruptions to the work, from whatever cause.

J. INTERPRETATIONS BY DIRECTOR

1. The Director shall make all necessary interpretations as to the meaning and intent of the specifications and drawings, and shall give all advice and assistance as contemplated therein or thereby, or in every case in which a difficult or unforeseen condition arises during the prosecution of the work. Should there be any discrepancies in or between, or should any misunderstanding arise as to the import of anything contained in the drawings and specifications, the interpretation of the Director shall be final and binding. Any errors or omissions on the drawings or in the specifications may be corrected by the Director when such corrections are necessary for the proper fulfillment of their intent.
2. The Director shall in all cases determine the amount, quality and acceptability of the work to be paid for under the contract, and shall decide all questions in relation to said work. His decision and estimate shall be final and conclusive, and in case any question shall arise between the parties touching the contract, such decision and estimate shall be a condition precedent to the right of the Contractor to receive payment under that part of the contract which is in dispute.
3. Interpretations will be rendered by the Director as promptly as possible but should delay occur for any reason, the Contractor shall have thereby no claim for damages or extra compensation.

K. ALTERATIONS OF PLANS OR OF CHARACTER OF WORK

1. The Director reserves the right to change the alignment, elevation, grade, form, length, dimensions or materials of the work under the contract, whenever any conditions or obstructions are met that render such changes desirable or necessary. All such alterations shall be paid for at a unit price bid for these items of work, except as follows:
 - a. In case such alterations make the work less expensive to the Contractor, a proper deduction shall be made from the contract prices and the Contractor shall have no claim on this account for damages or for anticipated profits on the work that may be dispensed with.

- b. In case such alterations make the work more expensive, a proper addition shall be made to contract prices. Any such deduction or addition shall be subject to the approval of the Director.
 2. Any changes and/or alteration to the approved contract documents shall be submitted and approved by the Director prior to beginning work on that item. Minor alterations may be noted on the as-built drawings if approved by the Director.

L. COORDINATION OF PLANS, SPECIFICATIONS AND SPECIAL PROVISIONS

These specifications, the accompanying Plans, Special Provisions and all supplementary documents are essential parts of the Contract. They are intended as to be mutually supplementary and to describe and provide for a complete work. In case of discrepancy, figure dimensions shall govern over scale dimensions. Plans shall govern over Specifications. Special Provisions shall govern over both Specifications and Plans.

M. COOPERATION OF CONTRACTOR REQUIRED

The Contractor will be supplied by the Director with five copies of the Plans and of the Specifications, and the Contractor shall have available at the site of work at all times, during the prosecution of the work, one copy each of said plans and specifications. The Contractor shall give the work his constant attention to facilitate the progress thereof and shall cooperate with the Owner in every way possible. He shall at all times have a competent English-speaking representative on the work site, authorized to receive orders and act accordingly.

N. OTHER CONTRACTORS

1. The Contractor shall cooperate with and so conduct his operations as not to interfere with or injure the work of other contractors or workmen employed by the Owner. He shall promptly make good, at his own expense, any injury or damage which may be done by him or his employees or agents on the work.
2. The Contractor shall suspend such part of the work herein specified, or shall carry on the same in such manner as may be ordered by the Director, when necessary to facilitate the work of such other contractors or workmen.

O. SOURCE OF SUPPLY AND QUALITY OF MATERIALS

1. In conjunction with Section 1000-4.0-C the source of supply of each of the material shall be approved in writing by the Director before the delivery is started. Representative preliminary samples of the character and quantity prescribed shall be submitted by the Contractor or producer, said samples being taken under the observation of the Director, for examination, and tested in accordance with the methods referred to herein. Only materials

conforming to the requirements of these specifications and approved by the Director shall be used in the work. No materials which, after approval, have in any way become unfit for use, shall be used.

2. Unless a material has a satisfactory record of performance, the Director reserves the right to withhold approval of a new source of supply, even though it meets the specification requirements, until its qualities have been verified and proved in actual service.
3. Tests of all materials specified will be made in accordance with the latest official approved methods effective as of the date of Contract as described in the Special Provisions, on the Contract Drawings or in these Standard Specifications, for the specified material. When A.S.T.M., A.A.S.H.T.O., A.S.A., A.W.W.A., or Federal Specification standard specifications and serial numbers are stipulated, the reference shall be construed to be the latest effective specification. If material previously certified is subsequently declared substandard or unfit for the intended use by the certifying agency, the Director may declare the unused materials unsatisfactorily or unfit for use under the Contract.
4. The Contractor shall furnish every facility for the verification of all scales, measures and other devices which he operates.

P. STORAGE OF MATERIALS

1. Materials shall be stored so as to insure the preservation of their quality and fitness of the work.
2. The portion of the easement or right-of-way not required for public travel may be used for storage purposes and for the placing of the Contractor's plant and equipment, and any additional space required, unless otherwise stipulated, shall be provided by the Contractor at his expense.
3. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored material.

Q. CONDITIONAL ACCEPTANCE (CAPITAL PROJECTS ONLY)

Whenever, in the course of performance of a Contract, the Contractor shall consider the work to have been properly completed and ready to be accepted by the County, the Contractor shall make a written application for conditional acceptance for the Contract, and payment based upon the Contractor's final estimate of the value of authorized work done under the terms of the Contract. The Contractor shall also certify to the County the completion of the work, the amount of his final estimate, and the total amount due to be paid the Contractor pursuant to the Contract. Prior monthly estimates are subject to correction in the Contractor's final estimate. Such application and final estimate shall be submitted to the Director for verification and approval prior to payment. Upon receipt of

such application and the Contractor's final estimate, the County will make an inspection of the work. Upon completion of all repairs or replacements by the Contractor which may appear at that time in the judgment of the County to be necessary, the County will process the Contractor's final estimate for Conditional Estimate Payment.

If, at the conclusion of the conditional acceptance inspection requested by the Contractor as described above, additional tests, testing, and/or reinspection is required because of failures or defects due to improper or faulty construction, materials, and/or equipment furnished and/or installed by the Contractor, or for other reason(s) attributable to the Contractor's performance of work under the terms of this Contract, or because of lack of preparation for delivery of documentation required by this Contract as a condition to conditional acceptance, all costs of County personnel, equipment, utilities, and services associated with the reinspection(s) and/or retest(s) will be deducted from amounts retained or to be paid to the Contractor.

The date of this conditional acceptance certification will be the beginning of a one year guarantee period (unless noted otherwise), during which the Contractor shall at his own cost and expense, make all repairs and replacements which, in the judgment of the County, may become necessary during the guarantee period on account of any failures or defects due to improper construction or materials furnished by the Contractor. During the guarantee period, should the Contractor fail to make needed repairs and replacements within 14 calendar days of service of notice by the County, the County shall be empowered to make any repairs or replacements and the cost of the required repairs or replacements shall be the financial responsibility of the Contractor. To insure the County against the nonpayment of such costs, the County will either require the retainage of 10 percent of the total value of the Contract plus the value of work remaining at the time of Conditional Acceptance or require the Contractor to post an equivalent Maintenance Bond.

R. FINAL ACCEPTANCE

Upon expiration of the aforesaid guarantee period, the County will make a final inspection of the work under the Contract, and if at such inspection all construction provided for and contemplated by the Contract is found completed, such inspection shall constitute the final inspection and the County shall make the final acceptance as of that date and the Contractor shall be notified of such acceptance. After final acceptance, the County will assume responsibility for maintenance, repairs, and/or replacement except where otherwise provided by the Contract.

6.0 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

A. LAWS TO BE OBSERVED

The Contractor shall at all times observe and comply with all Federal, State and/or local law ordinances, rules and regulations in any manner affecting the conduct of the work, and all such orders or decrees as exist

at present and those which may be enacted later, by bodies or tribunals that have jurisdiction or authority over the work, and shall indemnify and save harmless the Owner, its agents or servants against any claims or liability arising from or based on violations of any such law, ordinance, regulation, order or decree, whether by himself or by his employees.

B. CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

1. Compensation and Employer's Liability Insurance

The Contractor shall procure and maintain during the life of the Contract statutory Workers' Compensation and Employer's Liability Insurance for all of his employees to be engaged in work on the project under the contract and, in case any such work is sublet, the Contractor shall require and the Subcontractor is similarly required to provide Workers' Compensation and Employer's Liability Insurance for all of the latter's employees to be engaged in such work in an amount of not less than One Million Dollars (\$1,000,000.00).

2. Bodily Injury Liability and Property Damage Liability Insurance

The Contractor shall procure and maintain during the life of the contract Bodily Injury Liability and Property Damage Liability Insurance to protect him and any Subcontractor performing work covered by the contract from claims for damages for personal injury, including accidental death, as well as from any claims for property damage, which may arise from operations under the contract, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by either of them, and the amount of such insurance should not be less than:

- a. Bodily Injury Liability Insurance in an amount not less than One Million Dollars (\$1,000,000.00) for injuries including wrongful death to any one person, and subject to the same limits for each person in an amount not less than One Million Dollars (\$1,000,000.00) on account of one accident.
- b. Property Damage Insurance in an amount not less than that specified to fully and completely insure said property.
- c. Fire Insurance: The Contractor shall have adequate fire and standard extended coverage insurance with a company acceptable to the Owner, that covers the project under Contract. The insurance shall provide protection at all times against loss by the Owner and Contractor until final acceptance of the work.

3. The Contractor shall file insurance certificates with the Owner prior to execution of the contract.

4. Written in the body of the certificate shall be:
 - a. "In the event of cancellation of the insurance, the Owner shall be given ten (10) days prior written NOTICE BY THE INSURANCE COMPANY."
 - b. "This certificate covers Contract(s) Number(s) ; Name of job, i.e., Ocean Pines Wastewater Treatment Plant."

C. PATENT FEES, ROYALTIES AND LICENSES

Whenever any materials, process, composition or thing used in the work done or materials furnished, under the contract are covered by Letters Patent, the Contractor, before using or employing such material process, composition or thing, must secure the assent in writing of the Owner or licensee of such Letters Patent and file same with the Director. In the event that the Contractor shall fail to obtain such prior consent, he and his surety Bond given for the faithful performance of his work under the Contract, shall be liable to the Owner for any and every claim, suit or demand brought against the Owner by reason of any default or neglect of the Contractor to obtain the assent in writing of such owners or licensees of such Letters Patent.

D. PERMITS AND LICENSES

1. Such permits, licenses, insurance policies, etc., as may be necessary in order to comply with Federal, State or local laws in conducting the work, shall be provided by the Contractor/Developer at his own expenses, except as otherwise provided.
2. The Owner has or will obtain a permit for any work within the State, County or Municipal Rights-of-Way, Railroad Rights-of-Way, and the Contractor shall perform all work in accordance with the requirements of this permit and to the satisfaction of the Director. Copies of any permit obtained by the Owner will be included with the bid forms at the time of bidding.

E. CLAIMS FOR DAMAGES

1. If the Contractor shall claim compensation for any damage sustained by reason of the acts of the Owner, or any official or agent thereof, he shall within ten (10) days after sustaining such damage make a written statement to the Director of the nature of the damage sustained, and shall, on or before the fifteenth (15th) day of the month succeeding that in which he shall allege that such damage has been sustained, file with the Director an itemized statement of the details and amount of the details and amount of such damage.
2. Whenever it shall appear to the Contractor that, due to the exigencies of the work, he is about to incur damage, owing to the

neglect or refusal of the Director to issue an extra-work order or to any other cause whatever, he shall at once notify the Director or his representative in writing, of such fact and state the nature of his possible claim, in order that the Director may obtain necessary and authentic information to guide future consideration and action on such claim and unless the Contractor shall comply with this requirement his claim for damage shall be fortified and invalidated. Such notifications shall not take the place of, but shall be in addition to, written statement herein above required to be submitted within ten (10) days after the occurrence of and alleged cause of damage.

3. In any case where the Contractor deems extra compensation is due him for work or materials not clearly covered in the contract, or not ordered by the Director as an extra, as defined herein, the Contractor shall notify the Director in writing of his claim for such extra compensation and receive the approval of the Director before he begins the work on which he bases the claim. If such notification is not given, or the Director is not afforded proper facilities by the Contractor for keeping strict account of actual cost, then the Contractor is deemed to have waived the claim for such extra compensation and or not have had a valid claim initially. In case the claim is found to be just, it shall be allowed and paid as an extra as provided for herein for extra work under Section 1000-4.0-K.

F. PUBLIC CONVENIENCE AND SAFETY

1. The Contractor at all times shall conduct the work in such a manner as to ensure the least obstruction to traffic practicable. The convenience and services of the general public and of the residents along and adjacent to the improvement shall be provided for in an adequate and satisfactory manner. Material stored along the improvement shall be placed so as to cause as little obstruction to the traveling public as is considered necessary. The Contractor shall, unless otherwise specified, provide and maintain in passable condition such temporary highways and bridges as may be necessary to accommodate the traffic diverted from the roadbed affected by the construction, and he shall provide and maintain in a safe condition temporary approaches to, and crossing of, intersecting highways. On highways occupied by a railway, vehicle access shall be provided and maintained by the Contractor in an approved manner. Fire hydrants on or adjacent to the improvement shall be kept accessible at all times to fire fighting personnel and equipment.
2. In the performance of their work, all contractors shall comply with all applicable Local, State, and Federal safety and health laws and regulations.

G. USE OF EXPLOSIVES

1. The use of explosives will not be permitted unless authorized in writing by the Director. When use of explosives is permitted, the Contractor shall use the utmost care so as not to endanger life or property; and whenever necessary the number of charges and size of the charge shall be reduced. The Contractor's attention is directed to the necessity of safeguarding the public during dynamiting operations, and a sufficient number of watchmen, flagmen, signs, etc. shall be used to warn motorists during periods of blasting. All explosives shall be stored in a secure manner, and all such storage places shall be marked clearly -- "Dangerous Explosives"--and shall be in care of competent watchmen at all times. Explosives shall be stored and handled in conformity with provisions of the statutes of the State of Maryland and local laws and ordinances.
2. The Contractor shall notify each property owner/resident and public utility company having structures in proximity to the site of the work of his intention to use explosives, and such notice shall be given sufficiently in advance to enable the property owners/residents and companies to take steps as they may deem necessary to protect their property from injury. Such notice shall not relieve the Contractor of any responsibility for damages which may occur as a result of his operations.
3. Expert powder men licensed by the State Fire Marshal shall be employed by the Contractor for handling and use of explosives, and all their work shall conform to these requirements.
4. The Contractor shall notify the Worcester County Fire Marshal's Office of his intention to use explosives, at least 48 hours in advance so the Fire Marshal's office can schedule their operations.
5. The authorization by the Director for use of explosives shall not relieve the Contractor of his full responsibility for damages which may occur or for obtaining all necessary permits.
6. The Contractor must file a copy of the blasting permit with the Director prior to the use of any explosives. The cost of the blasting permit shall be borne by the Contractor.

H. MAINTENANCE OF TRAFFIC

Unless otherwise noted in the Special Provisions, it shall be the responsibility of the Contractor to maintain highway and pedestrian traffic safely, adequately, and continuously on all portions of the project. Traffic control shall be in accordance with the Worcester County or Maryland State Highway Administration approved traffic control plan. Where it has previously been established that traffic cannot be maintained, specific information relative to the use of detour routes and working restriction, if

any, will be included in the Contract Documents. If, during the conduct of the work, conditions are such that traffic cannot be maintained and other routes are available, the Contractor may with the approval of the Director request that the Division of Engineering and Transportation establish a detour route.

The Contractor shall, at his own cost and expense, furnish all watchmen, detour signs, road closure signs, and barricades in accordance with the approved traffic control plans and erect them at locations designated by the Director prior to the initiation of any work.

The cost of maintaining traffic as noted above shall be considered as incidental to other items and included in the price bid for them except when a special item for "Maintenance of Traffic" is provided in the Bid Form.

I. PRESERVATION AND RESTORATION OF PROPERTY, TREES, MONUMENTS, ETC.

The Contractor shall not enter upon private property for any purpose without obtaining permission, and shall be responsible for the preservation of all public and private property, trees, monuments, etc., along and adjacent to the work and shall use every precaution necessary to prevent damage or injury thereto. He shall use adequate precautions to prevent damage to tracks or pipes, conduits and other underground structures, and shall protect carefully from disturbance or damage all land monuments and property marks until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed, and replacement of same shall be borne by the Contractor. The Contractor shall not willfully or maliciously injure or destroy trees or shrubs and he shall not remove or cut them without proper authority. He shall be responsible for all damage or injury to property of any character, during the prosecution of the work, resulting from any act, omission or misconduct in his manner or method of executing said work or due to the non-execution thereof on the part of the Contractor; he shall restore, at his own expense, such property to a condition at least equal to that existing before such damage or injury was done, by repairing, rebuilding or otherwise restoring, as may be directed, or he shall make good such damage or injury, in an acceptable manner. In case of the failure on the part of the Contractor to restore such property, or make good such damage or injury, the Director may, upon forty-eight (48) hours notice, proceed to repair, rebuild or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from the monies due or which may become due the Contractor under his contract. Mail service shall be maintained at all times.

J. REQUIREMENTS OF THE MARYLAND DEPARTMENT OF STATE FORESTS AND PARKS

1. In conjunction with Section 1000-4.0-H 1-D-8, the attention of the Contractor is called to the fact that he will be required to protect

and save from harm those trees which have been designated on the Contract drawings.

2. It will be required that the Engineer secure a permit from the Maryland Department of State Forest and Parks, which will be made part of the Bid Documents.
3. The Contractor must assume all expenses incurred by inspection and supervision service required by the Maryland Department of State Forest and Parks, and it is, therefore, necessary for the Contractor to contact the Maryland Department of State Forest and Parks' local District Office for further information.

K. INDEMNIFICATION OF THE OWNER

1. The Contractor shall indemnify and save harmless (including, but not limited to, compensation of attorney fees) the Owner and its officers, agents, and employees from all suits, actions, or claims of any character, name and description brought for or on behalf of persons or property due to any neglect in safeguarding the work, the use of unacceptable or defective material in the construction of the work, or on account of any act or omission, neglect, or misconduct of the Contractor, its agents, employees, or subcontractors.
2. The Owner may retain as much of the monies due the Contractor as shall be considered necessary by the Owner to assure settlement of said suits, actions or claims. In case no monies are due, the Contractor's bond shall be held until all suits, actions, or claims thereon have been settled and suitable evidence to that effect furnished to the Owner.

L. NO WAIVER OF LEGAL RIGHTS

The Owner shall not be precluded or estopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefor, from showing the true amount and character of the work performed and materials furnished by the Contractor, from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor from showing that the work or material does not in fact conform to the Contract. The Owner shall not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate, any payment in accordance therewith, from recovering from the Contractor or its sureties, or both, such damage as it may sustain by reason of its failure to comply with the terms of the Contract. Neither the acceptance by the Owner or any representative of the Owner, nor any payment for the whole or any part of the work, nor any extension of time, nor any possession taken by the Owner, shall operate as a waiver or any portion of the Contract or of any power herein reserved, or any right to damages.

The waiver of any breach of the Contract shall not be held to be a waiver of any other or subsequent breach.

M. WAIVER OF CONTRACT

Neither the acceptance of the whole or any part of the work by the Director nor any order by the Owner for the payment of money, nor any payment by the Owner for the whole or any part of the work, nor any extension of time, nor any possession taken by the Owner or its employees, shall operate as a waiver or any portion of the Contract or of any power therein reserved to the Owner, or any right to damage therein provided, nor shall any waiver of any breach of the Contract be held to be a waiver of any other or subsequent breach.

7.0 PROSECUTION AND PROGRESS

A. TIME OF BEGINNING AND COMPLETION

1. The Contractor shall accept a Contract with the understanding and intention to perform fully, entirely and in an acceptable manner the work contracted for within the Contract time stipulated in the Bid, accounting from the date provided in the Notice to Proceed. Time is of the essence in all Contracts.
2. The Contractor shall attend and participate in a Pre-Construction Meeting at a time and place indicated by the Owner. The Contractor's Superintendent must attend such meeting, as well as any other key personnel from the Contractor's work force deemed necessary by the Owner.
3. In connection with the improvement, the right is reserved to award any work not included in the Contract to another Contractor for performance during the progress of the Contract, or to perform such work by Owner's forces, and the Contractor for this Contract shall cooperate and so conduct his operations as to minimize the interference therewith.
4. When the Contract time is on a calendar day basis, it shall consist of the number of consecutive calendar days stated in the Contract, including all Sundays, holidays, and non-work days, but excluding all calendar days elapsing between the effective dates of any orders of the Director to suspend and resume operations. If, however, the prosecution of the work shall be delayed or suspended in consequence of the Contractor's inability to obtain the necessary materials, or in consequence of any act or omission of the County and not by any fault of the Contractor, then the time for completion of the work shall be increased by a period of time equal to the aggregate time expressed in calendar days, and parts of days, during which the prosecution of the work has been so delayed or suspended.

5. No allowance shall be made for delay or suspension of the prosecution of the work due to the fault of the Contractor. The Contractor, under certain conditions, may be ordered or after written application to the Director, be granted permission, in writing to suspend operations in whole or in part. During such periods if, the Contractor elects, and is permitted in writing, by the Director, to do any work, the time charged shall bear the same ratio to the total time allowed for completion of the work as the value of work performed bears to the total value of the Contract. Work of an emergency nature ordered by the Director for the convenience of the traveling public or for the production or delivery of materials for storage, if performed during such periods of suspension, shall not be charged to the Contract time.
6. Following the date on which all work has been completed except those landscaping items on which work is restricted to specified seasons and when final inspection and acceptance is being deferred pending completion of those landscaping items on which work is not permissible at the time because such work is currently out of season, and for no other reason, no time shall be charged against the Contractor until such time as it is again permissible to proceed with such work. However, time shall be charged during any extensions of the specified season which may be granted the Contractor.
7. If the satisfactory execution and completion of the Contract, as awarded and exclusive of extra work thereafter authorized, shall require work or material in greater amounts or quantities than those set forth in the Contract, then the number of days allowed for completion shall be increased in the same proportion as the additional work bears to the original work contracted for, figured at the Contract prices.
8. The Director shall compile a statement showing the date the Contractor was required to complete all the work, in accordance with all the terms and provisions of the Contract, as compared with the time actually consumed by the Contractor in so completing said work, and also showing the recommendations of the Director as to the number of days, if any, for which the Contractor shall pay liquidated damages.
9. The above statement, after being compiled by the Director, shall be certified by him and forwarded with his recommendations to the Director of Procurement.

B. SUB-LETTING AND ASSIGNMENT

1. The Contractor shall give his personal attention constantly to the faithful performance of the work, shall keep the same under his own control, and shall not assign the Contract by power of attorney or otherwise, nor sublet the work or any part thereof, without the previous written consent of the Director. He shall state

- to the Director, in writing, the name of each subcontractor he intends to employ, the portion of the work which he is to do, or the materials which he is to furnish, his place of business and such other information as the Director may require in order to know whether such subcontractors are reputable and reliable, and able to perform the work or to furnish the materials as called for in the Specifications. A subcontractor may not sublet work assigned to him.
2. The Contractor shall perform with his own organization work amounting to not less than 50 percent of the remainder obtained by subtracting from the total original Contract value the sum of any items designated in the Contract Special Provisions as "Specialty Items." Only complete items may be sublet.
 3. The Contractor shall not, either legally or equitably, assign any of the moneys payable under the Contract, or his claims thereto, unless by and with the like consent of the Director.
 4. The Contractor shall not be released from any of his liabilities or obligations under his Contract should any subcontractors fail to perform in a satisfactory manner the work undertaken by him or them.
 5. The Contractor shall be as fully responsible to the County for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.
 6. Nothing contained in the Contract Documents shall create any contractual relation between any subcontractor and the County.

C. WORKMANSHIP

All work shall be performed and all materials furnished in carrying out the Contract shall be of the character and quality required by the Contract documents. Where no standard is specified for such work or materials, they shall be the best of their respective kinds. Any unsatisfactory work done or materials furnished, at whatever time they may be discovered, shall be immediately removed and satisfactorily replaced by the Contractor, when notified to do so by the Director. If the Contractor shall neglect or refuse to remove such unsatisfactory work or material within forty-eight (48) hours after the receipt of the above mentioned notice, or if he shall not make satisfactory progress in doing so, the Director may cause said work or material to be removed and satisfactorily replaced, by contract, or otherwise, and the expense thereof shall be charged to the Contractor. Such expense shall be deducted from any moneys due or to become due the Contractor under the Contract. Upon the completion of the Contract, the entire work shall be delivered to the Owner in a condition equal to or better than the industry standard, complete, and in a satisfactory working condition.

D. COMPETENCE OF LABOR

Only competent labor shall be used. Any employee of the Contractor who shall use profane or abusive language to the Inspector or other employees of the Owner, or is otherwise disorderly and interferes with him in the performance of his duties, or who is careless and incompetent, shall be discharged on the request of the Director and shall not again be employed on the Contract Job except with the Director's consent.

E. ABANDONMENT OF OR DELAY IN WORK

If the work under the Contract shall be abandoned by the Contractor, or if at any time the Director shall be of the opinion, and shall so certify in writing to the Owner, that the performance of the Contract is unnecessarily or unreasonably delayed, or that the Contractor is violating any of the provisions of the Contract or is executing the same in bad faith, or if the work be not fully completed within the time named for its completion, together with such extension of time as may have been granted, the Owner, by written notice, may order the Contractor to discontinue all work thereunder, or any part thereof; and thereupon the Contractor shall discontinue the work, or such part thereof, and the Owner shall have the power, by contract, or otherwise, to complete said work and deduct the entire cost thereof from any moneys due or to become due the Contractor under the Contract. For such completion of the work, the Owner may for itself or its contractors, take possession of and use or cause to be used any or all materials, tools, machinery and appliances found on the line of said work. When any part of the Contract is being carried on by the Owner as herein provided, the Contractor shall continue the remainder of the work in conformity with the terms of the Contract, and in such manner as not to interfere with the workmen employed by the Owner.

F. DEFAULT OR FAILURE TO COMPLETE WORK ON TIME

Should the Contractor fail to fully complete the work in accordance with the Contract Documents and within the time specified, the Director shall determine the number of days that the Contractor is in default in completing the work under the Contract and shall certify the same in writing. For each day so certified, the Contractor shall pay to the Owner the sum stipulated in the Bid and the Contract for each and every day thereafter, until and including the day when the said work shall be completed to all intent and purposes, as set forth in the Bid under the Contract and the specifications, in an acceptable manner and to the satisfaction of the Director, which sum is agreed upon, not as a penalty, but as liquidated damages which the Owner shall suffer by reason of such default: However, the Owner may, as hereinafter provided, extend the time for the completion of the work authorized and is empowered to deduct and retain the amount of any damages determined, as hereinbefore provided for, each day that the Contractor shall be in default in completing the work after the time fixed under the Contract, or for any later date to which the time of completion may have been extended, from any moneys due or to become due the Contractor under the Contract, at

any time after such damages are so incurred, provided, however, that the Owner may extend the time for the completion of the work beyond the Contract time. The permitting of the Contractor to finish the work after the time fixed for its completion or after the date to which the time fixed for its completion or after the date to which the time for completion may have been extended, shall not in any way operate as a waiver on the part of the Owners or any of their rights under the Contract.

8.0 MEASUREMENT AND PAYMENT

A. GENERAL

1. Lump Sum Contracts - Lump sum payment shall include clearing and grubbing, removal and replacement of existing sidewalks, shrubbery, driveways, poles, mail boxes, signs, fences, or any other existing objects which are required to be restored to complete the work, and all new work such as trench excavation and backfill, sheeting and shoring, dewatering, furnishing and laying pipe, furnishing of materials and construction of manholes, vaults, headwalls, bends Y branches, and any other structures incidental to the work, and all other operations and materials required to complete the work. Lump sum contracts shall include, for the bid price, all costs of materials and services for which the Contractor shall be paid under the Contract, plus profit. No further or additional compensation is due and owing the Contractor except as the Contract may be modified to provide for.
2. Unit Price Contracts
 - a. Unit prices where directed shall be paid for by measurements of all quantities of work and material by the Director according to the specifications and drawings and the working-lines that may be given. No allowance will be made for any excess above the quantities required by the specifications, drawings and lines on any part of the work, except where such excess material has been supplied or work done by written order of the Director and in the absence of default or negligence on the part of the Contractor. Should the dimensions of any part of the work or of the materials be less than those required by the drawings or the directions of the Director, only the actual quantities placed will be allowed in the measurements. The County reserves the right to withhold payment of particular items or portions thereof until the item(s) in question has proven conformance by the Director's inspection and satisfactorily passing the applicable testing requirements stipulated in the Contract documents.
 - b. When a mobilization item has been established in the bid it shall consist of the furnishing of all work, materials, and operations required for the assembling and setting up for the project, including, but not limited, to the following:

- i. Initial movement of personnel to the project site.
 - ii. Establishment of the Contractor's office.
 - iii. Establishment of the Engineer's field office.
 - iv. Establishment of shops and plants.
 - v. Construction of sanitary and other facilities required by the Specifications and state or local regulations.
 - vi. Clearing and grubbing, moving on and offsite all construction, hauling units, concrete mixers, hoisting equipment, compressors, and tools required to complete the work.
 - vii. Establishment of storage area.
- c. Mobilization shall also include all other work and operations which must be performed prior to beginning work on compensable items of work at the project site.
- d. The cost of required insurance and bonds and/or any other initial expense required for the start of work shall be included in this item.
- e. Payment will be made at 50 percent of the lump sum price bid for "MOBILIZATION" of the Bid payable on the first monthly estimate subsequent to the Contractor's moving in all facilities required as indicated in the foregoing. The remaining 50 percent will be paid in equal monthly payments based on the specified construction term, during the progress of the contract. Payment as directed will be full compensation for all labor, materials, equipment, tools, and incidentals required to complete this item, regardless of the fact that the Contractor may have, for any reason, shut down the work on the project and moved equipment away from the project and then back again.
- f. Where unit price contracts are directed, following the completion of the work and before final payment is made therefore the Director shall make final measurements to determine the quantities of various items of work performed as the basis for final settlement. The Contractor, in case of unit price items, will be paid for the actual amount of work performed and for the actual amount of materials in place, in accordance with these specifications as shown by the final measurements. All work contemplated under the Contract shall be measured by the Director according to the standards of weight and measures recognized by the National Bureau of Standards.
- g. Measurements of items paid for on the basis of linear or surface area shall be along and parallel to the actual lines and surfaces on the roadway surfacing having an area of nine (9) square feet or less. In computing volumes, the

method of average end areas will be used for excavation, embankments and removal of existing masonry. The pay weight for all items to be paid for by weight, certified shipping weight or by computed weight as hereinafter specified and no allowance for overrun, other than designated herein, shall be made.

- h. Materials specified for measurement by tallying of vehicles having predetermined carrying capacity shall be hauled only in approved units, struck off at the top of the carrying unit or to permanent lines at the loading point and tallied at the point of delivery. Unless all vehicles have uniform carrying capacity, each hauling unit shall be marked identifying the approved capacity.
- i. In the volumetric measurements of the "Tamped Fill" over pipe, "Masonry" and "Stone Backfill" around pipe, deduction shall be made for the volume occupied by the pipe.
- j. In the measurement of pipe whenever special fittings are used, for which a separate item price is set up, the accumulative linear measurement occupied by these fittings shall be deducted from the total linear measurement of pipe placed.

B. MONTHLY ESTIMATES

- 1. The Contractor shall, submit in writing on a date specified by the Director, and on forms provided by the Department of Public Works, an estimate, such as he shall believe to be just and fair, of the amount of work done under each item of the contract during the estimate period. Such estimate shall not be required to be made by strict measurements, but may be approximate only, and shall be subject to correction in later estimates. Monthly estimates shall not contain any allowance for materials delivered upon the site of the work but not incorporated therein, and the Contractor shall not be entitled to receive any payment therefore, except where specifically permitted by the Director. The estimate shall be submitted to the Director for confirmation that the work for which payment is claimed has been performed.
- 2. Upon the Owner's approval of each monthly estimate, the Owner will retain a portion of the amount due the Contractor, in accordance with the following:
 - a. Withholding of 10 percent (10%) of the payment claimed for projects \$200,000 or less for the entirety of the project;
 - b. For projects over \$200,000:

- i. Withholding of 10 percent (10%) of the payment claimed until Work is 50 percent (50%) complete;
- ii. When the work is 50 percent (50%) complete, and at the sole discretion of the Director, the withholding may be stopped or lowered to a lower percentage of the payment claimed for all remaining work satisfactorily completed to date, provided that the Contractor is making satisfactory progress and there is no specific cause for greater withholding.
- iii. The County may reinstate up to 10 percent (10%) withholding of the total payment for the work completed to date, if the Contractor is not making satisfactory progress or there is other specific cause for such withholding.
- iv. The County may accept securities negotiable without recourse, condition or restrictions; a release of retainage bond; or an irrevocable letter of credit provided by the Contractor, instead of all or part of the cash retainage.
- v. In no case shall the withheld amount be less than 5 percent (5%) of the dollar value of the Work completed to date.

Director may retain out of such payment any or all sums which, by the terms of these specifications, the Contract, or of any law of the State of Maryland in force at the date of the signing of the Contract, it is authorized to retain. Payments on monthly estimates may be withheld if, in the judgment of the Director, the Contractor is not complying with the terms of the Contract.

3. In the instance of lump sum items, the Director shall estimate the percentage of the lump sum item satisfactorily performed during the preceding month. The percentage of the lump sum items shall be computed from the approved Contractor's breakdown.

C. FINAL ESTIMATE

1. Upon completion of the work, the Contractor shall make a written final estimate, based upon the Director's measurement of the whole amount of authorized work done by the Contractor, and the value thereof under the terms of the Contract, and shall certify to the Owner the completion of the work and the amount of the final estimate. The Director's measurements upon which the final estimate is based, shall be final and conclusive. The estimate shall be submitted to the Director for confirmation that the work for which payment is claimed has been performed. Following his review the Director will submit the estimate for payment.
2. Upon approval of the final estimate, the Owner will notify the Contractor, in writing, of the conditional acceptance of the work. Out of the amount representing the total of the final estimate, the

Owner will deduct ten (10) percent, which shall be in addition to any and all other amounts which under the Contract is entitled or required to retain, and shall hold said sum for a period of twelve (12) months from and after the date of payment of the final estimate, as herein below stipulated. Such part as may be necessary, or all, of said retained sum shall be applied to any expense to which the Owner may be subjected, during the said period of twelve (12) months, in repairing any defects found in the work under the Contract which may be deemed to have been caused by failure of the Contractor to comply with the terms of the Contract, or to any breach of the Contract whatsoever on the part of the Contractor. The Owner shall be empowered to make any required repairs or renewals during said period, without notice to the Contractor, if they shall judge such action to be necessary, or if, after notice, the Contractor shall refuse or neglect to do said required work or make satisfactory progress thereon within such period as the Director shall consider necessary or reasonable. Where such emergency repairs have been made without prior notice to the Contractor, he shall be so advised as soon as possible thereafter. The right of expenditure of any retainage as provided for above shall be in addition to the Owner's right to proceed against any and all bonds posted or security by the Contractor.

2. Within fifteen (15) days after the approval of the final estimate, the Owner will pay to the Contractor the amount remaining after deducting from the total amount of the final estimate all such sums as have heretofore been paid to the Contractor under the provisions of the Contract, and also such amounts as the Owner has or may be authorized by these specifications or under the Contract to reserve or retain.

D. RECORD DRAWINGS

The Contractor shall keep one copy of the contract drawings at the site in good order to mark all changes made during construction. These record drawings shall be made available to the Director at any time and shall be delivered at the completion of the construction. In addition, Project Record Drawings shall be prepared by a Professional Surveyor licensed in the State of Maryland showing the project as constructed. The Record Drawings shall include stationing or dimensions from structures for all valves, fittings, service connections, sewer lateral connections, hydrants, or other appurtenances.

E. FINAL ACCEPTANCE AND PAYMENT

Prior to expiration of the aforesaid period of twelve (12) months succeeding the payment of the conditional acceptance the Owner will pay

the Contractor all sums reserved or retained, less such amounts as it may be empowered under the provision of the Contract permanently to retain.

F. EVIDENCE OF PAYMENT

The Contractor shall furnish the Owner with a release of liens within ten (10) days after the final completion and acceptance of the whole work under the Contract from each person, partnership and corporation who has done work or furnished materials under the Contract, or in or about the work contracted for. In the event a release of lien is not furnished by the Contractor, the Director may withhold an amount from monies retained or due to the Contractor under the Contract as it deems necessary to cover the cost of materials or labor provided until a release of lien is received by the Director.

G. MAINTENANCE BOND

At any time after the approval of the final estimate the Contractor may be permitted to furnish a Maintenance Bond in favor of the Owner in the amount which would otherwise be retained by the Owner. Such bond shall be in a form and with a surety approved by the Owner, binding the Contractor as principal and the surety to promptly and properly replace any improper work or materials that may become apparent within a period of twelve (12) months following the conditional acceptance of the work. Upon acceptance by the Owner of such a bond, the sum retained by the Owner will be paid to the Contractor.

H. TERMINATION OF THE OWNER'S LIABILITY

The acceptance by the Contractor of the final payment made as aforesaid shall operate as and be a release to the Owner and every officer and agent thereof, for all claims by and liabilities to the Contractor and/or any other person, corporation or association for anything done or furnished for or relating to or affecting or affected by the work under the Contract.

PART 2
TECHNICAL
REQUIREMENTS

DIVISION 2 - SITE WORK

**PART 2
TECHNICAL REQUIREMENTS**

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**SECTION 02012
TEST PITS**

1.0 GENERAL

A. DESCRIPTION

1. Test pits shall include, but not necessarily be limited to, excavation to determine the exact horizontal location and/or elevation of underground structures, utilities, and other obstructions; the backfill and compaction of the excavation; and the stabilization of the surface, in accordance with the Contract Documents.
2. Prior to construction it shall be the Contractor's responsibility to establish the location and/or elevation of existing utilities and structures that may affect the proposed work.

B. RELATED WORK INCLUDED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Restoration: Section 02800

C. QUALITY ASSURANCE

It is intended that all suitable materials removed from the test pit excavation, exclusive of paving materials, be used for backfill. The County has the right to inspect all material used as backfill to determine the material's suitability for use as backfill.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

None

B. CONTRACTOR'S OPTIONS

1. Use of Excavated Material

All suitable material excavated from test pits shall be used, as far as practicable, for backfill. The Contractor shall properly store or stockpile and protect all materials that are to be reused in the work. The Contractor shall replace, at his own expense, material that was suitable when excavated, which has subsequently become unsuitable because of careless, neglectful, wasteful, or unprotected storage. The Contractor shall have no property right in any material taken from any excavation and no excavated material shall be wasted or otherwise removed from the project site without permission of the County. All unsuitable material shall be removed from the excavation and disposed of off-site in accordance with local, state and federal regulations by and at the expense of the Contractor.

2. Borrow

Borrow material for test pit backfill shall meet the requirements of Section 02250.

3. Graded Aggregate Subbase

Graded aggregate subbase for test pit backfill shall meet the gradation requirements specified in Section 02240.

3.0 EXECUTION

A. GENERAL

It shall be the Contractor's responsibility to determine the location and/or elevation of underground structures and utilities by the use of test pit excavation prior to initiating excavation operations for the installation of the proposed facility. Test pits shall be of the size, depth and location as approved by the County. Should the location and/or elevation thus determined be different from that shown on the Plans, the Contractor shall promptly furnish the correct information to the County so that the impact on the project may be determined.

B. TEST PITS

1. The Contractor shall provide all necessary traffic control in accordance with the applicable regulations.
2. Surface preparation, excavation, backfill, compaction, and maintenance of the backfilled excavation shall be as specified in Section 02250 for trenches, except that the limits of the work shall be as approved by the County.
3. Restoration shall be as specified in Section 02800 unless otherwise specified or directed by the County.

4.0 METHOD OF MEASUREMENT

Measurement for test pits will be made on the basis of the volume of material actually removed from within the limits specified by the County.

5.0 BASIS OF PAYMENT

Payment for test pits will be made at contingent prices established in the bid proposal. The price bid shall include furnishing all labor, material, equipment, and incidentals necessary to perform the traffic control, excavation, backfill, compaction and surface restoration or pavement patch for the test pit.

No payment will be made for test pit excavation performed to establish the location of existing utilities shown on the Plans.

****END OF SECTION 02012****

**SECTION 02050
REMOVAL OR ABANDONMENT OF EXISTING UTILITIES**

1.0 GENERAL

A. DESCRIPTION

1. Removal or abandonment of existing utilities and underground structures shall include, but not necessarily be limited to, the removal, salvage, demolition in place, abandonment, or other disposition of existing utilities, underground structures, or other facilities shown on the plans, encountered in the course of the work, and/or as directed by the County and in accordance with the Contract Documents.
2. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the Contractors property. Salvaged materials specified to remain the property of the County shall be transported to another location designated by the County.

B. RELATED WORK INCLUDED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Mains: Section 02660
3. Gravity Sanitary Sewer and House Connections: Section 02700
4. Sanitary Sewer Manholes: Section 02710
5. Cast-in-Place Concrete: Section 03300
6. Flowable Fly Ash: Section 03500
7. Mortar: Section 04100
8. Brick Masonry: Section 04200

B. QUALITY ASSURANCE

The County will inspect all materials and work to insure compliance with the Contract Documents.

2.0 MATERIALS

A. GENERAL

Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. MATERIALS FURNISHED BY THE COUNTY

Not Applicable.

C. CONTRACTOR'S OPTIONS

None

D. DETAILED MATERIAL REQUIREMENTS

1. Borrow material for backfilling the space left by removal of facilities or backfilling abandoned structures shall meet the requirements specified in Section 02250.
2. Pipe plugs and caps for water or sewer main abandonment shall be as specified in Section 02660 and 02700 respectively.
3. Portland cement concrete for abandonment of utilities shall be Mix No. 1 as specified in Section 03300.
4. Flowable Fly Ash shall be as specified in Section 03500.
5. Mortar shall be as specified in Section 04100.
6. Brick for pipeline and structure bulkheads shall be sewer brick as specified in Section 04200.

3.0 EXECUTION

A. General

1. Utilities to be abandoned or removed shall not be abandoned or removed until all required proposed utility work is installed and tested to the complete satisfaction of the Director. Furthermore, the Contractor shall notify the Director at least three (3) days prior to beginning the abandonment or removal.
2. The area over the existing facility to be removed shall be excavated and, after removal or abandonment as specified, backfilled and compacted in accordance with Section 02250.
3. Brick construction shall be as specified in Section 04200 and as specified herein.
4. Rubbish and debris shall be removed from the site unless otherwise directed so as to not allow accumulations inside or outside the project site. Materials that cannot be removed daily shall be stored in areas approved by the County.

B. REMOVAL

Where indicated on the Plans, or directed by the County, existing utility pipelines and/or appurtenances shall be removed by the Contractor.

C. ABANDONMENT

1. Sanitary Sewers 15-inch Diameter and Smaller
 - a. All open ends of abandoned sewer pipe shall be sealed by setting an approved plug in the pipe or constructing a minimum 12-inch thick brick and mortar or concrete bulkhead.
 - b. Where a sewer is to be abandoned while the adjacent manhole is to remain active the Contractor shall seal (watertight) the pipeline opening in the manhole with an approved plug or constructing a minimum 12-inch thick brick and mortar or concrete bulkhead. Existing manhole channels and benches shall be reconstructed as necessary with brick and mortar to provide a smooth transition within the manhole.
2. Sanitary Sewers 18-inch Diameter and Larger
 - a. All open ends of abandoned sewer pipe shall be sealed by setting an approved plug in the pipe or constructing a minimum 20-inch thick brick and mortar or concrete bulkhead.
 - b. Where a sewer is to be abandoned while the adjacent manhole is to remain active the Contractor shall seal (watertight) the pipeline opening in the manhole with an approved plug or construction a minimum 20-inch thick brick and mortar or concrete bulkhead. Existing manhole channels and benches shall be reconstructed as necessary with brick and mortar to provide a smooth transition within the manhole.
3. Sanitary Manholes
 - a. Frames and covers of abandoned manholes will remain the property of Worcester County. They shall be removed from the structure and transported to a designated location.
 - b. The Contractor shall remove the structure to at least two feet (2' - 0") below finished grade.
 - c. Pipe openings within the manhole shall be sealed as noted within this section prior to backfilling the structure with approved backfill material that meets the compaction requirements noted in Section 02250, 3.0, D.
4. Water Mains and Appurtenances

Where indicated on the Plans, or directed by the County, the Contractor shall abandon existing water mains and/or appurtenances as follows:

 - a. The section of water main remaining in service shall be capped or plugged and strapped and/or buttressed in accordance with the Contract Documents.
 - b. When abandoning water mains 20-inches in diameter and larger, construct a 20-inch thick brick and mortar or concrete bulkhead, or plug,

or cap each end of the abandoned sections. All open ends of abandoned water pipe shall be sealed.

- c. For water mains smaller than 20-inch diameter, install plugs or caps at each end of the abandoned sections.
- d. Abandon water services by exposing the corporation stop at the main, turning stop off, disconnecting the service line from the corporation stop, inserting a plug or cap on the exposed end of the corporation stop, encasing corporation in 6 inches of concrete, and backfill excavation to finished grade.
- e. The Contractor shall remove all structures to a minimum depth of two feet below finished grade, break or drill holes in the bottom of the structure to provide drainage, and backfill the structure as specified in Section 02250.

4.0 METHOD OF MEASUREMENT

A. REMOVAL

Measurement for removal of existing utilities and appurtenances will be made horizontally along the centerline of the pipe for each size and type of pipe removed without deduction for valves or fittings. Measurement for removal of existing structures will be made on the basis of the count or number of structures removed.

B. ABANDONMENT

Measurement for abandonment of existing utilities and underground structures will be made on the basis of the count or number of pipeline sections and/or structures abandoned.

5.0 BASIS OF PAYMENT

A. GENERAL

- 1. Payment will be made at the unit prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown, specified, and in strict accordance with the Contract Documents.
- 2. The price bid for removal or abandonment of existing utilities and underground structures shall include the following:
 - a. Excavation, backfill, and compaction as specified in Section 02250.
 - b. Furnishing and installing borrow material for backfilling the space left by removed facilities, initial excavation, and/or abandoned structures as required by the Contract Documents.
 - c. Storage of materials to be retained by the County, and disposal of those materials which the County does not want to retain.

- d. Furnishing materials for and constructing or installing caps, plugs, and/or bulkheads and appropriate concrete blocking on pressurized mains.
- e. Furnishing materials for and reconstructing channels or benches in existing manholes and/or structures.

3. Payment will be made for contingent items when approved by the County.

B. REMOVAL

Payment for removal of existing utilities will be made at the unit price bid per linear foot for each size and type of pipe removed. Payment for removal of existing structures will be made at the unit price bid per each structure removed. The price bid shall include all traffic control, surface restoration and incidental items to remove the existing utility or underground structure.

C. ABANDONMENT

Payment for abandonment of existing utilities and underground structures will be made at the unit price bid per each section of utility and/or structure abandoned. The price bid shall include all traffic control, surface restoration, and incidental items to abandon the existing utility or underground structure.

****END OF SECTION 02050****

**SECTION 02110
CLEARING AND GRUBBING**

1.0 GENERAL

A. DESCRIPTION

1. Clearing and grubbing shall include, but not necessarily be limited to, clearing areas of trees, brush, shrubs, down timber, rotten wood, other vegetation, debris and rubbish, as well as removal of fences and incidental structures; and grubbing or removing from the ground all stumps, roots and stubs, brush, organic materials, and debris, in accordance with the Contract Documents and within the limits of disturbance.
2. Contractor shall be responsible for acquiring all required permits associated with tree removal and tree trimming.

B. RELATED WORK INCLUDED ELSEWHERE

None

C. QUALITY ASSURANCE

The County will inspect the work to insure that it is performed in accordance with the Contract Documents.

2.0 MATERIALS

Not applicable.

3.0 EXECUTION

A. LIMITS

1. General
 - a. Unless otherwise indicated in the Contract Documents, all trees and other growth within the site easement or rights-of-way may be removed. Designated trees in temporary construction easements are to be saved.
 - b. Within the limits indicated on the Contract Documents to be cleared and grubbed, the County has the right to designate trees and other growth which the County may desire to leave standing.
 - c. The clearing and grubbing operation shall be completed before major construction is undertaken.
2. Utility Construction

Limits of clearing and grubbing include only those areas within the easement or right-of-way which are actually necessary for construction. Clearing will not be

permitted in temporary construction easements unless specifically indicated in the Contract Documents or approved by the County.

B. UNSUITABLE MATERIALS

Note that after the clearing and grubbing operations are completed, unsuitable materials such as unstable formations, root mat, or swamp muck encountered below the surface of the ground must also be removed and properly disposed.

C. SALVAGED MATERIALS

When indicated, such materials as leaf mold or other organic materials above the surface of the ground and suitable for use as mulch or topsoil shall be salvaged and stockpiled.

D. TREES, SHRUBBERY AND PLANTS

The County will designate and clearly mark any trees, shrubbery, and plants which are not to be removed, and the Contractor shall protect them from any damage, as outlined in the "General Provisions." Where trees which are left standing are trimmed or become scarred by the Contractor's operations, the cuts or scars shall be repaired by the Contractor. All trimming and repairs shall be done by skilled workmen and in accordance with good tree surgery practices under the supervision of a tree expert licensed by the State of Maryland.

E. BURNING

If allowed, the Contractor shall obtain the appropriate permits to allow the burning of trees, brush, trash, or other perishable materials. If burning is prohibited by the Fire Marshall, the Contractor shall remove these materials and dispose of them off-site in permitted disposal facilities.

F. DISPOSAL LOCATIONS

Perishable materials and debris shall be removed from the site easement or right-of-way and disposed of at locations off the project and outside the limits of view from the project by the Contractor. The Contractor shall make all necessary arrangements with property owners, in writing, for obtaining suitable disposal locations, and furnish the County with a copy of the agreement. The cost involved shall be included in the price bid. The Contractor shall be responsible for obtaining all State and local permits for the disposal locations and furnish the County with evidence indicating the sites are approved for disposal.

G. FENCES

All fences within the easement or right-of-way that are identified to remain shall be removed as carefully as practicable and replaced so that it remains in a condition equal to or better than what existed prior to construction.

H. EXCAVATION AREAS

Within areas to be excavated, all imbedded stumps, root mats, etc., shall be removed to a depth of not less than 1-foot below the subgrade or slope surfaces. All depressions made below the subgrade or slope surfaces by the removal of stumps or roots shall be refilled with materials suitable for embankment and shall be compacted in accordance with the requirements in Section 02250.

4.0 METHOD OF MEASUREMENT

The amount of clearing and grubbing will not be measured.

5.0 BASIS OF PAYMENT

Payment for clearing and grubbing will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.

**** END OF SECTION 02110 ****

**SECTION 02240
AGGREGATE BACKFILL**

1.0 GENERAL

A. DESCRIPTION

Aggregate backfill shall include, but not necessarily be limited to, furnishing and placing granular material for the installation of pipes, fire hydrants, manholes, vaults, and other structures as directed by Worcester County, indicated on the plans, and in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Mains: Section 02660
3. Water Services and Appurtenances: Section 02664
4. Fire Hydrants: Section 02666
5. Gravity Sanitary Sewer and House Connections: Section 02700
6. Sanitary Sewer Manholes: Section 02710
7. Sanitary Sewer Force Mains: Section 02720

C. QUALITY ASSURANCE

All aggregate fill material will be subject to test by the County to determine the material's compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish aggregate fill material.

B. CONTRACTOR'S OPTIONS

When properly compacted, sand that meets the Maryland SHA requirements for fine aggregate may be used for PVC water mains and sanitary force mains in lieu of Size 57 as shown on the Standard Details.

C. DETAILED MATERIAL REQUIREMENTS

1. Aggregate fill material for the installation of pipes, hydrants, manholes, vaults and miscellaneous structures as noted in the Standard Details shall meet the requirements of AASHTO M43, Size 57.

2. Aggregate fill material for subgrade stabilization shall meet the requirements of AASHTO M 43, Size 3.
3. Aggregate backfill material that meets the Maryland SHA requirements for graded aggregate subbase may be used with the approval of Worcester County.

3.0 EXECUTION

- A. If areas of the foundation are soft, composed of mud, or are, in the County's judgment, unfit to receive the pipe, structure, concrete, or masonry, then such unacceptable material shall be removed and replaced with aggregate fill material as directed by Worcester County.
- B. The aggregate backfill material shall be carefully placed to the dimensions indicated on the plans or directed by Worcester County.
- C. Except for Size 57 or 3, all aggregate backfill material shall be compacted.
- D. Aggregate fill shall not be dropped from heights in excess of 5 feet above utility.

4.0 METHOD OF MEASUREMENT

- A. Except when used as a contingent item or noted otherwise, measurement for aggregate fill will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.
- B. When used as a contingent item or noted otherwise, measurement for furnishing and installing aggregate fill will be made on the basis of the volume of material accepted and satisfactorily placed to the lines, grades, and dimensions shown in the Contract Documents.

5.0 BASIS OF PAYMENT**A. GENERAL**

1. Except when used as a contingent item or noted otherwise, payment for aggregate fill will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.
2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. AGGREGATE FILL

1. Payment for furnishing and installing aggregate fill complete and in place will be made at the contingent prices established in the bid proposal. The price shall include all traffic control, and incidental items to complete excavation and placement.

2. Payment for removal of unacceptable foundation material will be made under the pertinent contingent item.
3. No payment will be made for any aggregate fill which is used because of any error in the Contractor's operations, such as excavating beyond specified lines or grades, etc.

**** END OF SECTION 02240 ****

**SECTION 02250
TRENCH EXCAVATION, BACKFILL AND COMPACTION**

1.0 GENERAL

A. DESCRIPTION

1. Trench excavation, backfill and compaction shall include, but not necessarily be limited to, the excavation, backfill, and compaction of trenches for pipelines, fire hydrants, valves, manholes, vaults and other structures shown on the Plans, and in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Test Pits: Section 02012
2. Removal and Abandonment of Existing Utilities: Section 02050
3. Aggregate Backfill: Section 02240
4. Boring and/or Jacking Pipe: Section 02300
5. Tunneling: Section 02400
6. Water Mains: Section 02660
7. Water Valves and Appurtenances: Section 02662
8. Water Services, Water Meter Settings and Vaults: Section 02664
9. Fire Hydrants: Section 02666
10. Gravity Sanitary Sewer and House Connections: Section 02700
11. Sanitary Sewer Manholes: Section 02710
12. Sanitary Sewer Force Mains: Section 02720

C. QUALITY ASSURANCE

All materials removed from trench excavations and used for backfill will be subject to test by the County to determine the material's suitability for use as backfill.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for trench backfill other than those materials which are available from the trench excavation limits as shown on the Standard Details and the Contract Documents.

B. CONTRACTOR'S OPTIONS

Not applicable.

C. DETAILED MATERIAL REQUIREMENTS

1. Material for backfills may be from on-site excavations (if of proper quality) or from borrow sources. The material shall be free from organic material, sludge, grit, trash, muck, roots, logs, stumps or frozen material and other deleterious substances. Except as otherwise specified or approved, the material shall not contain rocks or lumps larger than six inches in greatest dimension. The material shall not contain mica in quantities which, in the judgment of the County are sufficient to affect compaction characteristics. Materials having a maximum dry density of less than 100 pounds per cubic foot (AASHTO T 180) shall not be used unless specifically approved in writing by the County. Cinders, ashes, rubble and construction debris shall not be used in the work. The use of any soil additive that in the judgment of the Director may adversely affect the proposed utility is strictly prohibited.
2. Use and Ownership of Excavated Material
 - a. All suitable material excavated from utility trenches shall be used, as far as practicable, for backfill in trenches.
 - b. The Contractor shall properly store, stockpile and protect all materials that are to be reused in the work. The Contractor shall replace, at his own expense, material that was suitable when excavated, which has subsequently become unsuitable because of careless, neglectful, wasteful, or unprotected storage. The Contractor shall have no property right in any material taken from any excavation and no excavated material shall be wasted or otherwise removed from the project site without permission of the County. All unsuitable and surplus suitable material, as determined by the County, shall be removed from the excavation and disposed of off-site by and at the expense of the Contractor in accordance with all applicable Federal, State, and local regulations.
 - c. If insufficient suitable soils are available from excavation on the contract project, the Contractor may obtain suitable soils from sources designated in the Special Provisions, or from such sources within 300 yards of the site as may be approved by the County. If these sources do not supply sufficient suitable soils, the Contractor shall submit for inspection and test by the County borrow excavation sites from which such soils as may be required to complete the construction of excavation backfill on the contract project. Borrow Excavation shall be supplied and placed at the contract unit price or when not provided for in the contract at a negotiated price for "Extra Work".
3. Excavation Backfills on rights-of-way, improved easements or supporting pavements or surface loads shall be constructed of Class 1 Soils compacted as herein specified or noted in the Contract Documents.

Class 1 Soils shall meet the requirement for materials as classified by AASHTO, A-1, A-2 or A-3, or as classified by the Unified Soil Classification System as GW, GP, GM, SW, SP, SM or SC.

4. Excavation Backfills not supporting surface loads or pavements and in unimproved easements shall be constructed of Class I or Class II Soils placed as herein specified or noted in the Contract Documents.

Class II Soils shall include all materials designated in Class 1 Soils and Unified Soil Classifications ML, CL, MH or CH.

5. Aggregate backfill for pipe and structure installation, bedding and trench backfill shall meet the gradation requirements specified in Section 02240.

3.0 EXECUTION

A. SURFACE PREPARATION

1. Sediment Control

The Contractor shall install all required sediment control devices in accordance with permits and all applicable Federal, State and local regulations.

2. Clearing and Grubbing

The Contractor shall clear and grub the surface over the line of the trench in accordance with the requirements of Section 02110.

3. Removing Pavement, Sidewalk, Curb, etc.

- a. The Contractor shall remove pavement, sidewalk, curb, etc. over the line of the trench in accordance with Standard Details.

- b. The Contractor shall remove paving only to the width shown on the Standard Details, noted in the Special Provisions, or as directed by the County. When the Contractor removes paving for a greater width than is deemed necessary or disturbs paving, sidewalk, curbs, etc. due to settlement, slides, or cave-ins, or in making excavation outside the limits of the trench without written order of the County, the County will require the Contractor to replace the excess damaged area and may retain from payments due the Contractor such amounts required to permanently replace the excess material removed. The Contractor shall be responsible for repaving or surfacing roadbeds or replacing sidewalk, curbs, etc. that have failed, settled, or have been damaged at any time before expiration of the Contract maintenance period due to work or any other activities by the Contractor, his subcontractors, or suppliers.

4. Maintaining Traffic

The Contractor shall furnish all labor, tools, equipment, and materials required for the maintenance of traffic during construction in accordance with the traffic control plan or permits.

B. TRENCH EXCAVATION**1. General**

- a. Excavation for the installation of utilities shall be unclassified and shall consist of the excavation removal and/or disposition of all material encountered to the lines, grades, and sections shown on the Plans and/or the Standard Details, as specified, or as directed by the County.
- b. Unless otherwise indicated, excavation shall be by open cut, except that short sections of a trench may be tunneled, or the pipeline jacked, if, in the opinion of the County, the pipe can be safely and properly installed.
- c. Trenches may be excavated and backfilled either by hand or by machinery. The Contractor shall have no claims, nor will extra compensation be allowed, for hand excavation or backfill which may be required by these Specifications or by the County for protection of existing utilities or structures.
- d. Ground profiles shown on the Plans represent the elevations along the centerline of the trench.

2. Protection of Property and Structures

The Contractor shall, at his own expense, sustain in place and protect from direct or indirect injury all existing facilities in the vicinity of the excavation, whether above or below the ground, or that may appear in the trench. The Contractor shall be responsible for the implementation of protective measures associated with the presence or proximity of pipes, poles, tracks, walls, buildings, property markers, and other structures and property of every kind and description in or over his trenches or in the vicinity of his work whether above or below the surface of the ground. The Contractor shall repair or replace damaged facilities at his expense.

3. Utility Adjustments

- a. All adjustments to utilities other than those owned by the County shall be performed by the utility owner.
- b. Adjustments to water services between the property line and the water main shall be performed by qualified utility contractors. Adjustments between the property line and the house shall be performed in accordance with Worcester County Plumbing Code. It shall be the Contractor's responsibility to obtain all permits necessary for the performance of this work.
- c. Adjustments to sanitary sewers within the County Easement or right-of-way shall be accomplished by a qualified utility contractor. Adjustments to sanitary sewers outside the County Easement or right-of-way shall be performed in accordance with the Worcester County Plumbing Code. It shall be the Contractor's responsibility to obtain all permits necessary for the performance of this work.

4. Obstructions Shown on Plans

- a. Certain information regarding the reputed presence, size, character, and location of existing underground utilities and structures has been shown on the Plans based upon available records. There is no certainty of the accuracy of this information, and it shall be considered by the Contractor in this light. If test pit data is not shown on the Plans, the Contractor shall excavate test pits in advance of his work in accordance with Section 02012 to locate existing utilities. The Contractor shall hereby distinctly understand that the County is not responsible for the correctness or sufficiency of the information given. The Contractor shall have no claim for delay or extra compensation on account of incorrectness of information given, or on account of the insufficiency or absence of information regarding obstructions. The Contractor shall have no claim for relief from any obligation or responsibility under the Contract in case the location, size, or character of any underground facility is encountered that is not shown on the Plans.
- b. It shall be the responsibility of the Contractor to notify "MISS UTILITY," all municipal and county utilities, all utility line owners, and any other parties affected prior to the beginning of work. It is the Contractor's responsibility to reference and maintain the location markings during the construction of the project. In the event that a utility location needs to be re-established by Worcester County, the cost to provide this shall be borne by the Contractor.

5. Removing Obstruction

- a. Should the position of any pipe, conduit, or other structure above or below ground be such as, in the opinion of the County, to require its removal, realignment, or change due to the work to be done under the Contract, the work of removal, realignment, or change will be done as extra work, or will be done by the owner of the obstructions without cost to the Contractor; but the Contractor shall uncover and support the structures in the limits of his trench at his own expense before such removal, and before and after such realignment or change. Whether the obstruction is shown on the Plans or not, the Contractor shall not be entitled to any claim for damage or extra compensation on account of the presence of said structure or on account of any delay in the removal or rearrangement of the same; however, if said structure is not shown on the Plans, time extension will be allowed if deemed to be warranted by the County.
- b. In the event that obstructions would delay the work of pipe installation, the Contractor may, with County approval, be permitted to leave a gap in the work and return to fill the gap after the obstructions have been removed. The installation shall be completed by laying full pipe lengths and appropriate closure pieces.
- c. The Contractor shall not interfere with any persons, firms, or corporations or with the County in protecting, removing, changing or replacing pipes, conduits, poles, or other structures.

- d. In the event that the County has entered into any agreement with an affected utility owner or owners which will have an effect on the operations or financial responsibilities of the Contractor, the requirements of these agreements will be included in the Special Provisions of the Contract.

6. Change of Trench Location

- a. In the event the County directs that the location of a trench be changed to a reasonable extent from that proposed on the drawing on account of the presence of an obstruction, or from other cause, or if a changed location shall be authorized upon the Contractor's request, the Contractor shall not be entitled to extra compensation or to a claim for damages; provided that the change is made before the excavation is begun. If, however, such change, made at the direction of the County involves the abandonment of excavation already made, such abandoned excavation together with the necessary backfill, will be considered extra work and the Contractor shall be compensated accordingly. In the event that the trench is abandoned in favor of a new location, at the Contractor's request, the abandoned excavation and backfill shall be at the Contractor's expense.
- b. If an obstruction shall lie within the trench in such manner that the trench has to be excavated to extra width in order that sheeting or bracing may be properly placed, or in order that a structure to be placed in the trench may be properly built, such extra width of trench shall be classed as miscellaneous excavation. No sloping of sides of excavation, however, for the purpose of avoiding the necessity of placing sheeting or bracing, either in the presence or absence of obstructions, will be considered as excavation beyond pay limits.

7. Trench Width and Depth

- a. Trenches shall be excavated to the necessary width and depth as may be shown on the Plans or Standard Details, as specified in the Special Provisions, or as directed. The trench subgrade shall be such as to provide a uniform and continuous bearing and support for the pipe on solid undisturbed earth for the full length of each pipe, except for that portion at the bell hole. Any part of the bottom of the trench excavated below subgrade shall be backfilled with approved material and compacted in accordance with Contract Documents.
- b. Subgrade, in the case of pipe lines, shall be six (6) inches below the underside of the pipe barrel, where the pipe is laid on a granular bedding. Where the pipe is laid on a natural foundation, subgrade shall be four (4) inches below the underside of the pipe barrel.
- c. The sides of the trenches shall be practically plumb and under no circumstances will they be permitted to be sloped except with the written approval of the County. Should the Contractor elect to slope or cut-back the sides of the trench, no additional payment will be made for extra

excavation, backfill, restoration, or contingent items beyond the limits indicated on the Standard Details.

- d. Bell holes shall be excavated in the bottom of the trench to ensure that pipe has continuous bearing.
- e. Where sheeting or trench boxes are used, the maximum width shall be as noted in the Standard Details.

8. Length of Open Trench

- a. The Contractor shall keep the backfill operation to the top of trench for offsite and existing areas and to road subgrade in areas of new construction, within 100 feet of excavation and pipe laying operations. The County reserves the right to require the backfilling of open trenches over completed pipe lines if, in his judgment, such action is necessary; and the Contractor shall thereby have no claim for extra compensation, even though to accomplish said backfilling, he is compelled temporarily to stop excavation or other work at any place.
- b. All trenches shall be closed at the end of each work day.
- c. The excavation of all trenches shall be fully completed at least one full pipe length in advance of pipe installation, unless otherwise authorized.

9. Responsibility for Condition of Excavation

The Contractor shall be responsible for the condition of all excavations made by him.

10. Trench Support

- a. The support of the trench shall be the sole responsibility of the Contractor.
- b. The Contractor shall support the sides and ends of all excavations wherever necessary with braces, sheeting, shoring or stringers, trench boxes, or other acceptable excavation support systems. All trench support systems shall be installed by men skilled in such work and shall be so arranged that it may be withdrawn as backfilling proceeds, without injury to the utility or structure constructed or to any roadbed, adjacent structure or property.
- c. All timbering in excavations, trench boxes, or excavation support systems shall be withdrawn as the backfilling is being done, except where and to such extent as the County shall order in writing that said timbering or excavation support system be left in place or where the County permits the trench support to be left in place at the Contractor's expense and upon his request. The Contractor shall cut off any sheeting left in place 2 feet below finished grade and shall remove the material cut off without compensation therefore.

- d. Wherever necessary, in running sand, or soft ground, or for the protection of any structure or property, sheeting shall be driven without extra compensation to such a depth below the bottom of the trench as may be required or directed. Where directed by the County to leave sheeting in place, payment will be made under the appropriate contingent item.
- e. All work shall be performed in accordance with the latest applicable Federal, State, and local safety and health regulations.

11. Drainage and Dewatering

- a. The Contractor shall grade the site as necessary to prevent surface water ponding or from flowing into the trench or other utility excavations and shall provide all necessary temporary surface drainage and keep the same operating to the satisfaction of the County until permanent drainage or finished grading and permanent surface stabilization has been completed.
- b. It shall be the Contractor's responsibility to adequately control water that may be present in the excavation. He shall provide for the disposal of water removed from excavations in such a manner not to cause damage to public or private property or to any portion of the work completed or in progress or cause any impediment to the use of any area by the public; nor shall the Contractor discharge any flushing or ground water or any material of any nature into existing sanitary sewer system during the construction of the facilities. All water shall be discharged through an approved sediment control device. The costs of dewatering trench excavations will not be paid for directly, but will be included in prices bid for other related items.

12. Excavation Below Subgrade

- a. The Contractor shall, without additional compensation, before any pipe or appurtenance is installed, fill all unauthorized depressions or irregularities in the bottom of the trench or tunnel with aggregate fill.
- b. Where the bottom of the trench, at subgrade, is in unstable or unsuitable material, excavation shall be carried to such depth as ordered by the County. The trench bottom shall be restored to subgrade with aggregate fill. Excavation and backfill for removal of unsuitable material will be paid for under the appropriate contingent item.

C. BACKFILL

- 1. The Contractor shall backfill all trenches as rapidly as practicable after the installation of the utility therein, or after the excavation has served its purpose.
- 2. Subgrade to 2'-0" above top of pipe: Suitable material shall be carefully placed around and to a depth of two feet over the pipe. These initial lifts shall be carefully placed and hand-tamped in four inch layers. Care should be exercised in this operation to insure that the alignment of the utility is not disturbed.

3. 2'-0" above top of pipe to top of trench: The remainder of the trench may be backfilled in layers not exceeding the specified compaction lift depths. However, if lift thickness is followed and the specified compaction is not obtained based on the testing during backfilling, the Contractor shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified compactions. In backfilling the remainder of the trench, stones of not more than 6 inches in largest dimension which have been taken out in excavating may be mixed with earth in an amount not exceeding 25% of the backfill volume. Stones of larger size or in greater quantities shall not be used, unless directed by the County. The Contractor shall not permit excavations to be used for the disposal of refuse.
4. In paved areas, the Contractor shall furnish and backfill the trench as per the requirements of the governing regulatory agency, and/or Contract Documents.
5. Should additional material be required for backfilling in excess of that obtained from excavation, the Contractor shall obtain Borrow material from off-site sources, to complete the trench backfill.
6. No layer of soil shall be placed on a frozen surface of a preceding layer or on a frozen subgrade.

D. COMPACTION

1. In unimproved areas where full trench compaction is not specified on the plans, compaction shall be accomplished as follows for the remaining depth of trench: Backfill material shall be placed in maximum 2 foot layers or as approved by the County and compacted in such a manner that a completely dense refill is obtained which is free of voids and not susceptible to undue settlement or depression.
2. Full trench compaction as described below will be required within all improved easements or rights-of-way except as noted on the contract drawings.
 - a. Rights-of-Way, Commercial/Industrial Zoned Property and Trenches in Easements Supporting Driveways and Sidewalks

The remaining trench depth less any thickness left for crusher run, paving, or concrete specified hereinafter shall be backfilled with suitable material and mechanically tamped in layers not to exceed twelve inches to not less than 92% of the maximum density at optimum moisture content as determined by the Modified Proctor Method, AASHTO Designation T-180 to within the top foot of subgrade which shall be compacted to 95% of the maximum density determined as noted above. All compaction must comply with the aforementioned or the latest edition of the governing applicable road code or permit whichever is most stringent.

- b. Residentially Zoned Property (Areas not in Rights-of-Way or supporting driveways or sidewalks)

The remaining trench depth shall be backfilled with suitable material and mechanically tamped in layers not to exceed twelve inches to not less than 85% of the maximum density at optimum moisture content as determined by the Modified Proctor Method, AASHTO Designation T-180.

3. Insofar as the specifications for mechanical tamping equipment or methods are concerned, no specific requirements are included in these Specifications other than that the use of any particular type of equipment is subject to the approval of the County and that the County has sole right to judge what equipment is suitable for the uses intended.
4. The developer or contractor shall secure the services of a soil consultant for the purpose of monitoring any and all requirements as per the Worcester County Standards and Specifications. The soil consultant shall be acceptable to the County.

E. MAINTENANCE OF BACKFILLED TRENCH

1. All backfilled trenches shall be maintained in an acceptable condition by and at the expense of the Contractor for a period of twelve (12) months following the date of conditional acceptance of the work.
2. If the Contractor fails to fill depressions in the backfilled trench within 24 hours after the receipt of notice from the County, the County may refill said depressions and the cost thereof shall be retained from any monies due the Contractor, under the Contract. In case of emergency, the County may refill any dangerous depression or protect with lights wherever necessary without giving previous notice to the Contractor; and the cost of so doing shall be retained from any monies due to become due the Contractor under the contract.
3. The Contractor shall be responsible for any injury or damage that may result from lack of maintenance of any refilled excavation at any time prior to final acceptance of the Project.

4.0 METHOD OF MEASUREMENT

A. TRENCH EXCAVATION, BACKFILL AND COMPACTION

Trench excavation, backfill, and compaction will not be measured as a separate item, but will be included with other items of work contained in the Bid Documents.

5.0 BASIS OF PAYMENT

A. GENERAL

1. No separate payment will be made for trench excavation, backfill, and compaction. The cost shall be included in the price bid for installing pipe, or constructing the various appurtenances included in the Contract. The bid prices shall include furnishing all labor, tools, equipment, and materials necessary to

complete the work as shown and specified in strict accordance with the Contract Documents.

2. Payment will be made for contingent items when approved by the County.

B. TRENCH EXCAVATION, BACKFILL AND COMPACTION

In addition to the work listed above, trench excavation, backfill, and compaction shall also include the traffic control, removing, storing, and rehandling of surface materials over the trench, including paving; the scoring of existing paving in a straight and uniform line; the excavation of all materials encountered in the trench including excavation at manholes, structures, vaults, and other appurtenances that may be shown or required, and any extra excavation necessary for sheeting or bracing or installation of other excavation support systems; the backfilling and compaction of trenches; the removal and disposal of unsuitable and/or surplus material; and all other incidental items to complete the work.

****END OF SECTION 02250****

**SECTION 02300
BORING AND/OR JACKING PIPE**

1.0 GENERAL

A. DESCRIPTION

Boring and/or jacking pipe shall include, but not necessarily be limited to, furnishing and installing carrier pipe and/or casing pipe beneath railways, roadways, or other locations indicated on the Plans and in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Aggregate Backfill: Section 02240
2. Trench Excavation, Backfill, and Compaction: Section 02250
3. Water Mains: Section 02660
4. Water Services and Appurtenances: Section 02664
5. Gravity Sanitary Sewer and House Connections: Section 02700
6. Sanitary Sewer Force Mains: Section 02720
7. Flowable Fly Ash: Section 03500

C. QUALITY ASSURANCE

The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for boring and/or jacking pipe.

B. CONTRACTOR'S OPTIONS

Directional drilling or micro-tunneling may be used with Worcester County prior approval.

C. DETAILED MATERIAL REQUIREMENTS

1. Portland Cement Concrete

Portland cement concrete for inverts or cradles shall be Mix No. 1 as specified in Section 03300.

2. Mortar for Grout

- a. Mortar used for grouting voids outside the casing pipe shall conform to the requirements of Section 04100 except that it shall be composed of one part Portland cement and three parts sand.
- b. Mortar used for bulkheading sleeve ends shall conform to the requirements of Section 04100.

3. Flowable Fly Ash

Flowable fly ash fill shall be as specified in Section 03500, and used as fill inside the casing pipe to the levels shown on the Contract Drawings.

4. Brick Masonry

Brick Masonry for bulkheading sleeve ends shall conform to the requirements of Section 04200.

5. Steel Casing Pipe

- a. Steel casing pipe shall be smooth walled and have a minimum yield strength of 36,000 psi. Minimum wall thickness shall be as noted herein or as specified in the Contract Documents.

<u>Nominal Pipe Size (inches)</u>	<u>Casing Pipe</u>	<u>Wall Thickness (inches)</u>
12		0.375
16		0.375
20		0.375
24		0.375
30		0.500
36		0.500
48		0.500

- b. The pipe shall be fabricated and field connected in accordance with Section 02660. Joints shall be fully welded around the circumference of the pipe.
- c. The exterior of the pipe including field connection shall be bituminous coated before installation. Bituminous coating shall meet the requirements of AWWA C210.

6. Carrier Pipe

Carrier pipe shall be as specified in the Contract Documents and meet the requirements specified in Sections 02660, 02700, or 02720 as appropriate.

7. Skids/Blocking

Skids and/or blocking for securing carrier pipes shall be constructed of pressure treated lumber suitable for exterior use.

3.0 EXECUTION

A. PREPARATION

1. Bored and/or jacked pipe greater than 4 inches in diameter shall receive a casing pipe unless directed otherwise.
2. Preliminary work shall consist of excavating and sheeting a suitable shaft on the lower side of the crossing and installation of a backstop and guide rails. The guide rails shall be long enough to hold at least two lengths of pipe and shall be carefully checked for line and grade before any pipe is placed on them.

B. BORING AND/OR JACKING

1. When augers or similar devices are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The arrangement shall be removable from within the pipe in the event an obstruction is encountered. The excavation by the cutting head shall not exceed the outside diameter of the pipe by more than ½ inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft material.
2. If an obstruction is encountered during installation that stops the forward action of the pipe, and it becomes evident that it is impossible to advance the pipe, operations shall cease and the pipe abandoned in place and filled completely with flowable fly ash.
3. Bored or jacked installations shall have a bored hole essentially the same as the outside diameter of the pipe plus the thickness of the protective coating. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe (plus coating) by more than approximately 1-inch, grouting or other methods approved by the County shall be employed to fill such voids.
4. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site. The pumps shall be in constantly attended operation on a 24 hour basis until their operation can be safely halted. When dewatering, close observation shall be maintained to detect any settlement or displacement of surface facilities. Should settlement or displacement be detected, the Contractor shall notify the County immediately and take such action as necessary to maintain safe conditions and prevent any further damage.
5. All operations shall be conducted so as not to interface with, interrupt, or endanger the operation of traffic, or damage, destroy, or endanger the integrity of any surface facilities.

6. Carrier pipe will be tested in accordance with Section 02660 or Section 02700 as applicable, prior to the placement of flowable fly ash fill.
7. Each end of the sleeve will be bulkheaded in accordance with Section 02050.

C. INSTALLATION OF CARRIER PIPE

1. Carrier pipe shall be installed within the casing pipe as shown in the Contract Documents and as specified in Sections 02660, 02700, and 02720.
2. Where shown or specified in the Contract Documents, the annular space between the casing and carrier pipes shall be filled with an approved flowable fly ash fill.

4.0 METHOD OF MEASUREMENT**A. CASING PIPE**

Measurement for bored and/or jacked casing pipe will be made of the length of casing pipe satisfactorily installed. Measurement will be made horizontally along the centerline of the pipe between the ends of the casing pipe.

B. CARRIER PIPE

Carrier pipe will not be measured as it will be incidental to the casing pipe installation.

5.0 BASIS OF PAYMENT**A. GENERAL**

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
2. Payment will be made for contingent items when approved by the County.
3. Should a contractor elect to make a boring and/or jacking pipe under trees, sidewalks, curbs, pipelines, or similar obstructions that are not specifically noted as a boring and/or jacking operation in the Contract Documents it shall be done at no additional cost to the County.

B. CASING PIPE

Payment for bored and/or jacked casing pipe will be made per linear foot for the various diameters of casing pipe furnished and installed by boring and/or jacking. The price(s) bid shall include the traffic control, compaction, excavation, support, and restoration of the boring and receiving pits; removal and disposal of excess excavated material; dewatering, settlement monitoring; furnishing and placing flowable fly ash fill within the casing pipe, carrier pipe, fittings, jointing material, joint restraint, testing, disinfection (if applicable), and incidental items to complete the installation.

C. CARRIER PIPE

Payment for bored and/or jacked carrier pipe will not be made as it will be incidental to the casing pipe installation.

****END OF SECTION 02300****

**SECTION 02400
TUNNELING****1.0 GENERAL****A. DESCRIPTION**

Tunneling shall include, but not necessarily be limited to, furnishing and installing tunnel liners beneath railways, roadways, or other locations indicated on the Plans and in accordance with the Contract Documents.

B. RELATED WORK INCLUDE ELSEWHERE

1. Aggregate Backfill: Section 02240
2. Trench Excavation, Backfill, and Compaction: Section 02250
3. Water Mains: Section 02660
4. Gravity Sanitary Sewer and House Connections: Section 02700
5. Sanitary Sewer Force Mains: Section 02720
6. Flowable Fly Ash: Section 03500

C. QUALITY ASSURANCE

The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS**A. MATERIALS FURNISHED BY THE COUNTY**

The County will not furnish any materials for tunneling.

B. CONTRACTOR'S OPTIONS

None.

C. DETAILED MATERIAL REQUIREMENTS

1. Portland Cement Concrete

Portland cement concrete for invert cradles shall be Mix No. 1 as specified in Section 03300.

2. Mortar for Grout

For filling voids outside the liner plate, the grout shall conform to the requirements of Section 04100 and the following. The mortar shall be composed on one (1) part Portland Cement (Type 1) and three (3) parts sand with only enough water to permit the material to flow properly. The grout shall remain fluid long enough to be injected through the lining and to fill the voids and shall set promptly enough to avoid grout flowing into the new annular space after the next advance.

3. Flowable Fly Ash

Flowable fly ash fill shall be as specified in Section 03500, and used as fill inside of the tunnel to the levels shown on the Contract Drawings.

4. Liner Plate

- a. Steel liner plate shall conform to requirements of ASTM A 569. Liner plate steel shall have the minimum mechanical properties of flat plate before cold forming as follows:

Tensile strength	=	42,000 psi
Yield strength	=	28,000 psi
Elongation, 2 inches	=	30%

At least 10% of the number of liner plates shall be drilled, tapped, and fitted with a cast iron grout plug. The actual location and spacing of the plugs shall be determined by the Contractor and approved by the County.

- b. Bolts and nuts shall conform to requirements of ASTM A 307. The bolts shall have rolled threads.

c. Coatings

- i. Liner plate shall be hot dipped galvanized to meet requirements of AREA Chapter 1, Part 4, Section 4.13 Specification for Corrugated Structure Steel Plate Pipe, Pipe Arches and Arches. Bolts and nuts shall be galvanized to meet requirements to ASTM A 153.

- ii. Liner plate shall be bituminous coated to meet requirements of AREA Chapter 1, Part 4, Section 4.6.1. Specification for Bituminous Coated Galvanized Steel Pipe and Pipe Arches. Provide prime coat as required to assure compatibility with galvanized surface.

5. Carrier Pipe

Carrier pipe shall be as specified in the Contract Documents and meet the requirements specified in Sections 02660, 02700, or 02720 as appropriate.

6. Surface Settlement Markers

- a. Surface settlement markers within pavement areas shall be P.K. nails.
- b. Surface settlement markers within non-paved areas shall be wooden hubs.

7. Skids/Blocking

Skids and/or blocking for securing carrier pipes shall be constructed of pressure treated lumber suitable for exterior use or of a County approved molded plastic construction (insulators).

3.0 EXECUTION

A. CONSTRUCTION CRITERIA

1. Tunnels for installing pipelines or other utilities shall be of sufficient size to allow, at all points, the proper joining of pipes and the proper refill around them. Tunnels shall be timbered or lined where and to such extent as may be necessary to support the tunnel in accordance with accepted methods. All methods of tunneling used shall be subject to the approval of the County, however, the safety of the tunnel construction and the protection, repair, or replacement of the tunneled obstruction shall be the sole responsibility of the Contractor.
2. Tunnel construction shall be performed in a manner that will minimize movement of the ground in front of and surrounding the tunnel, and prevent subsidence of the surface above and in the vicinity of the tunnel. During all stages of tunnel constructions, the ground shall be continuously supported and controlled in a manner that will prevent loss of ground and keep the perimeters and face of the tunnel stable. The Contractor shall be responsible for all settlement resulting from tunnel operations and shall repair and restore damaged property to its original condition at no cost to the County.
3. The Contractor shall comply with applicable ordinances, codes, statutes, rules, and regulations of the State of Maryland, SHA, applicable County building codes, and/or affected Railroad Company and applicable regulations of the Federal Government. (OSHA 29CFR 1926).

B. JOB CONDITIONS

1. Maintain an adequate supply of straight and tapered liner segments at the site at all times.
2. Prevent damage to protective coatings during storage and delivery. Keep wire ropes, chains, or hooks from direct contact with the coated surfaces.
3. Dewatering if required, shall be performed in accordance with acceptable methods.

C. EQUIPMENT

1. Tunneling equipment shall be of U.S. Bureau of Mines approved types.
2. Tunnel shields shall have uniform exterior surface from leading edge of head or poling plates to the rear edge of the tail. A horse-shoe-shape shield may have a closed or open bottom: a circular shield shall have closed bottom.
3. A substantially proportioned hood shall be provided which projects not less than 2 feet beyond the shield bottom with sufficient rear overhang or tail to provide at least 12 inches of overlap beyond the last element erected when the shield has been shoved forward to the fullest extent possible. The annular space between the tail and the lining shall be as small as current practice indicates, but in no case shall it be greater than 1 ½ inches.
4. Provide each shield with suitably designed breast-jacks or breast-tables or both, and such other bracing as is necessary to support the face of the tunnel excavation without loss of ground.
5. Provide on each shield a propulsion system capable of moving the shield in a forward direction while maintaining line, grade, and direction. The propulsion system shall be designed to prevent the shield from moving backward despite a failure of any element of the propulsion system and shall not over stress or distort the lining.
6. Prevent grout from leaking into the tunnel space between the shield and lining by incorporating a seal in the tail of each shield.
7. The shield shall be equipped with an erector arm or system capable of handling the largest sizes of lining and of erecting the sections of the lining to the required tolerances without damage to the lining.

D. POWER SUPPLY

1. All power machinery and tools within the tunnel shall be operated by either electricity, compressed air, diesel with approved scrubber, or other approved power. All electrical tools and equipment shall be grounded in accordance with the latest requirements of the National Electrical Code.
2. Temporary electric lights shall be provided to properly and safely illuminate all parts of the tunnel construction area including special illumination at the working faces. Lighting circuits shall be thoroughly insulated and separated from power circuits; and all lights shall be enclosed in wire or plastic cages. The Contractor shall secure all electrical permits necessary for the installation and operation of this service.

E. OPERATIONS BY TUNNEL SHIELDS AND MACHINES

1. On initial set-up, the tunnel shields or tunneling machines shall be supported and properly set at lines and grades which will permit the correct installation of the tunnel lining. During forward movement of the shield provide sufficient support at

the excavation face to prevent movement of any materials except such materials as are physically displaced by the elements of the shield itself.

2. The face shall be controlled using such support procedures as breasting, poling plates, face jacks, sliding tables, either singly or in combination, spaced as necessary.
3. Advance excavation for the tunnel liner in increments sufficient for the erection of one ring of liners and install liner plates immediately after each increment of excavation. Carry on excavation in such a manner that voids behind the liner plates are held to a minimum. Completely fill such voids with grout placed under pressure.
4. Whenever tunnel excavation is suspended or shut down, and there is danger of water infiltration from any source, maintain on duty qualified personnel to observe conditions that might threaten the stability of the heading. Contractor may substitute acceptable observation devices such as closed circuit TV that enables continuous monitoring of conditions at the face by qualified observers from outside the tunnel.
5. During shut down periods, support the face of the excavation by positive means; no support shall rely solely on hydraulic pressure.

F. INSTALLATION OF TUNNEL LININGS

1. Install the tunnel lining in a manner that will not damage the lining or coating.
2. Ensure that the edges are clean and free from material that could interfere with proper bearing.
3. Install bolts for liner plates in accordance with liner plate manufacturer's recommendations and retention or replace if necessary any bolt which does not meet the requirements.
4. Assemble liners to the lines and grades shown on the Plans or as directed by the County.

G. GROUTING

1. Fill annular voids between the tunnel excavation and the tunnel liner with grout mix.
2. Filling voids with grout shall generally proceed from the bottom grout hole of each ring to the top hole.
3. Vent air through one of the upper holes.
4. The grout pump and injection system shall be a type that will deliver the grout in a smooth even flow without surge. The grouting circuit shall contain a return line to allow return of the grout from the nozzle to the supply tanks. The grouting equipment shall be capable of developing a uniform pressure of 50 psi at the grout hole connection and equipped with hoses with a minimum inside diameter

of 1 ½ inches. The grouting equipment shall have a minimum capacity of ½ cubic yards.

5. Grouting between the liner plates and excavation shall follow progressively with each adjacent set of holes provided in the liner plates.
6. In general, grouting shall proceed from the lowest grout hole of each ring and proceed progressively upward. When going from lower to higher grout holes, do not make connection to the higher holes until grout has completely filled the space below. Fill all voids completely at the close of each 8 hour work period.
7. Continue grouting until grout appears in the next set of grout pipes, which shall be kept open during grouting to permit escape of air and water.

H. INSTALLATION OF CARRIER PIPE

1. Carrier pipe shall be installed within the tunnel liner as shown in the Contract Documents and as specified in Sections 02660, 02700 and 02720.
2. Provide bedding and anchorage in accordance with the Plans and Contract Documents.
3. Provide wooden skids or other approved devices as required to eliminate damage to pipe.
4. After line is tested, fill annular space between pipe(s) and tunnel with flowable fly ash fill. Positive means shall be provided to hold the pipe in place and to prevent flotation.

I. CLOSING

1. Each end of the tunnel will be bulkheaded in accordance with Section 02050.

4.0 METHOD OF MEASUREMENT

A. TUNNELING

Measurement for earth tunneling and liners will be made horizontally along the centerline of the tunnel satisfactorily installed between the ends of the tunnel.

B. CARRIER PIPE

Carrier pipe will not be measured as it will be incidental to the tunnel liner installation.

5.0 BASIS OF PAYMENT

A. GENERAL

1. Payment will be made at the unit and/or lump sum price bid. The price bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

2. Payment will be made for contingent items when approved by the County.
3. Should a contractor elect to install a tunnel in lieu of a bore and jack under roads trees, sidewalks, curbs, pipelines, or similar obstructions that are not specifically noted as a tunneling operation in the Contract Documents it shall be done at no additional cost to the County.

B. LINER PLATE

Payment for liner plate will be made per linear foot for the various diameters of liner plate furnished and installed by the tunneling operations. The price(s) bid shall include the traffic control, excavation, support, grouting, backfill, compaction, and restoration; removal and disposal of excess excavated material; dewatering, settlement monitoring; furnishing and placing flowable fly ash fill within the tunnel liner plate; carrier pipe, fittings, jointing material, joint restraint, testing, disinfection (if applicable), and incidental items to complete the installation.

C. CARRIER PIPE

Payment for carrier pipe will not be made as it will be incidental to the tunnel installation.

****END OF SECTION 02400****

**SECTION 02660
WATER MAINS****1.0 GENERAL****A. DESCRIPTION**

Water main installation shall include, but not necessarily be limited to, furnishing and installing water pipe, fittings, and appurtenances of the size and type shown on the Plans, installed on a firm foundation true to line and grade in accordance with the Contract Documents.

B. RELATED WORK SPECIFIED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Valves and Appurtenances: Section 02662
3. Water Services and Appurtenances: Section 02664
4. Fire Hydrants: Section 02666
5. Cast-In-Place Concrete: Section 03300
6. Miscellaneous Metals: Section 05500

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS**A. GENERAL**

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.
2. To minimize the number of joints, only standard manufacturers length of pipe shall be furnished and installed for all water mains unless otherwise indicated on the Plans, or as approved by the County.

B. PIPE SYMBOLS

For convenience and standardization, the various types of pipe are designated on the plans by the following symbols:

DIP	-	Ductile Iron Pipe
PVC	-	Polyvinyl Chloride Pipe

C. MATERIALS FURNISHED BY THE COUNTY

1. The County will not furnish any materials for water main construction.
2. Unless otherwise noted in the "Special Provisions," the County will make water available from its potable water system for pipeline testing at no charge to the Contractor for one test only. The Contractor shall contact the Division of Water and Sewer to coordinate its use. If subsequent testing is required, the Contractor will purchase additional water from the County's system.

D. CONTRACTOR'S OPTIONS

1. The Contractor may furnish Polyvinyl chloride plastic water pipe (PVC) and compatible specified fittings for water mains equal to or small than 12-inches in diameter unless specified otherwise by the County.
2. The Contractor may furnish ductile iron pipe (DIP) and compatible specified fittings for water mains 3-inches in diameter and greater unless specified otherwise by the County.

E. DETAILED MATERIAL REQUIREMENTS

1. Portland cement concrete for pipe fitting buttresses and anchorages shall be as specified in Section 03300.
2. Polyvinyl Chloride Plastic Water Pipe 4 inch through 12 inch shall be Class 150 (DR18) and shall meet the requirements of AWWA C900. PVC Water Pipe 3 inch and smaller shall be PVC 1120 (SDR21) and shall meet the requirements of ASTM D 2241. The outside diameters of DR18 shall be equivalent to cast-iron pipe. PVC Water Pipe shall have an integral bell with a rubber gasketed joint as listed in the AWWA C900 standard. Pipe and couplings shall be marked and factory tested in accordance with AWWA C900.
3. Ductile Iron Pipe and Fittings
 - a. Pipe
 - 1) Pipe shall be designed and manufactured in accordance with ANSI/AWWA C151/A21.51 unless directed in writing by the County.
 - 2) All pipe and fittings shall be designed and constructed to withstand all external pressure caused by overburden as indicated on the profile and traffic loads to which the pipe may be subjected.
 - 3) Pipe shall be double thickness cement mortar lined in accordance with AWWA C104 with an interior seal coat of bituminous material. The outside surface shall also be bituminous coated.

- 4) The minimum special standard thickness class shall be as noted herein or as shown on the plans or specified in the "Special Provisions".

Size (In.)	Class	Max. Cover (Ft.)
3	52	100+
4	52	100+
6	52	86
8	52	49
10	52	38
12	52	33
14	52	24
16	52	21
20	52	18
24	52	17
30	52	14
36	52	13
42	52	13
48	52	12
54	52	12

b. Joints

Joints may be mechanical or rubber gasketed push-on type. Unless otherwise noted, all joints shall be in accordance with ANSI/AWWA C111/A21.11 Standard.

c. Fittings

- 1) All fittings shall have mechanical joints.
- 2) All fittings 3-inches through 24-inches shall be manufactured in accordance with the ANSI/AWWA C153/A21.53 Standard. All fittings 30-inches through 48-inches shall be manufactured in accordance with the ANSI/AWWA C110/A21.10 standard for a working pressure of 250 psi unless specified or directed otherwise by the County.

5. Joint Restraint

- a. Restrained joint pipe and fittings shall be of the pipe manufacturer's standard design for prestressed concrete pressure, ductile iron, and fittings.
- b. Ductile iron joint restraint systems for use with mechanical type joints may be used on valves, fire hydrant leads, vault bypasses, retrofitting existing utility installations and in special cases as , approved by the Division of Water and Sewer Engineering office and not in lieu of restrained joint pipe as shown on the Contract Drawings.
- c. Rod for tie rod assemblies shall meet the material requirements of ASTM A 193, Grade B7, and shall be threaded for at least 4 inches on both ends. Rod shall be 3/4 inch diameter unless otherwise noted. Nuts shall meet the requirements of ASTM A 194. Manufactured tie rod and

accessories shall result in the completed restrained joint assembly having a minimum working pressure rating of 200 psi.

6. Detector Tape

Visual Detection Tape shall be 3 inches wide (minimum) nonmetallic blue plastic tape lettered "water" in black graphics.

7. Tracer Wire for Non Metallic Pipelines

Tracer wire shall be 8 gage, 7 strand continuous copper wire with a 45 mil polyethylene insulation. The wire shall be blue, have "UL" markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connections with a water proof binder and underground electrical tape.

8. Continuity Test Station

- a. The continuity test station aside a fire hydrant shall be a 2 1/2" shaft cathodic test box constructed of ABS plastic with cast iron rim and lid. The minimum box length shall be 24" and the body shall be flared or squared at the base to prevent pull out or settling. Lid shall be locking, blue in color and have raised custom lettering noting "test". Test station shall be complete with an inset removable terminal board with three (3) terminals.
- b. The continuity test station that is located over the water main shall be a 4 1/4" valve box with blue locking lid. Test station shall be complete with an inset removable terminal board with three (3) terminals.

3.0 EXECUTION

A. PREPARATION

1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250.
2. Prior to start of utility installation, all rights-of-way shall be graded to within ± 0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.
3. Trench Water: The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water.
4. Laying Pipe in Freezing Weather: No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe has been installed.

5. Pipe Bedding: Each pipe shall be bedded on a solid foundation acceptable to the County and in accordance with the Standard Details. Bedding shall be installed to insure that joints are properly made and the pipe is firmly supported the full length of the barrel. Aggregate bedding shall be installed to grade prior to laying pipe.

B. PIPE INSTALLATION

1. All pipe shall be installed in accordance with the approved manufacturers written instructions, Worcester County Standards, and as specified herein. These recommendations, if more restrictive than that shown in the Standard Details shall include: maximum trench width, bedding requirements, backfill material, and compaction, where applicable. In addition, the following shall apply unless otherwise noted:
 - a. Polyvinyl chloride water pipe (PVC) shall be installed in accordance with the Standard Details and the recommendations of Uni-Bell.
 - b. Prestressed concrete cylinder pipe (PCCP) shall be installed in accordance with the Standard Details and the recommendations of the Concrete Pipe Association.
 - c. Ductile iron pipe (DIP) shall be installed in accordance with the Standard Details and the recommendations of the Ductile Iron Pipe Research Association.
2. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used.
3. Pipe Installation: Pipe shall be carefully handled and lowered into the trench. Pipe shall be installed with special care to insure that each joint is watertight, has met the required manufacturers insertion depth, and has no shoulder or unevenness of any kind along the inside of the pipeline. No wedging or blocking will be permitted in installing any pipe unless directed by written order or permission in writing is obtained from the County.
4. Pipe Setting and Protection: No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Care shall be used to assure water tightness and prevent damage to, or disturbing of, the joints during the refilling process. After pipes have been installed and joints have been made, there shall be no walking on or working over the pipe, except as may be necessary in tamping the backfill material, until the backfill is at least 2 feet over the top of the pipe.
5. Cleaning Pipe: The pipes shall be thoroughly cleaned before being installed and shall be kept clean until acceptance of the completed work. Open ends of all pipelines shall be provided with a stopper carefully fitted to keep dirt and other substances from entering. This stopper shall remain in place at all times when installation is not in progress.
6. Cutting Pipe: Whenever a pipe requires cutting, to fit into the line or bring it to the required location, the work shall be performed by an approved method that leaves a smooth, square end. Cut PVC pipe ends shall have burrs removed and

the end beveled to match factory bevel. Field spigots shall be stop-marked with a felt tip marker or wax crayon for the proper length of assembly insertion.

7. Jointing Pipe

a. General

Before any joints are made in the trench, the Contractor shall demonstrate to the County by making a sample joint that methods he will employ conform with the Specifications, will secure a watertight joint, and that the workmen whom he intends to use for this work are familiar with the requirements for making proper joints.

b. Push-On Gasketed Joints

Prior to making gasketed joints, both mating pipe ends and the gasket shall be cleaned of all foreign material. The gasket shall then be inserted in or stretched over the cleaned gasket seat and lubricant applied as recommended by the manufacturer and approved by the County. The pipe ends shall be carefully aligned and pushed together to meet the required manufacturers insertion depth. There shall be no shoulder or unevenness of any kind along the inside of the pipeline. The method of inserting the spigot into the bell shall be as recommended by the manufacturer and approved by the County.

c. Prestressed Concrete Pressure Pipe and Fitting Joints

- 1) While the pipe is still clear of the trench bottom, it shall be aligned with the pipe to which it will be joined. Next, the pipe shall be advanced toward the pipe in place, the spigot depressed manually and the pipe guided into the flare of the bell. The pipe lowered until both sections are in the same plane, then the pipe shall be thrust home.
- 2) The joints of pipes 24-inch diameter and larger shall be checked by the Contractor from within the pipe. As the spigot is thrust home, its advance shall be checked by the Contractor by two steel inserts held in the seat of the bell 180E apart. These inserts shall then be removed and a feeler gauge entered into the recess until the gasket can be felt. By using the gauge, any irregularity in the position of the gasket can be felt. Should the gasket be out of place, the pipe shall be removed and the gasket examined for cuts. If it is undamaged, it may be used again, but both it and the joint shall be relubricated.
- 3) In pipes smaller than 24-inch diameter, the joint shall be checked from the outside by the Contractor. A gauge shall be inserted in the flare of the bell and run entirely around the pipe to assure that no portion of the gasket is protruding. Once the joint has been checked, the pipe shall be thrust completely home.
- 4) A cloth band shall be placed around the exterior joint recess, fastening it in place with either wire or the steel strapping stitched

into its edges. A 1 part cement to 2 parts sand mortar mix of sufficient consistency to flow easily shall be poured into the joint recess beneath the cloth band. To assist the flow and to assure complete filling of the entire recess around the pipe, the joint recess shall be rodded with a stiff wire curved to the radius of the pipe. The joint recess at the top shall be closed with a stiffer mix of the same material.

- 5) The interior joint recess of pipes 24-inch diameter and larger shall be filled with a 1 part cement to 1 part sand mortar mix. This shall be troweled flush with the interior surface, and all excess shall be removed.

d. Mechanical Joints

Mechanical joints shall be joined in accordance with the manufacturers recommendations as approved by the County. All nuts shall be tightened uniformly with a torque of not less than 75 or more than 90 foot-pounds.

- e. Other methods of jointing pipe will be given consideration by the County, provided the Contractor furnishes evidence that the proposed method is equal to or better than the specified methods, and further, provided that the proposed method has been successfully used and that the joint has previously been manufactured by the company from whom the Contractor proposes to purchase pipe.
 - f. All jointing material and workmanship shall be in accordance with the manufacturer's recommendations as approved by the County.
8. Tracer Wire: All non-metallic water mains shall have a ten (10) gauge copper wire secured with duct tape to the top of the pipe at ten (10) foot centers and attached to the valve boxes as noted in the Standard Details. The copper wire shall be continuous for the full length of the pipeline. Continuous conductivity shall be maintained and tested. Underground splice connections shall be made with solderless split bolt connectors and taped to pipe.
 9. Detector Tape: Install visual detection tape 12 inches below ground level.
 10. Restrained joints and joint restraint systems shall be assembled in accordance with the manufacturer's recommendations. Tie rod nuts shall be uniformly tightened and double nutted to prevent movement. Joint restraint systems shall be field protective coated with two coats of a bituminous coating after assembly.
 11. Connections to existing work shall be made by the Contractor in the presence of the County at such a time and in such manner as directed and approved by the County. The Contractor shall notify the consumers in the area to be affected by the shut-off. All valves necessary for making connections will be operated by the County. The Contractor shall complete the connections with the greatest possible speed and all work will proceed without interruption until the existing system is returned to operation, so that the public will be inconvenienced as little as possible.

12. Buttresses and anchors shall be installed at all caps, horizontal bends, tees, branches and vertical bends as required in the Contract Documents, Standard Details, and as directed by the County.

C. FIELD TESTS

1. General

- a. All portions of water mains and appurtenances shall be tested. The County shall have the final decision as to the methods used.
- b. During installation water mains will be visually inspected for compliance with these specifications and the contract documents by the County with the assistance of the Contractor. Further inspections and tests will be conducted by both parties after the section of pipeline being inspected and tested has been backfilled and has had ample time for the curing of buttresses.
- c. The Contractor shall schedule all tests with the County at least 48 hours in advance of the test, and shall conduct all tests in the presence of the County. On County Capital Projects, the County will witness one test at no cost to the Contractor. Should the pipeline fail the first County witnessed test, the Contractor shall reimburse the County for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the County for the cost of inspection if the Contractor is not prepared for any test, or for additional tests required.
- d. The pipeline shall be flushed free of all debris, silt, earth, gravel, rock or other foreign material. It shall be done in a manner to prevent debris or flushing water from entering the existing water mains.
- e. Control and/or treatment of the discharge of chlorinated water used for flushing, cleaning, or testing operations shall comply with all current applicable local, state, and federal regulations. Costs associated with the control or treatment procedures shall be the Contractor's responsibility.
- f. Any defective work which shows up while conducting tests shall be replaced or repaired as approved by the County by the Contractor at his expense.
- g. Water mains will be tested in sections dictated by the operational breaks noted on the Contract Documents or as approved by the County.
- h. No water mains will be connected to existing mains, except through 3/4" loading line, at any point until they have been tested and chlorinated.
- i. All stub valves will be open and testing will be through caps or blow-offs at buttress.

- j. After these tests have passed, the Contractor will drain the line. The Contractor will clean all piping and fittings that will be used to connect the new lines to existing mains with chlorinated water.
- k. After tying into existing mains the Contractor will refill and flush the lines and a representative of the County Water and Wastewater Division will check to see that the chlorine residual is back to acceptable levels before any water services are installed.
- l. Once the line is permanently tied into the County system the line shall remain charged unless directed otherwise by the County.

2. Materials

- a. The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents. When specific tests of materials are called for in the referenced standards and specifications, the County has the option of requiring that any or all of these tests be performed at the Contractors expense.
- b. Polyvinyl chloride (PVC) pipe and fittings shall be homogeneous throughout and free from visible discoloration cracks, bubbles, blisters, holes, foreign inclusions, cuts, or scrapes on inside or outside surfaces, or other imperfections which may impair the performance or life of the pipe.
- c. Ductile iron pipe (DIP) and fittings shall be sound and without defects that might impair its service.

3. Chlorination and Field Tests

a. General

- 1) When mains are completed, they shall be flushed, chlorinated, and tested. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the tests specified and to chlorinate the water mains.
- 2) Testing and tying in will be coordinated through the Resident County Inspector on the job. Under no circumstances will any existing valves or fire hydrants be operated by the Contractor without prior approval of the Resident County Inspector, and the Water and Wastewater Division.
- 3) The section of water main being tested shall be filled from an existing fire hydrant or main as designated by the County. The Contractor shall furnish an approved backflow preventer at the point of supply. When charging and testing water mains which are not sufficiently close to existing water mains, the Contractor may use an approved potable water truck to haul water from an approved source.

- b. Chlorination, Dechlorination, Flushing, and Bacteriological Testing
- 1) When the water mains are completed, each section (between operational breaks) shall be flushed and chlorinated in accordance with AWWA C651 "Disinfecting Water Mains" standard. Calcium Hypochlorite or approved equal shall be discharged into the water main near the point where the water main is being charged. This solution shall be of such strength and quantity as may be necessary to provide 25 parts per million residual chlorine after 24 hours, in the section of water main being charged.
 - 2) After the 24 hour (minimum) disinfection period, the Contractor shall test the water main for chlorine residual, then flush main with system water until system residual is met.
 - 3) Samples will be taken by the County and tested for chlorine residual and bacteriological contamination. Should the chlorine residual and bacteriological analysis not be satisfactory, the Contractor shall flush and rechlorinate the water main until satisfactory results are obtained.
 - 4) The discharge of chlorinated water into a sanitary sewer without a permit from the Water and Wastewater Division is prohibited. Permits will be issued on a case by case basis depending on chlorine content, geographic location and quantity.
 - 5) The discharge of all water on the ground surface shall be in accordance with all applicable federal, state and local requirements.
- c. Hydrostatic Testing
- 1) Water mains and appurtenances shall be hydrostatically tested between operational breaks by the Contractor, under the supervision of a Water and Wastewater Division representative, in accordance with AWWA C600 and as specified herein.
 - 2) The pressure in the water main shall be increased to 150 psi at the highest point of the section of main under test, provided the static pressure is under 100 psi. Where static pressure is over 100 psi, the test pressure shall be 50 psi above static pressure. This test pressure shall be maintained, without pumping for at least two (2) hours at 150 psi, then lowered to 100 psi for twenty-four (24) hours. Should this test show the main to be defective, the Contractor shall remedy such defects and retest the main as specified above. This procedure shall be repeated until the test requirements are met.

- 3) In the event that air is trapped within the main to be tested, the Contractor, with County approval, will make additional taps at his expense to release the trapped air. Preferably these taps shall be at proposed service locations.
 - 4) Hydrostatic testing, against a closed valve will not be permitted.
- d. Continuity Testing for Non-Metallic Pipe
- 1) After backfilling, the County shall test the tracer wire to demonstrate electrical continuity between valve boxes and through the length of the nonmetallic pipeline installed. The Contractor shall schedule all tests with the County at least 48 hours in advance. Any discontinuity shall be located, repaired, and retested at the Contractor's expense until continuity is demonstrated.
 - 2) On Capital Projects, the County will perform one continuity test at no cost to the Contractor. Should the continuity test fail, the Contractor shall reimburse the County for all costs resulting from such additional test so required until the continuity test passes.

4.0 METHOD OF MEASUREMENT

A. WATER MAINS

Measurement for furnishing and installing water mains will be made horizontally along the center line of the pipe for each size and type of pipe without deduction for fittings or valves less than 8-inches in diameter.

B. FIRE HYDRANT LEADS

Measurement for furnishing and installing fire hydrant leads will not be made as it will be incidental to fire hydrant installation.

5.0 BASIS OF PAYMENT

A. GENERAL

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
2. The prices bid for furnishing and installing water mains shall include the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.

- b. Furnishing and installing granular pipe bedding materials and concrete for pipe fitting anchorages and buttresses as shown on the Standard Details and as required elsewhere in the Contract Documents.
 - c. Furnishing and installing restrained joints and/or joint restraint systems where required by the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. WATER MAINS

Payment for furnishing and installing water mains, complete and in place, will be made per linear foot of the size and type of pipe installed and/or lump sum price bid. The price(s) bid shall include traffic control, furnishing and installing all pipe valves (less than 8-inches in diameter), fittings, jointing materials, and buttresses, providing an approved spoil site, and disposing of all spoil or excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, removing existing buttresses when necessary, and connecting to existing pipelines, structures; testing and disinfecting the water main, and incidental items to complete the water main.

C. FIRE HYDRANT LEADS

Payment for furnishing and installing fire hydrant leads, will not be made as it will be incidental to fire hydrant installation.

D. VALVES AND FIRE HYDRANTS

Payment for furnishing and installing valves and fire hydrants will be made as specified in Section 02662 and Section 02666.

****END OF SECTION 02660****

**SECTION 02662
WATER VALVES AND APPURTENANCES**

1.0 GENERAL

A. DESCRIPTION

Water valve and appurtenance installation shall include, but not necessarily be limited to, furnishing and installing gate, butterfly, air release, vacuum, combination air valves or assemblies with appurtenant valve vaults, roadway valve boxes and accessories in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Mains: Section 02660
3. Cast-In-Place Concrete: Section 03300
4. Precast Concrete: Section 03400
5. Brickwork, Unit Masonry: Section 04200
6. Miscellaneous Metals: Section 05500

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to insure compliance with the Contract Documents.

2.0 MATERIALS

A. GENERAL

Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any water valves or appurtenances.

C. CONTRACTOR'S OPTIONS

None

D. DETAILED MATERIAL REQUIREMENTS

1. Aggregate for bedding, leveling, and drainage shall meet the gradation requirements of AASHTO M 43, Size Number 57.

2. Water mains and appurtenances shall be as specified in Section 02660.
3. Tapping saddles and corporation stops shall be as specified in Section 02664.
4. Portland cement concrete for miscellaneous valve appurtenances and cast-in-place vaults shall be the mix number indicated on the Standard Details and as specified in Section 03300.
5. Precast concrete vaults, manhole sections and grade rings shall be as indicated on the Standard Details and as specified in Section 03400.
6. Brick for valve support and miscellaneous valve appurtenances shall be sewer brick as specified in Section 04200.
7. Mortar for brickwork shall be as specified in Section 04100.
8. Frames, covers, and steps shall be as indicated on the Standard Details and as specified in Section 05500.
9. Gate Valves
 - a. General

Gate valves shall be iron body, resilient-seated, non-rising stem, 2-inch square operating nut which shall turn left (counter-clockwise) to open, with ample strength to withstand and operate under a working pressure of 150 psi, unless otherwise noted. The thrust collar shall be effective for both opening and closing. Valves up to and including 12" shall be manufactured in accordance with AWWA C 509. Valves greater than 12" shall be manufactured in accordance with AWWA C 509 or C 515. Valves shall be furnished with mechanical joint ends unless flanged or other type ends are indicated in the Contract Documents.
 - b. Gate valves through 20-inch diameter shall be vertical type with O-ring stem seals.

Gate valves 20-inches and greater shall have gearing as approved by Worcester County.
 - c. Gate valves shall be coated in accordance with AWWA C550. Both the inside and outside surfaces of the body and bonnet shall be epoxy coated.
 - d. Buried valves shall be furnished with an extension in accordance with the Standard Details.
 - e. Wedge rubber shall be molded in place and bonded to the ductile iron portion, and shall not be mechanically attached with screws, rivets, or similar fasteners.

- f. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or sealing.
- g. Wedge shall be constructed of gray or ductile iron, fully encapsulated in synthetic rubber except for guide and wedge nut areas.

10. Tapping Valves and Sleeves

Valves for tapping service shall meet all the requirements for gate valves. In addition, the body seat rings shall have a clear opening equal to the nominal size of the tapping valve. Tapping sleeves shall be iron body mechanical joint type, or as approved by the County. Tapping valves for ductile iron pipe shall have flange by mechanical type ends unless otherwise shown on the Plans. All tapping sleeves shall be furnished with an outlet for testing. Tapping sleeves for prestressed concrete pipe shall be furnished and installed in accordance with the pipe manufacturer's recommendations.

11. Butterfly Valves

- a. Butterfly valves shall be manufactured in accordance with AWWA C504 as modified herein. Valves shall be Class 150B, and designed for a differential pressure across the valve of 150 psi and a minimum flow of 16 feet per second for opening and closing.
- b. Valves shall be furnished with mechanical joint ends unless otherwise noted in the Contract Documents. When flanged ends are specified, valves shall be of the short lay length configuration.
- c. Valves shall be furnished with a rubber seat, either in the body or on the disc, and a seat mating surface of alloy cast iron conforming to ASTM A 436, Type I, or 18-8 stainless steel, Type 304 or 316. Valves 24-inch diameter and larger shall have adjustable seats of a design that permits replacement in the field without removal of the valve from the line.
- d. Valve shafts shall be stainless steel or monel, and shall be horizontal when the valve is installed in the water main.
- e. Valve actuators may be worm gear or traveling nut type with a 2-inch square operating nut which shall turn left (counter-clockwise) to open. Operators shall be fully enclosed in a gasketed grease-filled enclosure, and shall withstand an input of 350 foot pounds to the nut at extreme operator position without damage.
- f. Valves shall be furnished with an extension stem terminating a maximum of 6-inches below finished grade. The operating nut shall be located in a standard valve box and shall include a sealed valve position indicator which shows a valve position, and direction and number of turns to open or close the valve.

12. Air and/or Vacuum Release Valve

- a. Air-release, air/vacuum, and combination air valves shall be manufactured in accordance with AWWA C512 as modified herein. Valves shall be furnished with threaded ends unless otherwise noted in the Contract Documents.
- b. The air/vacuum valve shall have a cast iron body and cast iron cover. The internal compound level mechanism shall be stainless steel and all other internals including float shall be stainless steel to avoid galvanic action. The stainless steel float shall withstand a minimum pressure of 1,000 psi.
- c. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

<u>PART</u>	<u>MATERIAL</u>	<u>SPECIFICATION</u>
Body and Cover	Cast Iron	ASTM A48, Class 35
Internal Linkage	Stainless Steel	Series 300
Float and Internals	Stainless Steel	Series 302
Seat	Buna-N	
Exterior Paint	Phenolic Primer Red Oxide	FDA approved for potable water

- d. All internals shall be easily removed through the top cover without removing the main valve from the lines.
- e. An isolating valve shall be installed between main and air/vacuum release valve for maintenance.
- f. Air/vacuum release valve shall be installed in an easily accessible vault. Vault shall be adequately vented to meet air/vacuum release valve requirement.
- g. The valve manufacturer shall furnish installation and maintenance instruction manuals with each valve.

13. Roadway Boxes

Screw type roadway valve boxes and covers shall be made of cast iron conforming to the requirements of ASTM A 48, Class 30 B and shall meet the dimensional and marking requirements indicated on the Standard Details and Section 05500.

3.0 EXECUTION

A. GENERAL

- 1. Excavation, foundation preparation, backfill, and compaction shall be as specified in the Standard Details and Section 02250.

2. Valves shall be restrained, supported, and strapped and/or anchored in accordance with the Standard Details.

B. GATE AND BUTTERFLY VALVES

1. Gate and butterfly valves shall be installed in accordance with the Standard Details and at the locations shown on the Plans or as directed by the County.
2. Roadway valve boxes shall be centered and plumb over the valve operating nut. Backfill shall be compacted under and around valve boxes to insure that no vertical loads are transmitted to the valve operators.

C. VALVES IN VAULTS OR MANHOLES

Dewatering and air release, vacuum, and combination air valves shall be installed in manholes in accordance with the Standard Details.

D. FIELD TESTS

1. Water valves and appurtenances installed at the same time as a new water main shall be tested, after installation, by the Contractor along with the water main in accordance with Section 02660.
2. Water valves and appurtenances installed in an existing water main will be visually inspected for leakage by the County at the existing water main line pressure before the excavation is backfilled. The valve and joints shall be leak free under line pressure.
3. Tapping sleeves and valves shall be tested after assembly on the existing water main but prior to making the tap. The Contractor shall pressurize the complete assembly to 150 psi for 15 minutes with zero leakage, unless otherwise noted, and the County will visually inspect the tapping sleeve and valve for leakage. No leakage will be permitted.

4.0 METHOD OF MEASUREMENT**A. WATER VALVES**

Measurement for furnishing and installing water valves (gate, tapping valves and sleeves, and butterfly) 8-inches in diameter and greater and appurtenances will be made of the number of each size and type installed complete.

B. AIR AND/OR VACUUM AND COMBINATION AIR VALVES

Measurement for furnishing and installing air and/or vacuum and combination air valves and appurtenances will be made of the number of each size and type installed complete.

5.0 BASIS OF PAYMENT**A. GENERAL**

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown and specified in strict accordance with the Contract Documents.
2. Payment for furnishing and installing water valves and appurtenances will include the following:
 - a. Excavation, backfill, compaction, and incidental items as specified in Section 02250.
 - b. Furnishing and installing aggregate, tie rods, retainer glands, and concrete valve support and restraint as shown on the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. WATER VALVES

Payment for furnishing and installing water valves (gate, tapping valves and sleeves, and butterfly) 8-inches in diameter and greater and appurtenances will be made for each size and type of valve installed. The price(s) bid shall include traffic control, furnishing and installing all valves, vaults, manholes, roadway valve boxes, jointing materials and buttresses, strapping, restoration; testing of the complete installation; and incidental items to complete the valve installation.

C. AIR AND/OR VACUUM AND COMBINATION AIR VALVES

Payment for furnishing and installing air and/or vacuum and combination air valves and appurtenances will be made for each size and type installed. The price(s) bid shall include traffic control, furnishing and installing all valves, saddles, vaults, manholes, pipe supports, angle valves, corporation stops, extensions, restoration; testing of the completion installation; and incidental items to complete the valve installation.

- D. Payment for furnishing and installing valves on water service connections will be made as specified in Section 02664.

**** END OF SECTION 2662****

**SECTION 02664
WATER SERVICES AND APPURTENANCES**

1.0 GENERAL

A. DESCRIPTION

Water services and appurtenances shall include, but not necessarily be limited to, furnishing and placing water services with appurtenant meter housings and connection to the water main in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Mains: Section 02660
3. Water Valves and Appurtenances: Section 02662
4. Cast-In-Place Concrete: Section 03300
5. Precast Concrete: Section 03400

C. QUALITY ASSURANCE

The County will inspect all materials before and after installation to insure compliance with the Contract Documents.

2.0 MATERIALS

A. GENERAL

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.
2. To minimize the number of joints, only standard manufacturers length of pipe shall be furnished and installed for all water services unless otherwise indicated on the Plans, or as approved by the County.

B. MATERIALS FURNISHED BY THE COUNTY

The County will furnish and install 5/8-inch and 3/4-inch water meters and remote readouts for water service connections in existing service areas. The Contractor will furnish and install water service and meter pits in all new developments. The Contractor will furnish the County 5/8-inch by 3/4-inch water meters and remote radio readouts for each water service connection.

C. CONTRACTOR'S OPTIONS

Refer to Standard Details and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

D. DETAILED MATERIAL REQUIREMENTS

1. Water Meters

- a. Water meters shall be as shown on the Standard Details and the Construction Documents.
- b. Water meters for either combined domestic and fire service or for fire service only shall be bronze, magnetic drive, flanged end turbo meters with hermetically permaseal glass and housing, registering in U.S. gallons, and furnished with a U.L. approved fire strainer as required.

2. Water Service

- a. Water services less than 3-inches in diameter shall be Type K, annealed copper tubing and shall meet the material, chemical and mechanical requirements of ASTM B 88 or SDR 21 gasketed PVC water pipe that meets the requirements of ASTM D 2241 and ASTM D 1784: PVC 1120. The pipe is to have an integral bell that utilizes a gasket for sealing that meets the requirements of ASTM F477.
 - b. Water services 3-inches in diameter and larger shall be as specified in Section 02660.
3. Meter fittings, copper setters, lids, covers, and appurtenances shall be as noted in the Approved List of Suppliers and Materials for Water Main Construction.
 4. Tubing Couplings - Copper tube couplings shall be as noted in the Approved List of Suppliers and Materials for Water Main Construction.
 5. Corporation stops with compression type fittings shall be as noted in the most recent Approved List of Suppliers and Materials for Water Main Construction.
 6. Gate valves, roadway valve boxes, curb boxes and tapping sleeves for water services shall be as specified in the Standard Details and Section 02662.
 7. All service line valves and fittings shall be manufactured in accordance with AWWA C800. Connection to service lines shall be compression type.
 8. Meter vaults for 1½-inch or larger service lines shall have aluminum access hatches designed to withstand an H-20 wheel load. Door leaf shall be ¼-inch aluminum diamond or safety tread pattern plate. Channel frame shall be ¼-inch aluminum with concrete anchor flange around the perimeter, bituminous coated where in contact with concrete, and a 1½-inch drainage coupling. Doors shall be equipped with stainless steel hinges and an automatic hold-open arm with release handle. The door shall have a locking mechanism and snap lock with a removable handle. The door shall be operable by a force not to exceed 30

pounds. Fixed ladders shall be equipped with an aluminum LadderUp safety post or approved equal.

9. Tapping saddles shall be manufactured of high strength ductile iron, ASTM A536, protected with a fusion applied epoxy or nylon fused (10-12 mil) coating. Saddles shall be furnished with Type 304 stainless steel straps with a minimum 2 inch wide bearing area and a rubber gasket suitable for potable water.
10. Pipe wall penetrations shall be as specified in the Standard Details.
11. Meter vaults shall be precast concrete vaults of the size indicated on the Standard Details furnished and installed as specified in Section 03400.
12. All water services and/or fire service lines shall be equipped with approved backflow prevention devices.
13. Detector Tape

Visual Detection Tape shall be 3 inches wide (minimum) nonmetallic blue plastic tape lettered "water" in black graphics.
14. Location Lumber

Lumber for marking house connection locations shall be minimum 2-inch x 6-inch boards of sufficient length to extend from the plug-at the end of the house connection to a height of 4 feet, more or less, above finished grade, painted blue above finished grade.
15. Tracer Wire for Nonmetallic Pipelines

Tracer wire shall be 8 gage, 7 strand continuous copper wire with a 45 mil polyethylene insulation. The wire shall be blue, have "UL" markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connectors with a water proof binder and underground electrical tape.
16. Continuity Test Station
 - a. The continuity test station aside a fire hydrant shall be a 2 1/2" shaft cathodic test box constructed of ABS plastic with cast iron rim and lid. The minimum box length shall be 24" and the body shall be flared or squared at the base to prevent pull out or settlement. Lid shall be locking, blue in color, and have raised custom lettering noting "test". Test station shall be complete with an inset removable terminal board with three (3) terminals.
 - b. The continuity test station that is located over the water main shall be a 4 1/4" valve box with blue locking lid. Test station shall be complete with an inset removable terminal board with three (3) terminals.

3.0 EXECUTION**A. PREPARATION**

1. Trench excavation, backfill, and compaction, bedding and haunching shall be as specified in Section 02250.
2. Prior to start of utility installation, all rights-of-way shall be graded to within ± 0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.
3. Trench Water: The service trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water.
4. Laying Service in Freezing Weather: No service shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the service has been installed.
5. Pipe Bedding: Each service shall be bedded on a solid foundation acceptable to the County and in accordance with the Standard Details. When aggregate bedding is required, bedding shall be installed to grade prior to laying pipe.

B. WATER SERVICES AND APPURTENANCES

1. Water services and appurtenances shall be installed in accordance with the approved manufacturers written instructions, County Standards, Contract Documents, and as specified herein:
2. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used.
3. Water services shall be jacked or driven under paving unless otherwise directed by the County. In case jacking or driving house services under any type of paving cannot be made, the County with approval of the pertinent agency may permit the Contractor to open cut. In the case of an open cut in paving, trench widths shall not exceed 18 inches or the requirements noted in the utility permit, whichever is most stringent.
4. House services installed in areas other than paving areas shall be open cut or driven at the Contractor's option.
5. All services shall be laid to the grade and lines in accordance with the Contract Documents or as directed by the County. Special care shall be taken to insure that the services are well-bedded. Any defects resulting from settlement shall be repaired by the Contractor at his expense.
6. All services shall be thoroughly flushed with potable water at the time the main is tapped. All PVC services and services larger than 3-inch diameter shall be installed, chlorinated and tested as specified in Section 02660.

7. The pipe and fittings shall be thoroughly cleaned before being installed, and shall be kept clean until the acceptance of the completed work.
8. All meter vaults 24-inch in diameter and smaller shall be set at a minimum depth of two feet, eight inches (2' - 8"). They shall be set on brick or precast concrete rings and bedded on firm undisturbed earth.
9. Tracer Wire: All nonmetallic water mains shall have a ten (10) gauge copper wire secured with duct tape to the top of the pipe at ten (10) foot centers and attached to the valve boxes as noted in the Standard Details. The copper wire shall be continuous for the full length of the pipeline. Continuous conductivity shall be maintained and tested. Underground splice connections shall be made with solderless split bolt connectors and taped.
10. Detector Tape: Install visual detection tape 12-inches below ground level.

C. CONNECTIONS TO WATER MAINS

1. Service taps greater than 1-inch in PVC pipe shall have service saddles.
2. Except as noted all service taps in mains that are 4-inch and smaller shall have service saddles.
3. Service taps 1-inch and smaller for 6-inch and larger mains shall have service saddles.
4. Service taps larger than 1-inch for 6-inch, 8-inch, and 10-inch mains shall have service saddles, tapped tees, or tapping sleeve and valve.
5. Excluding PVC pipe service taps for 12-inch and larger mains may be direct tapped through 2-inch. Service taps greater than 2-inch on 12-inch and larger mains shall be tapped tee, or tapping sleeve and valve.
6. Service taps for 12-inch PVC mains may be direct tapped through 1-inch. Service taps greater than 1-inch shall have service saddles, or tapping sleeves and valves.
7. Corporation taps or tapping sleeves shall be installed on new water mains under operating pressure after the water mains have been chlorinated and tested in accordance with the Contract Documents.
8. Service connections to existing water mains shall be made as noted in this section only where authorized by the County.
9. The County reserves the right to require a saddle on any water main service connection where the integrity of the connection or appurtenances is in question.

4.0 METHOD OF MEASUREMENT

- A. Measurement for water services will be made per each type and size of service installed.

- B. Measurement for meter settings and vaults or curb stops will not be made for it will be incidental to water service installation.

5.0 BASIS OF PAYMENT

A. GENERAL

- 1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown and specified in strict accordance with the Contract Documents.
- 2. The prices bid for furnishing and installing water services shall included the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.
 - b. Tapping the main or furnishing and inserting saddles or fittings in the main with appropriate buttresses, and furnishing and installing corporation stops or valves at the main.
 - c. Furnishing and installing cast-in-place or precast concrete or plastic meter vaults with frames and covers and access hatches as per the Contract Documents.
- 3. Payment will be made for contingent items when approved by the County.

B. WATER SERVICES

Payment for furnishing and installing water services will be made per each type and size of service installed. The price(s) bid shall include traffic control furnishing and installing the pipe or tubing, fittings, driving sleeves, curb stops, curb stop valve boxes, meter yoke/meter setting, bypass lines, temporary paving, and incidental items to complete the work.

C. METER SETTINGS AND VAULTS

Payment for furnishing and installing meter settings and vaults will not be made for it will be incidental to water service installation.

****END OF SECTION 02664****

**SECTION 02666
FIRE HYDRANTS**

1.0 GENERAL

A. DESCRIPTION

Fire hydrant installation shall include, but not necessarily be limited to furnishing and installing fire hydrants or relocating fire hydrants in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Main Installation and Chlorination: Section 02660
3. Water Valves and Appurtenances: Section 02662
4. Cast-In-Place Concrete: Section 03300
5. Unit Masonry: Section 04200

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to insure compliance with the Contract Documents.

2.0 MATERIALS

A. GENERAL

Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for fire hydrant installation or relocation.

C. CONTRACTOR'S OPTIONS

None.

D. DETAILED MATERIAL REQUIREMENTS

1. Washed gravel for hydrant foundation shall meet the gradation requirements of AASHTO M 43, Size Number 57.

2. Fire Hydrants
 - a. Hydrant valve opening shall be at least 5¼-inch diameter net. Inlet connection shall be 6-inch mechanical joint .
 - b. Hose connections shall consist of two 2½-inch diameter hose connections and one 4½-inch diameter steamer or pumper connection. Hose and pumper nozzle threads shall conform to ANSI Specifications B26 for "National (American) Standard Fire-Hose Coupling Screw Thread."
 - c. Operating nut shall be 5-sided, 1½ inches from point to flat, and shall turn left (counterclockwise) to open.
 - d. The inlet connection to hydrants shall be six (6) inch mechanical joint.
 - e. Hydrant design shall be such that when the barrel is broken, it may be replaced without excavating or breaking adjacent pavement; that the entire barrel, including all working parts along with the main and drain valve seats, may be removed for inspection or repair without excavating or disturbing the ground.
 - f. The groundline lugs and valve rod shall be frangible so that in the event of accident, damage or breaking of the hydrant above or near the grade level, the main valve will remain closed and reasonably tight against leakage. Breakaway lugs are required, breakaway bolts will not be accepted.
 - g. The main valve seal shall be compression type sealing against a bronze seat and the valve shall open against pressure. The main valve shall be removed by use of a short-stemmed wrench.
 - h. Minimum bury depth shall be three and a half (3 ½) feet measured from the top of the connecting pipe to the ground level at the hydrant.
 - i. Bonnet shall have cast on the top an arrow and the word "open" indicating the direction for opening.
 - j. Fire hydrants shall meet the requirements of the "AWWA" Standard for fire hydrants for ordinary water works service C502. All lug bolts shall conform to ASTM A307, Grade B.
 - k. Interior of shoe shall be epoxy coated.

3.0 EXECUTION

A. GENERAL

1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
2. Construction methods shall be in accordance with Section 02660.

B. FIRE HYDRANT INSTALLATION

1. Fire hydrants shall be installed and restrained in accordance with the Standard Details AWWA M17, at the locations shown, and to elevations directed by the County. Hydrants shall be set within an aggregate drainage well extending the full width of the trench, from the center of the hydrant to a length equal to the width in a direction towards the main line, and from the bottom of the trench to a point 6-inches above the drip opening.
2. Hydrant leads shall be laid level on a firm foundation to insure that the hydrant is set plumb. Backfill around the hydrant shall be compacted so as to obtain a density of at least 92% of maximum when measured in accordance with AASHTO T180, Method D.
3. Where hydrants are to be relocated, the Contractor shall ascertain whether or not the hydrant valve has been restrained before removing the hydrant to be relocated.
4. Where the existing lead is to be abandoned the lead shall be capped and blocked at the main by removing the hydrant valve and installing the cap or plug. All caps and plugs shall be buttressed and strapped to the main or restrained in accordance with County Standards.
5. The outside of all fire hydrants above the breakaway flange shall be painted with two coats of paint as noted in the County Approved List of Suppliers and Materials for Water Main Construction.
6. Main port of fire hydrant shall be directed towards pavement.

C. FIELD TEST

1. Fire hydrants installed at the same time as a new water main shall be tested after installation by the Contractor, along with the water main, in accordance with Section 02660.
2. Fire hydrants installed on an existing water main will be visually inspected for leakage by the County at the existing water main line pressure before the excavation is backfilled. The hydrant, valve, and connecting pipe shall be leak-free under line pressure.

4.0 METHOD OF MEASUREMENT

- A. Measurement for fire hydrant installations or relocations will be made of the number of hydrants satisfactorily installed or relocated as shown on the Plans or directed by the County.
- B. Fire hydrant lead pipe, fittings, valves and appurtenances will not be measured for it will be incidental to fire hydrant installation.

5.0 BASIS OF PAYMENT**A. GENERAL**

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown as specified in strict accordance with the Contract Documents.
2. The price(s) bid for furnishing and installing or relocating fire hydrants shall include the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.
 - b. Furnishing and installing aggregate fill and bedding, tie rods, retainer glands, and concrete thrust blocking as shown on the Standard Details or elsewhere in the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. FIRE HYDRANTS**1. New**

Payment for furnishing and installing fire hydrants complete and in place will be made per hydrant for the total number placed. The price bid shall include all traffic control, removal and disposal of spoil materials; furnishing and placing washed gravel under and around the hydrant; tee, hydrant lead, hydrant lead valve, hydrant, all hydrant and/or valve extensions (if required), bracing, testing and painting of the complete installation; and for incidental items to complete the hydrant installation.

2. Relocations

Payment for removing and reinstalling existing fire hydrants complete and in place will be made per hydrant for the total number placed. The price bid shall include all traffic control, removal and disposal of spoil materials, investigation of existing restraint system, all required lead modifications (including valve), the removal and reinstallation of the existing hydrant, all hydrant or valve extensions (if required), the capping or plugging of the existing lead line (if required), retapping the existing water main (if required); furnishing and placing washed gravel under and around the relocated hydrant, testing and painting of the complete installation; and incidental items to complete the hydrant relocation.

C. FIRE HYDRANT LEAD PIPES

Payment for furnishing and installing fire hydrant lead pipe, fittings, valves and appurtenances, including strapping the valve to the water main fitting, will not be made for it will be incidental to the fire hydrant installation.

****END OF SECTION 02666***

**SECTION 02700
GRAVITY SANITARY SEWER AND HOUSE CONNECTIONS**

1.0 GENERAL

A. DESCRIPTION

Sanitary sewer installation shall include, but not necessarily be limited to furnishing all labor, materials, and services necessary to install pipe, fittings, miscellaneous structures of concrete or brick masonry, and appurtenances for gravity sewer and house connections, of the size and type shown, in accordance with the Contract Documents.

B. RELATED WORK SPECIFIED ELSEWHERE

1. Trench Excavation, Backfill and Compaction: Section 02250
2. Sanitary Sewer Manholes: Section 02710
3. Precast Concrete Structures: Section 03400
4. Mortar and Masonry Grout: Section 04100
5. Unit Masonry: Section 04200
6. Miscellaneous Metals: Section 05500

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. GENERAL

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.
2. To minimize the number of joints, only standard manufacturers length of pipe shall be furnished and installed for all sanitary sewer mains and house connections unless otherwise indicated on the Plans, or as approved by the County.

B. PIPE SYMBOLS

For convenience and standardization, the various types of pipe are designated on the plans by the following symbols:

CISP	-	Cast iron soil pipe
DIP	-	Ductile iron pipe
PVC	-	Polyvinyl chloride pipe
RCSP	-	Reinforced concrete sewer pipe

C. MATERIALS FURNISHED BY THE COUNTY

1. The County will not furnish any materials for gravity sanitary sewer and house connections.
2. Unless otherwise noted in the "Special Provisions," the County will make water available from its potable water system for pipeline testing at no charge to the contractor for one test only. The Contractor shall contact the Division of Water and Sewer to coordinate its use. If subsequent testing is required, the Contractor will purchase additional water from the County's system.

D. CONTRACTOR'S OPTIONS

1. The Contractor may furnish Polyvinyl chloride (PVC), or ductile iron pipe (DIP) for sewers equal to or smaller than 24-inch diameter unless specified otherwise in writing by the County.
2. The Contractor may furnish reinforced concrete pipe (RCSP), or ductile iron pipe (DIP) for sewers greater than 24-inch diameter unless specified otherwise in writing by the County.
3. Prestressed concrete pipe and fittings specified in Section 02660 may be furnished in lieu of reinforced concrete pipe as specified herein provided it meets the specified design, quality control, and test requirements.
4. The Contractor may furnish precast, cast-in-place, or masonry construction for miscellaneous sanitary sewer structures unless specified otherwise in writing by the County.

E. DETAILED MATERIAL REQUIREMENTS

1. Polyvinyl Chloride Sewer Pipe (PVC) and Fittings
 - a. Polyvinyl chloride (PVC) pipe and fittings 4-inch through 16-inch in diameter must comply with ASTM D 3034 and F1336 and have a minimum wall thickness of SDR 35. Pipe and fittings 18-inch through 24-inch diameter shall meet the material requirements of ASTM F679 and F1336 and have a minimum wall thickness of T-1. All PVC compounds for all sizes shall comply with ASTM D 1784 and have a minimum cell classification of 12454B and comply with ASTM D 1784.
 - b. All pipe and fittings must be manufactured with a locked-in gasket.

- c. House service riser pipe shall be heavy wall sewer pipe having a minimum wall thickness of SDR 26 and shall meet the requirements of ASTM D 3034.
 - d. The PVC Y and fitting supporting the house service riser shall be integrally cast in concrete as per the Standard Details.
2. Ductile Iron Pipe (DIP) and Fittings and Cast Iron Fittings
 - a. Ductile iron pipe (DIP) and fittings shall conform to ANSI/AWWA C150/A21.50 in matters of design and ANSI/AWWA C151/A21.51 for materials. Pipe thickness shall conform to the Special Thickness Class 51 minimum. Pipe class shall be as shown on the Plans.
 - b. Ductile iron pipe, ductile iron fittings and cast iron fittings shall be cement-lined in accordance with AWWA C 104, double thickness. This lining shall be sealed with a bituminous seal coat. The outside surfaces shall be bituminous coated.
 3. Cast Iron Soil Pipe and Fittings

Cast iron soil pipe and fittings for sanitary house connections outside the public right-of-way or on risers shall meet material requirements of ASTM A74, service weight or heavier with mechanical, or gasketed joints.
 4. Pipeline Plugs for Testing

Pipeline plugs shall be rubber gasketed or ribbed, watertight, airtight to the extent required by air testing requirements of this Section, cannot be dislodged by testing pressure (internal or external), and of an approved design.
 5. Detector Tape

Detector Tape shall be 3 inches wide (minimum) nonmetallic green plastic tape lettered "sewer" in black graphics.

3.0 EXECUTION

A. PREPARATION

1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250.
2. Prior to start of utility installation, all rights-of-way shall be graded to within +0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.
3. Trench Water: The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water. In the event significant groundwater is encountered during construction,

the Director may require the Owner and/or Contractor to prepare a corrective plan of action for review and approval by the County.

4. Laying Pipe in Freezing Weather: No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe had been installed.
5. Pipe Bedding: Each pipe shall be bedded on a solid foundation acceptable to the County and in accordance with the Standard Details. Bedding shall be installed to insure that joints are properly made and the pipe is firmly supported, the full length of the barrel. All sewer mains and services shall be installed with a minimum of six inches of aggregate bedding below the pipe invert, meeting the gradation requirements of AASHTO M43, size number 57. Aggregate bedding shall be installed to grade prior to laying of pipe sections.

B. PIPE INSTALLATION

1. All pipe shall be installed in accordance with the approved manufacturers written instructions, Worcester County Standards, and as specified herein. These recommendations, if more restrictive than that shown in the Standard Details shall include maximum trench width, bedding requirements, backfill material, and compaction, where applicable. In addition, the following shall apply unless otherwise noted:
 - a. Polyvinyl chloride sewer pipe (PVC) shall be installed in accordance with the Standard Details and the recommendations of Uni-Bell.
 - b. Ductile iron pipe (DIP) and cast iron soil pipe shall be installed in accordance with the Standard Details and the recommendations of the Ductile Iron Pipe Research Associations.
2. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used.
3. Pipe Installation: Pipe shall be carefully handled and lowered into the trench. Pipe shall be installed with special care to insure that each joint is watertight, has met the required manufacturer's insertion depth, and has no shoulder or unevenness of any kind along the inside of the pipeline. No wedging or blocking will be permitted in installing any pipe unless directed by written order or permission in writing is obtained from the County.
4. Pipe Setting and Protection: No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Care shall be used to assure water tightness and prevent damage to, or disturbing of, the joints during the refilling process. After pipes have been installed and joints have been made, there shall be no walking on or working over the pipe, except as may be necessary in tamping the backfill material, until the backfill is at least 2 feet over the top of the pipe.

5. **Cleaning Pipe:** The pipes shall be thoroughly cleaned before being installed and shall be kept clean until acceptance of the completed work. Open ends of all pipelines shall be provided with a stopper carefully fitted to keep dirt and other substances from entering. This stopper shall remain in place at all times when installation is not in progress.
6. **Cutting Pipe:** Whenever a pipe requires cutting, to fit into the line or bring it to the required location, the work shall be performed by an approved method that leaves a smooth, square end. Cut PVC pipe ends shall have burrs removed and the end beveled to match factory bevel. Field spigots shall be stop-marked with a felt tip marker or wax crayon for the proper length of assembly insertion.
7. **Alignment of Pipe:** A laser beam may be used to align the pipe to the proper grade. The Contractor is responsible to monitor the line and grade in each pipe run between structures at pipe station 0+50, and at each 100-foot interval thereafter as a minimum quality control, or as directed by the County. It is the Contractor's responsibility to maintain proper calibration of the equipment throughout the duration of the project.
8. **Jointing Pipe**
 - a. **General**

Before any joints are made in the trench, the Contractor shall demonstrate to the County by making a sample joint that methods he will employ conform with the Specifications, will secure a watertight joint, and that the workmen whom he intends to use for this work are familiar with the requirements for making proper joints.
 - b. **Push-On Gasketed Joints**

Prior to making gasketed joints, both mating pipe ends and the gasket shall be cleaned of all foreign material. The gasket shall then be inserted in or stretched over the cleaned gasket seat and lubricant applied as recommended by the manufacturer and approved by the County. The pipe ends shall be carefully aligned and pushed together to meet the required manufacturer's insertion depth. There shall be no shoulder or unevenness of any kind along the inside of the pipeline. The method of inserting the spigot into the bell shall be as recommended by the manufacturer and approved by the County.
 - c. **Other methods of jointing pipe will be given consideration by the County, provided the Contractor furnishes evidence that the proposed method is equal to or better than the specified methods, and further, provided that the proposed method has been successfully used and that the joint has previously been manufactured by the company from whom the Contractor proposes to purchase pipe.**
 - d. **All jointing and workmanship shall be in accordance with the manufacturer's recommendations as approved by the County.**
9. **Detector Tape:** Install visual detection tape within 12 inches below ground level.

10. Connections to existing work shall be made by the Contractor in the presence of the County at such a time and in such manner as directed and approved by the County. Shut-off operations will not be allowed. The Contractor shall complete the connections with the greatest possible speed and all work will proceed without interruption until the connection operation is complete. When specified in the "Special Provisions," the Contractor shall make connections at night.

C. SANITARY HOUSE CONNECTIONS

1. Sanitary house connection branch fittings shall be located where designated by the contract documents and/or the County. Short pieces of sewer pipe shall be field-cut to meet this condition as approved. The Contractor shall have available at the construction site factory approved equipment to machine and adapt the field-cut end to standard couplings and jointing materials.
2. Sanitary Sewer Taps: All taps made into sanitary sewer lines shall be made by an approved hole-cutting method in accordance with the manufacturer's recommendations. Every effort shall be made to prevent entrance of foreign matter into the pipe during the tapping procedure.
3. Backfill for the support of Y-branches and bends shall be placed as shown in the Standard Details, or as directed.

D. FIELD TESTS

1. General
 - a. All portions of the sewers and appurtenances shall be tested. The County shall have the final decision as to the method or methods used, i.e. water infiltration, water exfiltration, air, mirror, or combination of these.
 - b. After installation, sanitary sewers and sanitary house connections will be inspected by the County with the assistance of the Contractor for compliance with these specifications. Inspections and tests will not be conducted until the section of pipeline being inspected and tested has been backfilled, dewatering pumps have been removed from the area, and the ground water has stabilized.
 - c. The Contractor shall schedule all tests with the County at least 48 hours in advance of the test, and shall conduct all tests in the presence of the County. On County Capital Projects, the County will witness one test at not cost the Contractor. Should the pipeline fail the first County witnessed test, the Contractor shall reimburse the County for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the County for the cost of inspection if the Contractor is not prepared for any test, or for additional tests required.
 - d. The pipeline shall not contain any debris, silt, earth, gravel, rock, or other foreign material. If deemed necessary by the County, the pipeline shall be flushed with water. It shall be done in a manner that prevents debris or

water from entering the existing sewer and before the County witnessed test.

- e. Control and/or treatment of the discharge of chlorinated water used for flushing, cleaning, or testing operations shall comply with all current applicable local, state, and federal regulations. Costs associated with the control or treatment procedures shall be the Contractor's responsibility.
- f. Any defective work which shows up while conducting tests shall be replaced or repaired as approved by the County by the Contractor at his expense.

2. Materials

- a. When specific test of materials are called for in the referenced standards and specifications, the County has the option of requiring that any or all of these tests be performed.
- b. Polyvinyl chloride (PVC) pipe and couplings shall be homogeneous throughout and free from visible cracks, bubbles, blisters, holes, foreign inclusions, cuts or scrapes on inside or outside surfaces or other imperfections which may impair the performance or life of the pipe. Each pipe shall be straight-to-within 1 1/4 inch per 20-foot length of pipe when uniformly supported along its entire length, and shall have a true circular cross-section to within + 1/64 inch.
- c. Cast iron soil pipe, ductile iron pipe (DIP), and ductile iron and cast iron fittings shall be sound and without defects that might impair its service.

3. Visual Inspection

- a. All equipment necessary for the inspection will be furnished by the Contractor, however, the County shall provide an Inspector to certify the inspection.
- b. The County will inspect all sanitary sewers for alignment, grade, leakage, and condition. The inspection may be conducted by crawling or walking through the pipeline, using mirrors to reflect light through the pipeline, or closed circuit television equipment.
 - 1) If a mirror test is used, the pipe alignment will be acceptable if it is sufficiently true and straight to allow passage of the reflected light with an image of a "full moon". The Contractor will also perform a Mandel test on sewer mains.
 - 2) The pipeline shall be installed on a continuous grade so it does not pond or trap water anywhere along the line.
 - 3) No visible infiltration will be allowed. Any water leakage into the system sufficient to constitute any noticeable trickle or dribble shall be corrected.

4. Acceptance Testing

a. General

- 1) The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the specified tests. Testing shall be conducted only after the section of sewer has passed the visual inspection.
- 2) Generally sewers will be tested from manhole to manhole or from manhole to terminus of the pipeline if there is no manhole at the other extremity. Testing shall be by low pressure air and/or infiltration/exfiltration as specified herein and/or as determined by the County.
- 3) If the sanitary sewer or sanitary house connection fails any test specified herein, the Contractor shall, at his own expense, repair or replace any defective component and retest the failed section or component until all requirements are met. Defective material shall be replaced.
- 4) All equipment used for testing shall be approved by the County.

b. Low Pressure Air Test

Sanitary sewers 24-inch diameter and smaller and attached sanitary house connections shall be tested with low pressure air in accordance with the following procedures:

- 1) Test plugs shall be supplied and installed by the Contractor within the pipeline at each manhole. Each plug shall be securely braced.
- 2) If the pipeline to be tested is expected to be below the ground water table, the County may visually inspect the trench prior to backfilling to determine the elevation of the groundwater table. All gauge pressures for the test shall be increased by an amount to provide 4 psig above the back pressure due to ground water submergence over the end of the probe to a maximum of 6 psi in the pipe system to be tested.
- 3) If the air pressure required for the test is greater than 6 psig, the pipeline shall not be air tested, but shall be tested for infiltration in accordance with method indicated in Paragraph C, which follows.
- 4) The Contractor shall add air slowly to the portion of the pipeline under test until the internal pressure is raised to 4.5 psig greater than the average back pressure of any groundwater above the pipe's invert.
- 5) The Contractor shall not allow personnel in manholes after the air pressure is increased in the sewer. If the test plug is suspected of leaking, the Contractor shall first relieve the pressure before any

adjustments are made to eliminate air leakage at the plug. The Contractor may precoat the plug with a soap solution to check for leakage.

- 6) The Contractor shall allow the air temperature to stabilize for at least 2 minutes by adding only the amount of air required to maintain 4.5 psig above groundwater back pressure. After this 2 minute period, the Contractor shall completely disconnect the hose and compressor from the section being tested to assure no additional air is added to the pipeline.
- 7) The time required for the pressure to drop 1 psig will be observed and recorded. Pipelines which fail to maintain the stipulated pressure for a period equal to or greater than the holding time shown in the table at the end of this Section shall be deemed to have failed the low pressure air test and will not be accepted by the County.
- 8) The portion of the line being tested will be acceptable if the time required in minutes for the pressure to decrease from 4.5 to 4.0 psig shall not be less than the time shown for the given diameters in the following table:

Pipe Diameter in Inches	Minutes
6	5.0
8	5.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

- 9) Air testing may be required for pipe diameters greater than 24 inch when specified by the Engineer and approved by Worcester County.
- c. Infiltration/Exfiltration Tests
- 1) Sanitary sewers 24-inch in diameter and larger and sewers in which air testing is not specified or required shall be subjected to either infiltration or exfiltration tests as determined by the County. Testing may be conducted from manhole to manhole, or between more than two manholes, however, the length to be tested shall not exceed 700 feet. Minimum test duration shall be 24 hours unless otherwise directed by the County. Testing shall be conducted in accordance with ASTM C 969 as modified herein.
 - i) Infiltration test shall be made by measuring the amount of water infiltrating into the pipeline section at the lower end of the section being tested by means of a weir installed in

the pipe or by other measurement method approved by the County.

- ii) Exfiltration test shall be made by plugging the lower manhole, filling the pipeline section with water to a level of at least 2 feet above the crown of the pipe at the upstream end of the section being tested or 2 feet above groundwater level whichever is greater and measuring the water level drop in the manhole at the end of the specified test period. Pipelines shall be filled with water for at least 24 hours immediately before the test.

- iii) Test Criteria

The maximum leakage allowance in the completed sewer lines shall not be greater than 25 gallons per inch diameter per mile per twenty-four hours. Note that this is a rate and does not in any way prescribe or infer the length of the line to be included in each test section.

- d. Deflection Testing

In addition to other tests detailed in this Section, PVC sanitary sewers may be tested for deflection (reduction in vertical inside diameter). Testing shall be performed by passing a 5% undersized GO/NO-GO mandrel or sewer ball through the pipeline or measuring deflection continuously by using a deflectometer. Maximum allowable deflection shall be 5%.

4.0 METHOD OF MEASUREMENT

A. SANITARY SEWERS

Measurement for furnishing and installing sanitary sewers will be made horizontally along the center line of the pipe for each size and type of pipe without deduction for Y or drop connections. The inside lengths of manholes and junction chambers will be deducted.

B. SANITARY HOUSE CONNECTIONS

Measurements for furnishing and installing sanitary house connections will be made horizontally along the center line of pipe for each size and type of pipe from the center line of the sewer to the end of the house connection plus the vertical foot of standpipe without deduction for Ys, bends, cleanouts, plugs, or other fittings.

5.0 BASIS OF PAYMENT

A. GENERAL

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to

complete the work as shown and specified, in strict accordance with the Contract Documents.

2. The price(s) bid for furnishing and installing sanitary sewers and sanitary house connections shall include trench excavation, backfill, compaction, and incidental items as specified in Section 02250.
3. Payment will be made for contingent items when approved by the County.

B. SANITARY SEWERS

Payment for furnishing and installing sanitary sewers, complete and in place, will be made per linear foot of the size and type of pipe installed. The price(s) bid shall include traffic control, furnishing and installing of all pipe, fittings, plugs, stoppers, and jointing materials; connection to existing pipelines, structures, or manholes; testing; providing an approved spoil site, and disposing of all spoil or excess materials' aggregate bedding; all environmental and erosion or sediment control; restoration of all disturbed areas; and incidental items to complete the sanitary sewers.

C. SANITARY HOUSE CONNECTIONS

Payment for furnishing and installing sanitary house connections complete and in place will be made per linear foot for horizontal pipe and per vertical foot for height of standpipe, of the size and type of pipe installed. The price(s) bid shall include traffic control, furnishing and installing all pipe, fittings, cleanouts, plugs, jointing materials; connection to sewer branch fittings; testing; providing an approved spoil site, and disposing of all spoil or excess materials; aggregate bedding; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas; and incidental items to complete the sanitary house connection.

****END OF SECTION 02700****

**SECTION 02710
SANITARY SEWER MANHOLES**

1.0 GENERAL

A. DESCRIPTION

Sanitary sewer manhole installation shall include, but not necessarily be limited to, furnishing and installing sanitary sewer manholes and miscellaneous structures of concrete or brick masonry built to the shapes and dimensions shown and in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Sanitary Sewers: Section 02700
3. Cast-in-Place Concrete: Section 03300
4. Precast Concrete Structures: Section 03400
5. Mortar and Masonry Grout: Section 03600
6. Brick Masonry: Section 04200

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to insure compliance with the Contract Documents.

2.0 MATERIALS

A. GENERAL

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for sanitary manholes.

C. CONTRACTOR'S OPTIONS

1. The Contractor may furnish galvanized steel, polypropylene, or plastic-coated steel for manhole steps.
2. Standard sanitary manholes shall be precast construction; however, the Contractor may furnish cast-in-place, or masonry construction for miscellaneous sanitary sewer structures with the approval of the County.

D. DETAILED MATERIAL REQUIREMENTS

1. Granular bedding beneath manhole bases shall meet the gradation requirements of AASHTO M43, Size Number 57, as specified in Section 02240.
2. Portland cement concrete for cast-in-place structures shall be as specified in Section 03300, mix number as indicated on the Standard Details or the Plans.
3. Precast manhole bases, risers, cone sections, grade rings, and precast utility structures shall be as specified in Section 03400.
4. Joints shall be "O" ring compression type meeting the requirements of ASTM C-443.
5. Non-shrink grout shall be as specified in Section 04100.
6. Mortar for brickwork and grade rings shall be as specified in Section 04100.
7. Brick for manhole inverts and miscellaneous structures shall be sewer brick as specified in Section 04200.
8. Frames and covers shall be as shown in the Standard Details and as specified in Section 05500.
9. Manhole steps shall be as per the Standard Details. The plastic coated type shall be manufactured using a minimum 3/8-inch diameter steel reinforcing rod meeting the requirements of ASTM A 615, as a core. The plastic coating shall meet the requirements of ASTM 2146, Type II, Grade 4375B.
10. Waterproofing for exterior of manholes and miscellaneous structures shall be as specified in the Standard Details.
11. Manhole-to-Pipeline Connectors
 - a. Cast-in-place type connectors shall be:
 - 1) A Banded-boot type for sewer grades greater than 18% and less than 46.5%.
 - 2) A compression type for sewer grades less than 18%.
 - b. For doghouse type manhole applications a banded-boot type connector shall be used.
 - c. Mechanically wedge-in-place type connectors shall be used for cored openings.
12. Manholes shall have sealant between the manhole and the manhole frame. The sealant shall be mastic rope, type B, 3/4 inch minimum diameter, butyl based, meeting requirements of AASHTO M 198.

13. The plastic insert dish for manholes shall be manufactured of materials resistant to corrosion from atmospheres containing hydrogen sulfide and dilute sulfuric acid. The insert body shall be plastic. The manufacturer must furnish a load test verification showing a load test failure in excess of 3,000 lbs. The insert shall contain gas relief valves designed to release a pressure of .5 to 2.0 psi and have a water leakdown rate no greater than 5 gallons per 24 hours. The handle shall be able to withstand a pull of 500 lbs. without breakage.

3.0 EXECUTION

A. GENERAL

1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
2. Manholes and drop connections shall be installed in accordance with the Standard Details and as specified herein.
3. Miscellaneous structures shall be constructed where shown and as indicated on the Plans or as directed by the County.
 - a. Cast-in-place concrete construction shall be as specified in Section 03300.
 - b. Brick construction shall be as specified in Section 04200.
4. Pipelines connected to manholes and other structures shall have a pipe joint between 3 and 7 feet from the exterior wall of the structure.
5. All new openings in existing manholes shall be core drilled in a manner acceptable to the manhole manufacturer and the County.
6. A plastic insert dish shall be installed within all manholes where the edge of the cover is five (5) feet or less to the face of the curb. They shall also be installed in manholes that lie within the vertical sumps of roadways, swales, or ditches and as directed by the County.

B. MANHOLE INSTALLATION

1. Manholes, frames and covers shall be installed as pipeline installation progresses. The manhole vertical axis shall be plumb and directly over the centerline of the pipeline unless otherwise shown or directed.
2. Manhole joints shall be watertight. Exteriors shall be coated with waterproofing in accordance with the Standard Details.
3. Channels for receiving and passing water shall be formed in the bottom of manholes as shown or directed. All such channels shall be lined with sewer brick. Channels shall slope smoothly and evenly and a channel bench constructed to the height of the crown of the highest pipe. Channels and a watertight plug shall be installed in the manhole for future extensions where shown on the Plans or directed by the County.

4. Pipes shall be cut flush with the inside wall of the manhole.
5. The frame and cover shall be installed in accordance with the Standard Details.
6. Parging of the interior brick surfaces will not be permitted.

C. CURING

1. Manhole channels and benches shall receive a minimum twenty-four (24) hour cure time prior to being subjected to sewage flow. The County reserves the right to adjust this curing period if deemed necessary.

D. TESTS

Manholes and other structures may be visually inspected by the County for leakage. Any visible leak shall be sealed or resealed until all leakage into the unit is eliminated. Infiltration testing shall be conducted only when the sewers attached to the manholes or other structures are tested in that manner. Testing shall be in accordance with Section 02700.

4.0 METHOD OF MEASUREMENT

A. SANITARY SEWER MANHOLES

Measurement for furnishing and installing sanitary sewer manholes will be made per vertical foot for the number of each type constructed, as shown on the Standard Details. Measurement will be made from the lowest point in the manhole invert to the highest external point on the top of the manhole frame and cover.

B. DROP CONNECTIONS

Measurement for drop connections will be made for the number and type constructed. The manhole on which the drop structure is constructed will be measured and paid for separately as described above.

C. MISCELLANEOUS STRUCTURES

Measurement for miscellaneous structures will be made for the number of each type of unit constructed in accordance with the Contract Documents or as directed.

5.0 BASIS OF PAYMENT

A. GENERAL

1. Payments will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown, specified, and in strict accordance with the Contract Documents.
2. The price(s) bid for furnishing and installing sanitary sewer manholes shall include the following:

- a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.
 - b. Furnishing and installing granular bedding for manhole foundation as shown on the Standard Details and as required elsewhere in the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. SANITARY SEWER MANHOLES

Payment for sanitary sewer manholes will be made per each type and size (diameter) of manhole installed. The price(s) bid shall include traffic control, furnishing and installing all precast, masonry, or cast-in-place concrete units, waterproofing, reinforcing bars, ladder rungs, metal frames and covers; all testing; providing an approved spoil site, and disposing of all spoil and excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, and incidental items to complete the manholes.

C. MANHOLE DROP CONNECTIONS

Payment for drop connections will be made per type and size constructed as shown, specified, and directed. The price(s) bid shall include furnishing and installing all pipe, fittings, precast concrete, concrete encasement, aggregate and incidental items to complete the drop connection.

D. MISCELLANEOUS STRUCTURES

Payment for miscellaneous structures will be made for each structure constructed to limits shown on the Contract Documents and shall be full compensation for furnishing all items necessary to satisfactorily complete the work.

E. WATERPROOFING

No separate payment will be made for waterproofing, but will be considered incidental to unit prices bid.

****END OF SECTION 02710****

**SECTION 02720
SANITARY SEWER FORCE MAINS**

1.0 GENERAL

A. DESCRIPTION

Sanitary sewer force main installation shall include, but not necessarily be limited to, furnishing and installing pressure rated pipe, fittings, and appurtenances of size and type shown on the Plans, installed on firm foundation true to line and grade and in accordance with the Contract Documents.

B. RELATED WORK SPECIFIED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction; Section 02250.
2. Precast Concrete Utility Structures; Section 03400.

C. QUALITY ASSURANCE

1. Materials

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. GENERAL

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.
2. To minimize the number of joints, only standard manufacturers length of pipe shall be furnished and installed for all sanitary sewer mains and house connections unless otherwise indicated on the plans, or as approved by the County.

B. PIPE SYMBOLS

For convenience and standardization, the various types of pipe are designated on the plans by the symbols noted in Section 02660, entitled "Water Mains".

C. MATERIALS FURNISHED BY THE COUNTY

1. The County will not furnish any materials for sanitary sewer force main construction.

2. Unless otherwise noted in the "Special Provisions," the County will make water available from its potable water system for pipeline testing at no charge to the Contractor for one test only. The Contractor shall contact the Division of Water and Sewer to coordinate its use. If subsequent testing is required, the Contractor will purchase additional water from the County's system.

D. CONTRACTOR'S OPTIONS

The Contractor may furnish ductile iron pipe and fittings or polyvinyl chloride pipe and fittings for sanitary sewer force mains unless otherwise noted. Ductile or cast iron fittings shall be furnished for use with ductile iron pipe or polyvinyl chloride pipe.

E. DETAILED MATERIAL REQUIREMENTS

1. Portland cement concrete for pipe buttresses and anchorages shall be Mix No. 1, as specified in Section 03300.
2. Ductile iron pipe and fittings, and, polyvinyl chloride pipe and fittings, shall be as specified in Section 02660. Pressure rating or class shall be as noted in the Contract Documents. Cement lining and coatings shall be as required on ductile iron pipe (DIP) and fittings.
3. Joint Restraint
 - a. Restrained joint pipe and fittings shall be of the pipe manufacturer's standard design.
 - b. Ductile iron retainer glands for use with mechanical type joints shall be as approved.
 - c. Rod for tie rod assemblies shall meet the material requirements of ASTM A193, Grade B7, and shall be threaded for at least 8 inches on both ends. Rod shall be $\frac{3}{4}$ inch diameter unless otherwise noted.
 - d. Nuts shall meet the requirements of ASTM A194. Manufactured tie rod and accessories shall result in the completed restrained joint assembly having a minimum working pressure rating of 200 psi.
4. Resilient Seat Gate Valves
Resilient seat gate valves shall be as specified in Section 2662 for water valves.
5. Valve Boxes
Valve boxes shall be as specified in Section 02660, except the covers shall be labeled "SEWER."
6. Sewage Air Release and Combination Air/Vacuum Valves
 - a. Sewage air and vacuum valves shall be of the type that automatically releases air, gas or vapor under pressure, automatically exhausts large

quantities of air during the filling of a system, and allows air to reenter during draining or when a vacuum occurs.

- b. Sewage air and vacuum valves shall have an elongated cast iron body and cast iron cover. The internal compound lever mechanism shall be stainless steel and all other internals, including float, stainless steel to positively prevent a galvanic action. The stainless steel float shall withstand a minimum pressure of 1,000 psi.
- c. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

<u>PART</u>	<u>MATERIAL</u>	<u>SPECIFICATION</u>
Body and Cover	Cast Iron	ASTM A48, Class 35
Internals	Stainless Steel	Series 300
Float	Stainless Steel	Series 300
Seat	Buna-N	
Exterior Paint	Phenolic Primer Red Oxide	FDA approved for potable water

- d. The valve manufacturer shall furnish installation and maintenance instruction manuals with each valve.
- e. Isolating valve shall be installed between force main and air and vacuum valve.
- f. Sewage air and vacuum valves shall be installed in an easily accessible vault. Vault shall be adequately vented to meet air and vacuum valve requirements.
- g. All internals shall be easily removed through the top cover without removing the main valve from the lines.

7. Detector Tape

Visual detection tape shall be 3 inches wide (minimum) nonmetallic green plastic tape, lettered "SEWER" in black graphics.

8. Tracer Wire for Non-Metallic Pipelines

Tracer wire shall be 8 gage, 7 strand continuous copper wire with a 45 mil polyethylene insulation. The wire shall be blue, have "UL" markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connectors with a water proof binder and underground electrical tape.

9. Continuity Test Station

The continuity test station for force mains shall be a 4 1/4" valve box with a green locking lid. Test station shall be complete with an inset removable terminal board with three (3) terminals.

3.0 EXECUTION

A. GENERAL

1. Trench excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
2. Force main installation shall be as specified in Section 02660, "Water Mains," except chlorination is not required.
3. Pipe bedding, thrust and anchor blocks, and force main appurtenances shall be installed in accordance with the Standard Details for Water.
4. Resilient Seat gate valve installation shall be as specified in Section 02662 for water valves.
5. Sewage air release and combination air release/vacuum valves shall be installed in accordance with the Standard Details.

B. FIELD TEST

1. The force main and appurtenances shall be tested in accordance with Section 02660, except as modified herein.
2. Chlorination will not be required.

4.0 METHOD OF MEASUREMENT

A. FORCE MAIN

Measurement for furnishing and installing force main pipe and fittings will be per linear foot made horizontally along the centerline of the pipe through all fittings and appurtenances.

B. ISOLATION, SEWAGE AIR RELEASE AND COMBINATION AIR/VACUUM VALVES

Measurement for isolation, sewage air release and combination air/vacuum valves will be made of the number of each size and type of valves installed complete.

5.0 BASIS OF PAYMENT

A. GENERAL

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment and materials necessary to

complete the work as shown, specified, and in strict accordance with the Contract Documents.

2. Payment for furnishing and installing force main pipelines and appurtenances will include the following:
 - a. Trench excavation, backfill, compaction and incidental items as specified in Section 02250.
 - b. Furnishing and installing granular material for air release and vacuum valve manhole fill as per the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. FORCE MAIN

Payment for furnishing and installing force main pipelines, complete and in place, will be made per linear foot of the size and type installed. The price(s) bid shall include traffic control, furnishing and installing all pipe, fittings, and jointing materials, removing existing buttresses when necessary, joint restraint, furnishing materials for and constructing all concrete anchorages and buttresses; strapping of fittings, connecting to existing pipelines or structures, testing; all aggregate, bedding; providing an approved spoil site, and disposing of all spoil or excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, and for all appurtenances, and incidental items to complete the force main.

C. ISOLATION, SEWAGE AIR RELEASE AND COMBINATION AIR/VACUUM VALVES

Payment for furnishing and installing isolation, sewage air release and combination air/vacuum valves, complete and in place, will be made for each size and type of valve installed. The price(s) bid shall include traffic control, furnishing and installing all valves, saddles, vaults or manholes, lids or frames and covers, pipe supports, angle valves, corporation stops, extension bar, restoration; testing of the complete installation; and incidental items to complete the valve installation.

****END OF SECTION 02720****

**SECTION 02800
RESTORATION****1.0 GENERAL****A. DESCRIPTION**

Restoration shall include, but not necessarily be limited to all clean up and disposal of waste materials and the restabilization of disturbed areas including paved areas, non-paved areas, concrete improvements, street signs, mail boxes, fences, trees, shrubs and other improvements whether shown in the Contract Documents or not.

B. RELATED WORK INCLUDED ELSEWHERE

1. Test Pits: Section 02012
2. Removal or Abandonment of Existing Utilities: Section 02050
3. Clearing and Grubbing: Section 02110
4. Aggregate Backfill: Section 02240
5. Trench Excavation, Backfill and Compaction: Section 02250
6. Boring and/or Jacking Pipe: Section 02300
7. Tunneling: Section 02400
8. Turf Establishment: Section 02820
9. Sodding: Section 02830
10. Soil Stabilization Matting: Section 02850
11. Cast-In-Place Concrete: Section 03300

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS**A. GENERAL**

Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for restoration other than those acceptable materials which are available from the trench excavation limits as shown on the Contract Documents.

C. CONTRACTOR'S OPTIONS

Not applicable.

D. DETAILED MATERIAL REQUIREMENTS

Not applicable.

3.0 EXECUTION**A. GENERAL**

After the completion of backfilling, all materials not used therein shall be removed and disposed of in such a manner and at such point or points as shall be approved or directed by the County; and all roads, sidewalks, and other places on the line of the work shall be left free of debris, clean, and in good order. Said cleaning-up shall be done by the Contractor without extra compensation; and if he shall fail to do such work within twenty four hours after receipt of notice, the County may arrange to have the cleaning-up done by others; and the cost shall be retained out of the monies due or to become due to the Contractor under the Contract. In case of emergency, the County may restore or remove and dispose of materials wherever necessary without giving previous notice to the Contractor, and the cost of doing so shall be retained from any monies due to become due the Contractor under the contract.

B. PAVED AREAS

1. Immediately upon completion of the trench backfill and compaction as previously specified, the Contractor shall provide graded aggregate subbase, temporary bituminous surfacing material as per the Contract Documents and/or direction of the governing regulatory agency.
2. Weather permitting, the Contractor shall remove and dispose of the temporary surfacing materials, cut-back the edge of the existing pavement as per the Contract Documents, and permanently patch-pave the area as specified in the Contract Documents and/or governing agency direction. This shall be done within 30 calendar days after backfilling and compacting the trench as described in the paragraph above or within the time period specified by the governing agency.

C. CONCRETE IMPROVEMENTS

Sidewalks, curbs, combination curb and gutter, drive aprons, and other concrete improvements removed, soiled, or damaged by the Contractor's activities shall be cleaned or replaced by the Contractor in kind, or as directed by the County and/or Contract Documents without extra compensation.

D. NON-PAVED AREAS

1. Immediately upon completion of the trench backfill and compaction as previously specified, the Contractor shall temporarily stabilize the area in accordance with the Contract Documents.
2. Weather permitting, within 14 days after the completion of trench backfill and compaction, the Contractor shall permanently stabilize the area with seeding and mulching or sodding, as noted in the Contract Documents.

E. STREET SIGNS, MAIL BOXES, FENCES, SHRUBS, TREES, AND OTHER IMPROVEMENTS

1. Existing street signs and traffic control devices stored or relocated by the Contractor will be reset by the Contractor after construction in the area is complete and the work approved by the County.
2. In case of emergency, the County may reset street signs and traffic control devices wherever necessary without giving previous notice to the contractor; and the cost of doing so shall be retained from any monies due to become due the contractor under the contract.
3. Mail boxes shall be carefully removed by the Contractor to the extent required to permit construction operations and as directed by the Postal Service. It shall be the Contractor's responsibility to temporarily reset mail boxes during construction to maintain service until the boxes are permanently reset in their original locations or at locations designated by the Postal Service. The Contractor shall comply with all Postal Service regulations regarding the location and height of all mail boxes disturbed by his activities.
4. Existing fences, paper boxes, signs, property markers, and other similar items shall be carefully removed by the Contractor to the extent required to permit construction operations and as directed by the County. The Contractor shall safely store all items during the time that they are down and when possible, re-erect them in the original locations or at locations designated by the County.
5. Shrubs, hedges, and other plantings shall be transplanted with sufficient earth to insure that no damage to their major root system occurs. After transplanting has been accomplished, it shall be the Contractor's responsibility to water all plants until their growth is established.

4.0 METHOD OF MEASUREMENT

Restoration will not be measured.

5.0 BASIS OF PAYMENT

Restoration will not be paid for as a separate item but is considered incidental to other items of work. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

****END OF SECTION 02800****

**SECTION 02820
TURF ESTABLISHMENT**

1.0 GENERAL

A. DESCRIPTION

Turf establishment shall include, but not necessarily be limited to, soil preparation, seeding, fertilizing, mulching, liming as required, over seeding, and refertilizing all areas disturbed by construction and where designated for turf establishment in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Clearing and Grubbing: Section 02110
2. Solid Sodding: Section 02830
3. Soil Stabilization Matting: Section 02850

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to insure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

1. The County will not furnish any materials for turf establishment.
2. The Contractor may purchase water for hydroseeding or turf irrigation from the County's potable water system. The Contractor shall contact the Division of Water and Sewer to coordinate its use.

B. CONTRACTOR'S OPTIONS

1. Fertilizer may be furnished in either dry or liquid form unless otherwise noted.
2. Mulch may consist of straw, hay, salt hay, or wood cellulose fiber unless otherwise noted.

C. DETAILED MATERIAL REQUIREMENTS

1. Ground Limestone

Ground limestone shall contain not less than 80% calcium and magnesium carbonates. Dolomitic or magnesium limestone shall contain at least 10% magnesium as magnesium oxide. The limestone shall be ground to meet the following size gradation:

<u>Sieve Sizes</u> <u>U.S. Standard</u>	<u>Percent Passing</u> <u>by Weight</u>
No. 10	100
No. 20	98
No. 100	50

2. Fertilizer

- a. Fertilizer analysis shall be 5-10-10. It shall be a standard commercial grade fertilizer meeting the requirements of all State and Federal regulations and standards of the Association of Official Agricultural Chemists. Commercial fertilizer shall provide the minimum percentage of available nutrients specified.
- b. Fertilizer shall be furnished in bulk or new, clean, sealed, and properly labeled bags. Fertilizer failing to meet the specified analysis may be used as determined by the County providing sufficient materials are applied to comply with the specified nutrients per unit of measure without additional cost to the County.

3. Seed

- a. Seed lots must be state certified and blended under the supervision of the Maryland Department of Agriculture (MDA), Turf and Seed Section.
- b. All seed and labeling must fully comply with the Maryland Seed Law and these Specifications.
- c. Each container shall have permanently affixed to it an accurate analysis tag and a certification tag.
- d. All seed lots to be used in this mixture shall have been pretested by the Maryland Seed Laboratory to insure compliance with Specifications.
- e. A quality control sample of the delivered mixture may be submitted to the Maryland Seed Laboratory for testing prior to payment and any lots found not to comply with the Specifications shall be returned at the Contractor's expense.
- f. The Engineer's representative shall collect all seed certification tags and/or sod certification prior to the beginning of any seed or sod work.
- g. No seed shall be used after date of expiration.
- h. Certified grass seed shall consist of Tall Fescue mix consisting of 33%, 33%, and 34% of three (3) of the following varieties of improved Tall Fescue: Adventure, Arid, Bonanza, Apache, Mustang, Olympic, Rebel, Trident.

All seed varieties shall meet the following minimum specifications:

- 1) Minimum Purity 98%
 - 2) Minimum Germination 85%
 - 3) Maximum Other Crop 0.1%
 - 4) Maximum Weed Seed 0.1%
 - 5) Noxious Weeds None
- * Must be free of ryegrass, timothy, orchardgrass, bentgrass, Canada bluegrass, clover, or any other contaminant which shall be unsightly and uncontrollable.
- ** Must be free of dock, cheat, chess, chickweed, crabgrass, plantain, and black magic.
- *** Must be free of all Maryland prohibited and restricted noxious weeds.

4. Mulch

- a. Mulches shall be free of clay, stones, foreign substances, plant parts of Canada Thistle and Johnsongrass, and reasonably free of other weed seeds. Mulches containing Canada Thistle and Johnsongrass shall not be used for any purposes.
- b. Straw, hay, and salt mulches shall not contain sticks larger than 1/4-inch in diameter or other materials which would prevent matting down during application. No straw, hay, or salt hay mulches shall be used within 48 hours after cutting. Straw, hay, and salt hay shall be free from mold and other objectionable material and shall be in an air-dry condition suitable for placing with mulch blower equipment.
- c. The following mulches may be acceptable by visual inspection provided they meet the above and following requirements:
 - 1) Straw: Straw shall consist of thoroughly threshed wheat, rye, or oat straw.
 - 2) Hay: Hay shall consist of native grasses or other plant material approved by the County. Hay shall be free of noxious weed seeds as specified in the Maryland Seed Law.
 - 3) Salt Hay: Salt hay shall consist of well cured beach grasses or other approved material.
 - 4) Wood Cellulose Fiber: Wood cellulose fiber shall consist of specially prepared wood cellulose processed into a uniform fibrous physical state. Wood cellulose fiber shall contain a green

dye that will provide easy visual inspection for uniformity of the slurry spread. The wood cellulose fiber, including dye, shall contain no germination or growth inhibiting properties. The material shall be manufactured and processed in a manner that the wood cellulose fiber will blend with seed, fertilizer, and other additives to form a homogeneous slurry. The wood cellulose fiber shall perform satisfactorily in hydraulic seeding equipment without clogging or damaging the equipment.

The manufacturer shall certify that wood cellulose fiber meets the following requirements:

<u>Requirements</u>	<u>Specification Limits</u>
Particle Length	Approximately 3/8 inch
Particle Thickness	Approximately 3/64 inch
Net Dry Weight Content	Minimum stated on bag
ph, ASTM D778	4.0 to 8.5
Ash Content, ASTM D586	1.6% maximum
Water Holding Capacity	90% minimum

The material shall be delivered in packages of uniform weight not exceeding 75 pounds net weight and bear the name of the manufacturer, the net weight, and a supplemental statement of net weight content.

5) Mulch Binder

Mulch binder shall be emulsified asphalts or wood cellulose fiber meeting the requirements of Section 02820.2, Article C, Paragraph 4, Item c, 4).

6) Water

Water used in the planting or care of vegetation shall be free from oil, acids, alkalis, salts, or any substance injurious to plant life. Water from streams, lakes, ponds, or similar sources shall not be used unless the source is approved by the County.

3.0 EXECUTION

A. SEEDING SEASONS

Seed shall be sown from February 15 to May 1 and from August 15 to October 15 inclusive as soon as the soil is dry enough to allow proper penetration of a seedbed. Extensions beyond these time periods may be granted by the County, depending upon weather conditions for the period in question. Any planting outside of these seasons shall be solely at the Contractor's risk and shall not be subject to compensation until stabilization has been accomplished in accordance with these Specifications. No seeding shall be done on frozen ground or when the temperature is 32EF or lower.

B. SCHEDULE OF PROCEDURE

The Contractor shall begin his work at a point or points approved by the County. When topsoil is required for areas to be seeded, all topsoiling shall be completed before seeding operations are started.

C. SOIL PREPARATION

Soil shall be properly prepared as indicated hereafter. All areas to be seeded shall meet the finished grades shown on the plans and be free of any weed or plant growth. When ground limestone is required, it may be incorporated as part of the loosening for soil preparation. All areas shall be loosened by discing, harrowing, or other approved methods immediately prior to seeding, unless otherwise directed by the County. All clods, loose stones, and other foreign materials which are larger than 3 inches in any dimension shall be removed. All gullies, washes, or disturbed areas that develop subsequent to final dressing shall be repaired before seeding.

D. SEEDING

Seeding shall consist of soil preparation and application of seed, fertilizer, and mulch. Seed application shall be by either of the following application methods as the Contractor may elect:

1. Dry Application Method

- a. Ground Limestone: Ground limestone, shall be applied, at rates as determined by soil test or no less than 50 pounds per 1000 square feet, separately before the application of any fertilizer or seed on seedbeds which have previously been prepared. Where ground limestone is required to be worked in, the seedbed shall again be properly graded and dressed for seeding. Limestone shall be worked into seedbeds as follows:

<u>Seedbed</u>	<u>Depth of Limestone Incorporation</u>
4 inches of topsoil	3 inches
2 inches of topsoil	2 inches
Subsoil, serrated cut slopes and other non topsoiled areas 3:1 and steeper	Incorporation not required

- b. Fertilizer: Fertilizer of the analysis 5-10-10 shall be applied to topsoiled areas at a rate of 50 pounds per 1000 square feet.
- c. Seed Application: Strip seeding along trench excavations, etc., shall be applied at a rate of 6 pounds per 1,000 sq. ft. Seed in large areas, around buildings, along streets, etc., shall be applied at a rate of 175 pounds per acre. After seeding, the areas shall be lightly raked and rolled. Areas which do not "catch" shall be reseeded at an interval of fourteen (14)

days, which shall continue until a satisfactory growth of grass is established over the entire area.

2. Wet Application Method

- a. General: Apply seed and fertilizer (ground limestone, if required) by spraying the material on previously prepared seedbeds in the form of an aqueous mixture using the methods and equipment described herein. The rates of application shall be the same as those specified for the Dry Application Method.
- b. Spraying Equipment: The spraying equipment shall have a water tank equipped with a bar or liquid level gage calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity. The gage shall be mounted to be visible to the nozzle operator. The tank shall also be equipped with an agitation system capable of keeping all the solids in the mixture in complete suspension at all times until used.
- c. Ground Limestone
 - 1) Ground limestone, if required, shall be sprayed separately from mixtures of seed and fertilizer on areas flatter than 3:1. The water-limestone mixture shall contain a maximum of 600 pounds per 100 gallons. The water limestone mixture shall be applied at a minimum rate of 1000 gallons per acre. The water-limestone mixture shall be worked into the topsoil. After working the ground limestone into the topsoil, the seedbed shall again be properly graded and dressed.
 - 2) Ground limestone shall not be required to be applied separately on slope areas 3:1 and steeper. The water-seed-fertilizer and limestone mixture shall be applied at a minimum rate of 1000 gallons per acre in the relative proportions specified so that these combined solids do not exceed 600 pounds per 100 gallons.
- d. Application
 - 1) Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which ground limestone, if required, has been incorporated. Seed and/or fertilizer shall be mixed together with water in the relative proportions specified so that these combined solids do not exceed 300 pounds/100 gallons. The water-seed-fertilizer mixture shall be applied at a minimum rate of 1000 gallons/acre.
 - 2) All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All seed mixtures in aqueous agitation shall be used within eight hours after mixing, except for leguminous seed which shall be used within one hour after mixing. Seed mixtures not utilized within the time limits shall be wasted and disposed of at locations acceptable to the County.

- 3) The mixtures shall be applied by high pressure spray equipment which shall always be directed upward into the air so the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in a manner to produce erosion or runoff.
- 4) Particular care shall be exercised to insure that application is made uniformly at the prescribed rate and to guard against misses and overlaps. Proper predetermined quantities of the mixture, as specified, shall be used to cover specified sections of known area. Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or collecting containers over the area at intervals and observing the quantity of material deposited thereon.
- 5) The spray method shall not be used during periods of high winds which prohibit satisfactory spray patterns.
- 6) Seed and fertilizer applied by the spray method need not be raked into the soil.
- 7) Any spray or residual which disfigures or otherwise damages existing structures or vegetation shall be thoroughly cleaned from the damaged surface.

E. MULCH APPLICATION

1. Mulch materials shall be furnished, hauled, and evenly applied on the area shown in the Contract Documents and/or as directed by the County. All mulch shall be applied within 48 hours after seeding. Mulch applied by hand shall provide a loose depth of not less than 1.5 inches nor more than 3 inches. Mulch applied by the blowing method shall provide a loose depth of not less than 1 inch nor more than 2 inches, and 95% of the mulch shall be 6 inches or more in length. Mulch applied by the above methods shall achieve a uniform distribution and depth so no more than 10% of the soil surface is exposed. Mulch applied either by hand or the blowing method shall be spread evenly over all seeded areas at the rate of 2.0 tons per acre.
2. If the mulch is to be secured with a mulch anchoring tool, the rate shall be 2.5 tons per acre. If the tracking method is used, the rate of mulch shall be 1.5 tons per acre.

F. SECURING MULCH

Mulch may be secured by any of the following methods except the mulch anchoring tool. This method may be used with written County approval.

Where mulch has been secured with either an asphalt binder or wood cellulose fiber binder, it will not be permissible to walk on the slopes after the binder has been applied. The Contractor is warned that in the application of asphalt binder material he must take every precaution to guard against damaging or disfiguring structures or property on or

adjacent to the seeded area and that he will be held responsible for any such damage resulting from his operations. He will be required to place temporary protective covers over existing signs just before seeding and mulching. The covering shall be immediately removed after seeding and mulching operations are completed.

1. Peg and String Method

If the peg and string method is used, the mulch shall be secured by stakes or wire pins driven into the ground on 5-foot centers or less. Binder twine shall be strung between adjacent stakes in straight lines and crisscrossed diagonally over the mulch, after which the stakes shall be driven nearly flush to the ground to draw the twine down tight onto the mulch.

2. Spray Method

If the spray method is used, all mulched surfaces shall be sprayed with the selected binder material so the surface has a uniform appearance. Mulch binder may be sprayed on the mulched slope areas from either the top or the bottom of the slope. A spray nozzle of approved design must be used. The nozzle shall be operated at a distance of not less than 4 feet from the surface of the mulch. Uniform distribution of the binder material will be required. A pump or an air compressor of adequate capacity shall be used to insure the uniform distribution of binder material.

a. Asphalt Binder

Asphalt mulch binder shall be uniformly applied to the mulch at the rate of approximately 8.0 gallons per 1000 square feet, or as directed by the County. The minimum-maximum rates of application shall be 6 and 10 gallons per 1000 square feet depending on the type of mulch and the effectiveness of the binder securing it.

b. Chemical Binder

Wood cellulose fiber used as a binder shall be applied at a net dry weight of 750 pounds per acre.

The wood cellulose fiber shall be mixed with water, and the mixture shall contain a maximum of 50 pounds of wood cellulose fiber per 100 gallons.

3. Mix Method

If the mix method is used, the mulch shall be blown onto the area by a mulch blower; and the binder material shall be sprayed into the mulch as it leaves the mulch blower. For rates of application, see Spray Method above.

4. Anchoring Tool Method

If the mulch anchoring tool method is used, the mulch shall be incorporated into the soil to a minimum depth of 2 inches by equipment and a method acceptable to the County.

5. Tracking Method

If the tracking method is used, the mulch shall be incorporated into the soil with a bulldozer having steel cleats with a minimum depth of 1.5 inches. The equipment used and the method of tracking shall be acceptable to the County. Upon completion of tracking, the mulch shall be further secured as described for the spray method.

G. WOOD CELLULOSE FIBER

Wood cellulose fiber used as a mulch shall be applied at a net dry weight of 1,500 pounds per acre. The wood cellulose fiber shall be mixed with water at a maximum rate of 50 pounds of wood cellulose fiber per 100 gallons. This wood cellulose fiber will be permitted to be used in the following areas when approved, and as directed, by the County:

1. Narrow disturbed areas up to 8 feet wide adjacent to pavement where traffic created gusts of wind could cause problems with straw;
2. Deep or high slope areas inaccessible to straw application by a mulching machine.

H. REPAIR OF DEFECTIVE AREAS

1. The responsibility for maintaining treated areas shall be as follows. Until the Project is finally accepted, the Contractor will be required to repair or replace any seeding or mulching that is defective or damaged. When, in the judgment of the County, such defects or damages are the result of poor workmanship or failure to meet the requirements of the Contract Documents, the cost of necessary repairs or replacement shall be borne by the Contractor. However, once the Contractor has completed the seeding and mulching of any area in accordance with the provisions of the Contract Documents and to the satisfaction of the County, no additional work at his expense will be required. Subsequent repairs and replacements deemed necessary shall be made by the Contractor and will be paid for as additional work or extra work.
2. When either the Dry or Wet Application Method is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density. If, when the Contract has been completed, it is not possible to make an adequate determination of color, density and uniformity of such stand of grass, payment for the unaccepted portions of the areas will be withheld until these requirements have been met.

4.0 METHOD OF MEASUREMENT

- A. Except when used as a contingent item or noted otherwise, measurement for turf establishment will not be made, as it shall be included in the unit quantity item for utility installation.
- B. When used as a contingent item or noted otherwise, measurement for turf establishment will be made on the surface area, measured in place, acceptably established.

5.0 BASIS OF PAYMENT

A. GENERAL

1. Except when used as a contingent item or noted otherwise, payment for turf establishment will not be made, as it shall be included in the unit quantity item for utility installation.
2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
3. Payment will made for contingent items when approved by the County.

B. TURF ESTABLISHMENT

1. Payment for turf establishment will be made per square yard at the contingent prices established in the bid form. The price shall include all traffic control and incidental items to complete the turf establishment.

****END OF SECTION 02820****

**SECTION 02830
SODDING**

1.0 GENERAL

A. DESCRIPTION

Sodding shall include, but not necessarily be limited to, furnishing, hauling, and placing grass sod on prepared areas in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Clearing and Grubbing: Section 02110
2. Turf Establishment: Section 02820
3. Soil Stabilization Matting: Section 02850

C. QUALITY ASSURANCE

The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

1. The County will not furnish any materials for sodding.
2. The Contractor may purchase water from the County's potable water system. The Contractor shall contact the Division of Water and Sewer to coordinate its use.

B. CONTRACTOR'S OPTIONS

Fertilizer may be furnished in either dry or liquid form unless otherwise noted.

C. DETAILED MATERIAL REQUIREMENT

1. Grass Sod

Grass sod shall be well rooted and produced in the State of Maryland. It shall, when placed, be live growing grass not less than 3-years old, of which not less than 96% shall be improved tall fescue (Rebel II, Rebel Falcon, Olympic) and not more than 4% Kentucky Bluegrass (Victa, Nassau) at the time of installation. It shall, when placed, have been cut and rolled (stored) not longer than 48 hours. It shall be cut in strips not less than 12-inches nor more than 18-inches wide and have 3/4 inches of soil firmly attached to the roots. The sod thickness shall not be deficient more than 1/4-inch from the required thickness at or just before placement. This 1/4-inch tolerance does not relieve the Contractor of the responsibility of cutting the sod a full 3/4-inches thick. The thickness of sod is

measured by the thickness of soil firmly attached to the root system. The height of grass or thickness of thatch has no bearing on the determination of sod thickness. The sod and attached soil shall be free from noxious weeds: Common Bermudagrass, Nutsedge, Quackgrass, Garlic, Johnsongrass, Poison Ivy or Poison Oak, and Canada Thistle. Any lot of sod containing the following weeds either individually or collectively exceeding one percent of the total plant population by plant count or surface area covered shall be rejected as follows: Orchard-grass, Nimblewill, Annual Bluegrass, Crabgrass, Goosegrass and Foxtail. It shall not contain substances deleterious to growth or which might affect the survival or hardiness of the sod when transplanted.

2. Fertilizer shall be as specified in Section 02820.
3. Ground limestone shall be as specified in Section 02820.
4. Water shall be as specified in Section 02820.
5. Pegs shall be wooden wedges ½-inch x 1-inch x 6-inch to ½-inch x 1-inch x 12-inch.
6. Staples shall be made from No.11 or heavier steel wire bent to form a U. The staples shall average 1 to 1-1/2-inches wide. The staple shall be at least 6 inches long from top to bottom after bending.

3.0 EXECUTION

A. GENERAL

Sod sections or strips shall be of a length as may be readily lifted without breaking, tearing or loss of soil.

Sections or strips shall be cut by approved sod cutters, hauled or carried to storage piles or the point of installation without breaking, and set in final place as indicated on the Contract Documents and as directed by the County. All sod in stacks shall be kept moist and protected from exposure to the air, sun and freezing. Any sod permitted by the Contractor to dry out may be rejected whenever, in the judgment of the County, its survival after placing is rendered doubtful. No payment will be made for rejected sod.

In no event shall more than 48 hours elapse between the cutting and placement of sod.

During wet weather, sod shall be allowed to dry sufficiently to prevent tearing as a result of handling and placing. During dry weather it shall be watered before cutting and lifting to insure its vitality and prevent the dropping off of soil in handling.

B. GROUND PREPARATION

Before placing sod upon any topsoiled surfaces, all shaping and dressing of such surfaces shall be completed. The completed areas to be sodded shall present a smooth, uniform, well tilled surface true to line and cross-section. Any raking required to accomplish this shall be done immediately before placing the sod.

All areas to be sodded shall be fertilized and limed in accordance with Section 02820. The lime and fertilizer shall be worked into the top 2 inches of soil before placing sod.

C. SOD PLACEMENT

No sod shall be placed between the dates of June 1st and August 15th inclusive unless adequate irrigation is available to establish the sod nor any time when the temperature is below 32EF. No frozen sod shall be used. No sod shall be placed upon frozen soil.

Sod shall be lifted from trucks or storage piles and placed by approved methods with close joints and no overlapping. All cracks between blocks of sod shall be closed with small pieces of sod. All sod shall be tamped or rolled after laying to close the seams between the pieces and press the sod tight against the ground. A hand tamper shall weigh approximately 15 pounds and have a flat surface of approximately 100 square inches. A roller shall weigh 40 pounds per foot of width. Any slipping of sod is to be corrected by the Contractor without additional compensation.

D. WATERING

The sod shall be watered a minimum of 3 times after placement. The sod and soil directly beneath the sod shall be kept moist, by additional waterings if necessary, until acceptance or it has become established. The first watering shall be immediately after laying the sod. The second and third waterings shall be as necessary within 2 weeks of the first watering. No sod will be accepted until the water requirements have been satisfied, and the sod appears in good health.

E. SODDED SLOPES AND DRAINAGE DITCHES

On slopes 2:1 and steeper, sod shall be laid with the long edges parallel to the contour starting at the bottom of the slope. Successive strips shall be neatly matched and all joints staggered or broken. When placing sod in drainage ditches, the length of the strip shall be laid perpendicular to the direction of the flow of the water. Where the sod may be displaced during sodding operations, the workmen, when replacing it, shall work from ladders or treaded planks to prevent further displacement.

Each strip or section of sod placed on slopes 2:1 and steeper and surface drainage V-shaped or flat bottom ditches or gutters shall be staked securely with at least 2 wooden pegs spaced not more than 2-feet apart with the flat side against the slope and driven flush with the top of sod.

F. REPAIR OF DEFECTIVE AREAS

Until the project is conditionally accepted, the Contractor will be required to repair or replace any sod that is defective or damaged.

G. CONTRACTOR'S RESPONSIBILITY

Before final acceptance of the Project, it shall be the responsibility of the Contractor to remove all heaved staples, which have been in place a minimum of six months, from areas to be mowed, or as directed by the County.

4.0 METHOD OF MEASUREMENT

- A. Except when used as a contingent item or noted otherwise, measurement for sodding will not be made, as it shall be included in the unit quantity item for utility installation.
- B. When used as a contingent item or noted otherwise, measurement for furnishing and installing sodding will be made on the surface area, measured in place, acceptably installed.

5.0 BASIS OF PAYMENT**A. GENERAL**

- 1. Except when used as a contingent item or noted otherwise, payment for sodding will not be made, as it shall be included in the unit quantity item for utility work.
- 2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
- 3. Payment will be made for contingent items when approved by the County.

B. SODDING

Payment for furnishing and installing sodding complete and in place will be made per square yard at the contingent prices established in the bid form. The price shall include all pegging, irrigation, traffic control, and incidental items to complete the sodding.

****END OF SECTION 02830****

**SECTION 02850
SOIL STABILIZATION MATTING**

1.0 GENERAL

A. DESCRIPTION

Soil stabilization matting shall include, but not necessarily be limited to, furnishing and placing excelsior matting over seeded areas, and securing with wire staples on seeded areas in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

Turf Establishment; Section 02820.

C. QUALITY ASSURANCE

The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for soil stabilization matting.

B. CONTRACTOR'S OPTIONS

Not applicable.

C. DETAILED MATERIAL REQUIREMENTS

1. Excelsior Matting

- a. Excelsior matting shall be machine produced from wood which has been properly cured to achieve adequately curled and barbed fibers. A maximum of 20% of the fibers may be less than 6 inches in length.
- b. The excelsior matting shall have a uniform thickness and distribution of fibers throughout. The top and bottom of the excelsior matting shall be covered with a biodegradable extruded plastic netting having a maximum mesh opening of 2 inches x 2 inches. The average break strength of any two strands running lengthwise shall be 5 pounds minimum. The net shall be entwined with the excelsior to aid handling and provide sufficient reinforcement against damage during handling and placement.
- c. The excelsior matting shall be smolder resistant. A chemical treatment may be applied to the matting to make it smolder resistant. The chemical treatment, if used, shall be nonleaching, nontoxic to vegetation and germination of seed, and noninjurious to human skin. Rolls of the excelsior matting shall meet the following requirements: width - 48 ± 1

inch; weight - 0.60 pounds per square yard minimum at 0% moisture; nominal roll length - 180 feet.

2. Staples shall be as specified in Section 02830.
3. "T"-pin staples shall be made of No. 8 wire with an 8-inch leg, 4" head and a 1-inch secondary leg.
4. Materials required for seeding shall meet the requirements of Section 02820, except mulch binder will not be required.

3.0 EXECUTION

A. GENERAL

When topsoil is specified for areas where matting is being placed, topsoil placement shall be completed before the soil stabilization matting operations are started.

B. SEEDING

Seeding shall be performed in accordance with the provisions of Section 02820, except that Fall season installation of soil stabilization matting shall end on September 30, and the rolling operation shall be omitted. The seed mixture shall be the same as in the areas immediately adjacent to the area where matting is to be placed.

C. PLACING AND SECURING

The matting shall be placed prior to the first rain event or within 48 hours after seeding operations have been completed in the work areas, whichever is less. Matting shall be rolled on in the direction of the flow of water. Where more than one width of matting is required, the strips shall overlap at least 4 inches. Ends shall overlap at least 6 inches. The upgrade end of each strip of matting shall be turned down and buried to a depth of not less than 6 inches with the soil firmly tamped against it. Overlapping shall be done with the upgrade section on top. The County may require any other edge exposed to more than normal flow of water be buried in a similar manner. Edges of matting must be similarly buried around the edges of catch basins and other structures. Disturbed areas shall be fertilized and reseeded with the specified seed mixture for the area.

Matting shall be laid smoothly upon the seeded surface, and stretching shall be avoided. Matting shall be securely fastened with staples driven vertically into the soil, flush with the surface. Matting shall be in firm contact with the soil in its entirety. Staples shall be placed 2 feet apart along the edges and center of the matting. On all overlapping edges, staples shall be placed 18 inches apart. At all ends of the matting, staples shall be placed 6 inches apart.

D. CONTRACTOR'S RESPONSIBILITY

Before final acceptance of the Project, it shall be the responsibility of the Contractor to remove all heaved staples, which have been in place a minimum of 6 months, from areas to be mowed, or as directed by the County.

4.0 METHOD OF MEASUREMENT

- A. Except when used as a contingent item or noted otherwise, measurement for soil stabilization matting will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.
- B. When used as a contingent item or noted otherwise, measurement for furnishing and installing soil stabilization matting will be made of the surface area, measured in place, acceptably installed.

5.0 BASIS OF PAYMENT

A. GENERAL

- 1. Except when used as a contingent item or noted otherwise, payment for soil stabilization matting will not be made, as it shall be included in the unit quantity item for pipe and structures installed.
- 2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
- 3. Payment will be made for contingent items when approved by the County.

B. STABILIZATION MATTING

Payment for stabilization matting will be made per square yard at the contingent prices established in the bid form. The price bid shall include all traffic control, and incidental items to complete the soil stabilization matting.

****END OF SECTION 02850****

DIVISION 3 - CONCRETE

**SECTION 03200
CONCRETE REINFORCEMENT**

1.0 GENERAL

A. DESCRIPTION

Concrete reinforcement shall include, but not necessarily be limited to, furnishing and placing various types and/or sizes of steel reinforcing for embedment in Portland cement concrete as specified in the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Cast-In-Place Concrete: Section 03300
2. Pre-Cast Concrete: Section 03400

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after placement to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for concrete reinforcement.

B. CONTRACTOR'S OPTIONS

Substitution of smaller size bars will be permitted only upon specific authorization by the County. Substituted bars shall provide a steel area equal to or larger than that called for by the design provided the spacing is not reduced to a point where the clear distance between the bars is less than one and one-half times the nominal diameter of the bars, nor one and one-half times the maximum size of the course aggregate, nor 1 ½ inches, and further provided that the planned cover is maintained. No additional compensation will be allowed because of the substitution of larger areas of steel.

C. DETAILED MATERIAL REQUIREMENTS

1. General

Reinforcing steel shall conform to the requirements of ACI 318.

2. Bar Reinforcement

Bar reinforcement shall consist of deformed bars meeting the requirements of AASHTO M 31, Grade 60. Grade 40 may be used for #5 and smaller bars where indicated on the Plans.

3. Tie or Dowel Bars

Tie or dowel bars shall be round steel bars meeting the requirements of AASHTO M 31, Grade 40 or ASTM A 36.

4. Welded Steel Wire Fabric

Welded steel wire fabric shall meet the requirements of AASHTO M 55. When galvanizing is specified, the fabric shall be galvanized after fabrication.

5. Welded Deformed Steel Wire Fabric

Welded deformed steel wire fabric shall meet the requirements of AASHTO M 221.

6. Galvanizing

Galvanizing for deformed steel bars shall be in accordance with ASTM A 153.

3.0 EXECUTION**A. FABRICATION****1. General**

After bar lists and bending diagrams have been approved, fabricate each unit of reinforcement to the type, shape, size, grade, and dimensions shown on the approved shop drawings.

2. Cutting and Bending

Perform cutting and bending of reinforcing bars before shipment to the site. Bend all bars cold in a manner that will not injure the material and in accordance with the Manual of Standard Practice of the Concrete Reinforcing Steel Institute.

B. SHIPPING, HANDLING, AND PROTECTION OF MATERIAL

Reinforcing steel bars shall be shipped in standard bundles and tagged and marked in accordance with the provisions of the Code of Standard Practice of the Concrete Reinforcing Steel Institute. Bundles shall be kept intact and material undamaged and properly identified until ready for use.

Reinforcing steel bars shall be stored on blocking, racks, or platforms so as not to be in contact with the ground.

Bars shall be kept free from dirt, paint, oil, grease, loose or thick rust, detrimental mill scale, or other foreign substances. However, when steel has on this surface detrimental rust, mill scale, dust, or dirt, it shall be cleaned by a method approved by the County.

C. PLACING AND FASTENING

The placing of bars shall conform to the recommended practices in "Placing Reinforcing Bars" as published by the Concrete Reinforcing Steel Institute.

Reinforcing steel shall be accurately placed in the position shown on the plans and firmly held during the depositing and setting of the concrete. Cover, or the distance between the external face of the bar and the face of the finished concrete, shall be as indicated on the Plans. Reinforcing steel bars embedded in concrete shall not be bent after they are in place. Bars shall be tied at all intersections with 16 ½ gage black annealed wire except that where spacing is less than 1 foot each direction alternate intersections need not be tied. All intersections shall be tied in the top mat of reinforcement placed on the top slabs of box culverts. Abrupt bends shall be avoided except where one steel bar is bent around the other. Stirrups and ties shall always pass around the outside of main bars and be securely attached thereto. All reinforcing steel shall be securely held at the proper distance from the forms by means of plastic coated steel chains. Blocks for holding reinforcement away from contact with earth shall be precast concrete blocks of approved shape, mix, and dimensions and shall have tie wires embedded in them. Layers of bars shall be separated by approved plastic coated metal chairs or bolsters.

Any broken or damaged concrete spacer blocks shall be removed before concrete is placed. The use of pebbles, pieces of broken stone or brick, metal pipe, or wooden blocks as spacers will not be permitted. Reinforcing steel when placed in the work shall be free from flake rust, dirt, and foreign material before any concrete is placed. Any mortar which may be adhering to the reinforcing steel shall be removed. No concrete shall be deposited until the County has inspected the placing of the reinforcing steel and given permission to place the concrete. The Contractor shall allow the County ample time after the reinforcement and forms are in place to conduct the inspection. Any bars of incorrect size, length, or shape shall be removed and replaced with correct bars. Any bars located or spaced incorrectly shall be relocated or spaced correctly before approval is given to place concrete, and such replacements and corrections shall be at the Contractor's expense. All concrete placed in violation of these provisions shall be rejected and removed.

Contractor shall allow the County ample time after the reinforcement and forms are in place to conduct the inspection. Any bars of incorrect size, length, or shape shall be removed and replaced with correct bars. Any bars located or spaced incorrectly shall be relocated or spaced correctly before permission is given to place concrete, and such replacements and corrections shall be at the Contractor's expense. All concrete placed in violation of these provisions shall be rejected and removed.

D. SPLICING

Reinforcement shall be furnished in full lengths as indicated on the Plans. Splicing, except where shown on the Plans, will not be permitted without written approval from the County and if additional splices are used, the additional weight occasioned by such splices shall be at the Contractor's expense.

All splices shall conform to Class "B" in ACI 318 or as shown on the Plans. Splices shall be well distributed where conditions permit. Except where otherwise shown on the Plans, lap splices shall be made with the bars placed in contact and wired together. Lapped splices for reinforcement shall not be used for bar sizes larger than No. 11.

No welding of reinforcing steel or attachments thereto will be permitted without written authorization by the County, unless so indicated on the Plans. Welding, if permitted, shall be in accordance with AWS D1.4.

4.0 METHOD OF MEASUREMENT

Measurement for concrete reinforcement consisting of deformed bars, or wire mesh will not be made, but shall be included in the unit or lump sum price bid for cast-in-place concrete.

5.0 BASIS OF PAYMENT**A. GENERAL**

1. Payment for concrete reinforcement consisting of deformed bars, or wire mesh will not be made as such, but the cost thereof shall be included in the lump sum price bid for cast-in-place concrete.

****END OF SECTION 03200****

**SECTION 03300
CAST-IN-PLACE CONCRETE**

1.0 GENERAL

A. DESCRIPTION

Cast-in-place concrete shall include, Portland cement concrete and the construction of small below grade Portland cement concrete structures constructed to the lines and dimensions and at the locations shown on the Plans and in accordance with the Contract Documents.

B. RELATED WORK ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Aggregate Backfill: Section 02240
3. Water Mains: Section 02660
4. Water Valves and Appurtenances: Section 02662
5. Fire Hydrants: Section 02666
6. Sanitary Sewer Force Mains: Section 02720
7. Concrete Reinforcement: Section 03200

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

1. The County will not furnish any materials for Portland cement concrete.
2. The Contractor may purchase water from the County's potable water system in accordance with the current County policies and procedures.

B. CONTRACTOR'S OPTIONS

1. The Contractor may furnish higher strength concrete than specified.

C. DETAILED MATERIAL REQUIREMENTS

1. Portland Cement

Portland cement shall be in accordance with AASHTO M 85 with the fineness determined in accordance with AASHTO T 153 and the time of setting determined in accordance with AASHTO T 131.

2. Fine Aggregate

Fine aggregate shall meet the gradation requirements contained in Table 03300-1 and shall be in accordance with the quality requirements of AASHTO M 6.

3. Coarse Aggregate

Coarse aggregate shall be in accordance with the Class A quality requirements of AASHTO M 80 using sodium sulfate to determine the soundness. Grading of aggregate shall be in accordance with AASHTO M 43, size numbers 57, 67, or 7, Table 03300-1.

4. Aggregate Gradations

TABLE 03300-1

Mass Percent Passing

<u>Sieves Sizes</u>	<u>AASHTO M 43</u>		
	No. 57	No. 67	No. 7
U.S. Standard			
1 ½ inch	100	-	-
1 inch	95-100	100	-
¾ inch	-	90-100	100
½ inch	25-60	-	90-100
⅜ inch	-	20-25	40-70
No. 4	0-10	0-10	0-15
No. 8	0-5	0-5	0-5
No. 16	-	-	-
No. 50	-	-	-
No. 100	-	-	-

5. Water shall be Potable.

6. Admixtures

Admixtures to be used in concrete (except for air entrainment) shall be subject to written prior approval by the County. Admixtures for concrete shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610. The relative durability factor of concrete with Admixtures shall be determined in accordance with ASTM C 666, Procedure B.

a. Air Entraining

Air entraining admixtures shall be in accordance with AASHTO M 154.

b. Admixtures

Admixtures shall be in accordance with AASHTO M 194.

c. High Range Water Reducing Admixtures

When specified, high range water reducing admixtures shall be liquid and meet the requirements of AASHTO M 194, Type F or G. When this material is used in patching, the admixture shall be liquid and meet the requirements of AASHTO M 194, Type F, for air entrained concrete with the following exceptions.

- i. The water content shall be a maximum of 85% of that of the control.
- ii. The relative durability factor shall be a minimum of 90 when tested in accordance with ASTM C 666, Procedure B.
- iii. The 12 hour compressive strength for Type F admixture shall be 180% of that of control.

Additionally, the admixture shall be nonfoaming when tested in accordance with ASTM D 1173. It shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610.

7. Fly Ash

Fly Ash may be used with written prior County approval.

Fly ash shall be in accordance with AASHTO M 295, pozzolan Class C or F.

8. Concrete Reinforcement

Concrete reinforcement shall be the size and type specified and shall be in accordance with the requirements of Section 03200.

9. Waterstops

Waterstops shall be made of rubber or polyvinyl chloride. The rubber type may be natural rubber, suitable synthetic rubber, or a combination of natural and suitable synthetic rubber. The polyvinyl chloride shall contain at least 90% virgin polyvinyl chloride. The remaining 10% may include one or more monomers copolymerized with vinyl chloride or consist of other resins mechanically blended with polyvinyl. The waterstop shall be of the shape and dimensions shown on the plans. The cross section shall be uniform along the length and transversely symmetrical so that the thickness at any given distance from either edge of the waterstop shall be uniform. The waterstop shall be dense, homogeneous, and free from holes and other imperfections.

The waterstop shall meet the following requirements:

Tensile Strength, ASTM D 412, psi min.	2000
Elongation at Break, ASTM D 412, % min.	300
Hardness, Rubber, Type A Durometer, ASTM D 2240	55+5
Hardness, PVC, Type A Durometer, ASTM D 2240	75+5

10. Forms

Forms shall be constructed of wood, steel, or other approved material. Wall ties approved by the County shall be used where necessary. Surfaces of metal forms shall be free from irregularities, dents, and sags. Knot holes and broken places in wood forms shall be covered with metal patches. Lumber used in forms for exposed surfaces shall be smooth, uniform, and free from loose knots and other defects that would show defects in the finished concrete surfaces. For unexposed surfaces and rough work square-edge lumber may be used. By unexposed surfaces is meant any concrete surface not exposed to view on completion of the project. Interior and exterior corners shall have chamfer strips. The Contract may be required to submit details of forming to the County before work proceeds.

11. Form Release Compounds

Form release compounds shall effectively prevent the bonding of the concrete to the forms. The form release compounds shall not cause discoloration of the concrete nor adversely affect the quality or rate of hardening at the interface of the forms. The compounds will be tested in accordance with MSMT 503.

12. Portland Cement Concrete Curing Materials

Curing materials shall be burlap cloth, sheet materials, or liquid membrane-forming compounds.

a. Burlap

Burlap cloth shall be made from jute or kenaf and shall be in accordance with AASHTO M 182, Class 1, 2, or 3.

b. Burlap Polyethylene Sheeting

Sheet material shall be in accordance with AASHTO M 171 except that tensile strength and elongation requirements are waived. White burlap polyethylene sheeting shall give a finished product weight of not less than 10 ounces per square yard.

c. Liquid Membrane

Liquid membrane-forming compounds shall be in accordance with AASHTO M 148.

Field control testing of the white pigmented curing compounds will be on the basis of weight per gallon. The samples shall not deviate more than plus or minus 0.3 pounds per gallon from the original source sample.

13. Vapor Barrier
 - a. Building paper shall be Sisal-Kraft building paper, conforming to requirements of FSS UUB 790A.
 - b. Polyethylene sheeting shall be 0.006 inch thick, conforming to requirements of ASTM D 2103.

3.0 EXECUTION

A. GENERAL

1. Concrete shall be mixed as specified in this Section and shall be delivered to the site in accordance with ASTM C 94.
2. The Contractor will be required to use concrete equipment of sufficient capacity to complete any unit, as indicated on Contract Documents, in one continuous operation consistent with placement operations as approved by the County.
3. Hand mixing may be permitted with written approval of the County for small volumes of concrete. However, its intended use is for small isolated areas where structural integrity is not critical.
4. Before placing any concrete, the Contractor shall install all sleeves, anchors, fittings, pipes, conduits, or other special devices called for in the Contract Documents. No concrete shall be placed until this work has been approved by the County. The Contractor shall ascertain that all material to be installed in the concrete by other trades has been placed prior to pouring any concrete. Any concrete poured without prior provisions having been made for inclusion of the indicated inserts and materials will be subject to rejection by the County and/or correction at the Contractor's expense.
5. Coat aluminum accessories and embedded items with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete.

B. CONCRETE MIXES

The concrete shall be proportioned by weight. Water and admixtures may be proportioned by volume or weight. The mix shall be homogeneous, placeable, and uniformly workable.

Coarse aggregate shall be maintained at a uniform moisture content at least equaling its absorbed moisture. Water, if used for wetting, shall meet the requirements of this Section.

Portland cement concrete mixtures shall conform to the Maryland SHA standard specifications for construction and materials (October 1993) and are noted below for your convenience.

Mix No.	28 Day Specified Compressive Strength psi (MPa)	Min. Cement Factor Pounds per Cubic Yard (kg/m ³)	Coarse Aggregate	Max. Water/Cement Ratio	Slump Range	Total Air Content
			M43	by wt	In. (mm)	%
1	2500 (17.2)	455 (270)	57, 67	0.55	2-5 (50-125)	5-8
2	3000 (20.7)	530 (315)	57, 67	0.50	2-5 (50-125)	5-8
3	3500 (24.1)	580 (345)	57, 67	0.50	2-5 (50-125)	5-8
4	3500 (24.1)	615 (365)	57, 67	0.55	4-8 (100-200)	N/A
5	3500 (24.1)	580 (345)	7	0.50	2-5 (50-125)	5-8
6	4500 (31.0)	615 (365)	57, 67	0.45	2-5 (50-125)	5-8
7	350 (2.4) split tensile	580 (345)	57	0.50	1-1/2-3 (40-75), 2-1/2 max if slip-formed	5-8

Note 1: When concrete is exposed to sewage or water exceeding 15000 ppm sodium chloride content, Type II cement shall be used.

Note 2: When synthetic fibers are used, the slump shall not exceed 5 in.

C. MIXERS AND AGITATORS

1. All mixers shall display a current Maryland State Highway Administration approval stamp. Mixers and agitators and mixing and delivery of ready-mixed concrete shall meet the requirements of AASHTO M 157 with the following exceptions:
 - a. Transit mixed concrete will not be permitted. The following requirements shall apply when additional water is added on the job site:
 - i. No water shall be added after partial discharge of the batch.
 - ii. The water-cement ratio shall not be exceeded.
 - iii. Acceptance will be based upon a retest of the slump and air content.
 - b. All concrete shall be discharged within 1 hour after the mixing water is added or 1½ hours after the addition of the cement to the aggregates, whichever is the lesser time.
 - c. No mixer or agitator containing free water in the drum shall be loaded.

D. HAND MIXING PORTLAND CEMENT CONCRETE

1. No hand mixing of concrete shall be allowed without first obtaining permission from the County.
2. The amount of concrete shall be small enough in quantity, that in the judgment of the County, the delivery of the same is impractical.
3. Scheduling of mixing and placing shall be coordinated with the resident County inspector so that all work by the contractor is under the supervision of the resident inspector.
4. Under no circumstances shall hand mixing of concrete be allowed for any permanent buttresses that will not be subject to the 150 pound plus pressure test.

E. FORMS

1. Design Criteria

Design of the forms shall be the Contractor's responsibility. Forms shall be designed for strength and deflection to resist all loads and pressure of wet concrete. The design shall provide for rate of pour, effect of vibration, and use of retarders, etc. In addition, horizontal surfaces shall have applied to them a live load of 50 pounds per square foot. This load is to be used in the design of the forms for strength only and is not to be used in computing deflections. However, in the design of forms for horizontal slabs, in no case shall this loading be less than a total of 120 pounds per square foot. (This does not apply to form joists, form wales, etc.) No form member or support thereof shall have a deflection in excess of $L/240$ of its span length, and in no case shall said deflection exceed $1/4$ inch.

2. Concrete forms shall be built true to line and grade, mortar-tight, and sufficiently rigid to prevent displacement or sagging between supports. All form work shall be provided with adequate clean out openings to permit inspection and easy cleaning after all reinforcement has been placed.

3. Forms at Construction Joints and Corners

At construction joints in concrete, ties or bolts shall be provided 3 to 6 inches from each side of the joint for tightening the forms against the hardened concrete (first pour) immediately prior to placing fresh concrete. At joints where forms have been removed and reconstructed, the form surface shall extend over the concrete already in place; and the forms shall be drawn tightly against the previously placed concrete immediately prior to placing the fresh concrete. Where forms have been extended, the forms shall be retightened against the concrete already in place immediately before placing fresh concrete.

Forms shall be filleted at all exposed sharp corners, except when otherwise indicated on the Plans and shall be given a bevel or draft in the case of all projections, such as girders, copings, etc., sufficient to insure easy removal.

4. Bracing and Maintenance

Special attention shall be paid to bracing; and where the forms appear to be insufficiently braced or unsatisfactorily built, either before or during the placing of concrete, the County will order work stopped until the defects have been corrected. All forms shall be so maintained as to eliminate the formation of joints due to the shrinkage of lumber. All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. For narrow walls where access to the bottom of the forms is not readily attainable provide temporary openings and at such other locations as may be necessary to clean out all chips, dirt, sawdust, or other extraneous material immediately prior to placing concrete. Existing forms may be extended after the concrete in said forms has been placed for at least 12 hours, provided such form extension can be done without any damage to the previously placed concrete.

Unit stresses for forms, form supports, false work, and bracing shall not exceed the AASHTO Specification.

5. Form Removal

All forms for concrete work shall be removed and disposed of by the Contractor after form work requirements have been complied with, except those which are designated to remain in place.

Forms shall remain in place a sufficient time to allow the concrete to set properly and the Contractor shall assume all responsibility for removing same. In no case shall forms be removed until concrete has sufficient strength to carry its own weight and the loads upon it with safety. The Director, however, may, when he deems it advisable, order the forms to remain for a longer time, but his acquiescence in permitting the removal of forms shall not relieve the Contractor of responsibility for same.

Forms for pipe end walls may be removed after the concrete has been in place for a period of 24 hours unless it is necessary to protect the concrete against cold weather, in which case the forms shall remain in place for the entire protection period.

Forms for vertical surfaces shall remain in place for a period of 48 hours. If, however, forms are removed before the concrete is 7 days old, the vertical surfaces shall be immediately covered with curing material and the concrete kept wet and so covered until the concrete is 7 days old. Horizontal form, and false work, carrying loads shall remain in place for a minimum of 7 days and until the concrete has attained a compressive strength of 3000 psi. Internal bulkheads used for forming construction joints, contraction joints, expansion joints, etc. may be removed after the concrete has been in place for 24 hours, if it is necessary to do so for the continuance of the work without interruption.

Special care shall be taken not to break concrete edges in taking down forms. Any portion of concrete damaged while stripping forms may be ordered torn down and recast at the discretion of the County. Upon removal of forms, the County shall be notified by the Contractor. The County after inspecting the surfaces newly stripped, will designate what honey-combed parts, if any, shall be

pointed up and how the slightly damaged portions of concrete, if any, shall be repaired or replaced. No freshly stripped surfaces shall be pointed up or touched in any manner before having been inspected by the County.

In all cases, the Contractor shall assume all responsibility arising from the removal of forms and shall assure himself that the concrete is properly cured to sustain loads before forms are removed.

F. CONCRETING

1. Before placing concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from interior of forms. No struts, stays, and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, will be permitted.

All concrete shall be placed in the dry, unless Plans and/or "Special Provisions" require the placement of tremie concrete.

All concrete shall be placed in a continuous operations.

Concrete, after being placed in the forms, shall be thoroughly compacted and shall be spaded, tamped, or vibrated to the satisfaction of the County.

Chuting of concrete will be allowed only as approved by the County. No concrete shall have a free fall of over three (3) feet and if this height is exceeded, it shall be conveyed in place by approved spouts and chutes. Open troughs and chutes shall be metal or metal lined. Where steep slopes are required, the chute shall be equipped with baffles or be in short length that reverse the direction of movement. All chutes, troughs and pipes shall be kept clean and free from coatings or hardened concrete by thoroughly flushing with water after each run.

2. Retempering concrete by the addition of water shall not be permitted. The addition of water to the batch in the mixer, after ten (10) minutes have elapsed after the initial charging or the addition of water at any time after the concrete has been removed from the mixer, shall be construed as retempering. Batches of concrete prepared contrary to these specification shall be rejected and immediately removed from the project.

The concrete shall be mixed only in the quantity required for immediate use and concrete not in place within one hour from the time the ingredients were charged into the mixing drums, or that has developed initial set, shall not be used.

3. Cold Weather Specifications

Under no circumstances will concrete be permitted to be placed on frozen soil. Construction of plain and reinforced cement concrete pavements, curbs, gutters, combination curb and gutters, and sidewalks, except by specific written authorization and under very definite Special Provisions, shall not be continued when a descending air temperature in the shade and away from artificial heat falls below 45°, or resumed until an ascending air temperature in the shade and away from artificial heat reaches 40°F.

If temperature is below 45°F then one or more of the following methods shall be used to obtain the required temperature all as approved by the County.

- a. When the method of heated mixing water is used, the water shall not be above 170°F when introduced into the mix.
- b. When the method of heated aggregates is used, aggregates containing frozen lumps, ice, or snow shall be allowed to enter the mixer. Aggregates may be heated by steam coils or other dry heat but not by discharging live steam or hot water into them. Heating by means of a flame thrower or any direct flame will not be permitted.

Adequate protection of concrete against damage by frost during the making and early curing period is absolutely essential whenever temperatures below 40°F are likely to occur within that period.

4. Construction Joints

Construction joints shall be kept to a minimum and will be permitted only where shown on the approved Plans and/or shop drawings.

In order to bond successive courses, suitable keys shall be formed at the top of the lift where construction joints are permitted and at other levels where work is interrupted. These keys shall be as indicated on the Plans. At horizontal construction joints, the pour shall be allowed to set for about 12 hours before placing concrete above same.

After concrete has been placed and before it has hardened, all laitance and foreign material shall be removed from the surface. Before placing fresh concrete adjacent to hardened concrete, the surface of the hardened concrete shall be cleaned thoroughly of any remaining laitance or foreign material, scrubbed with wire brooms and clean water, and thoroughly drenched with water until saturated. It shall be kept saturated until the new concrete is placed.

Unless otherwise specified, the top surface of the concrete shall be leveled whenever a pour of concrete is stopped; and to insure a level, straight joint on exposed face, a strip of sheathing shall be attached to the form at the exposed face where the joint occurs. The concrete shall be carried not more than ½ inch above the underside of this strip. About 1 hour after concrete is placed, the strip shall be removed; and any irregularities in the joint line shall be leveled off with a wood float (use steel trowel at exposed face of joint). All laitance shall be removed. To avoid visible joints at chamfers, the top surface of the concrete shall be steel troweled adjacent to the chamfer using the top surface of the chamfer strip as a guide.

5. Consolidation

All concrete shall be internally vibrated unless herein noted otherwise. Vibration shall be in accordance with the following requirements:

- a. All concrete shall be deposited in the forms in its final position and shall be placed in layers of uniform thickness. All concrete shall be consolidated by vibratory methods, unless otherwise specified.

Vibration shall be internal and applied directly to the concrete, except when the use of other methods is authorized by the County or provided herein. The County will be the final judge as to which sections are unsuited for internal vibration.

The Contractor shall provide a sufficient number of vibrators to properly consolidate each batch immediately after it is placed in the forms and before the next batch is delivered, without delaying such delivery. The vibration shall be of sufficient intensity and duration to thoroughly consolidate the concrete, but it shall not be continued to such an extent as to cause segregation. Vibration shall not be continued at any one point to the extent that any localized areas of grout are formed.

Vibration shall be applied at points uniformly spaced not further apart than twice the radius over which the vibration is visibly effective.

Vibration shall not be used to transport concrete in the forms or to make it flow in the forms over distances so great as to cause segregation. Vibration shall not be applied directly or through the reinforcement or forms to sections or layer of concrete which have hardened to such a degree that the concrete ceases to be plastic under vibration.

Vibration shall be supplemented by such spading, along form surfaces, in corners, and at locations impossible to reach with the vibrators, as is necessary to insure smooth surfaces and dense concrete.

The provisions of this section shall apply to precast concrete cribbing and other precast members or units, except that if approved by the County the manufacturer's methods of vibrating may be used.

- b. Internal vibrators shall be of a type and design approved by the County. They shall be capable of transmitting vibration to the concrete at frequencies of not less than 4500 impulses per minute. The intensity of application shall be such as to visibly affect a mass of concrete of 1 inch slumps over a radius of at least 18 inches.

Internal vibration shall be applied directly to the concrete at the point of deposit and in the area of freshly deposited concrete. Vibrators shall be inserted in and withdrawn from the concrete slowly. Internal vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and imbedded fixtures and into the corners and angles of the forms.

6. Concrete Surface

a. General

Concrete surfaces shall be finished in accordance with one of the following designations. Unless otherwise specified, all concrete work shall have a "Grout Finish" for vertical surfaces and "Toweled Finish" for horizontal surfaces. Strict compliance with the Specifications and the intent pertaining to finished surfaces will be enforced. Any concrete structure or concrete work which exhibits surfaces with defective finish will not be accepted until finishing has been completed in accordance with the Specifications. All concrete surfaces shall be finished within 24 hours after the forms are removed. If the concrete surfaces are not finished as specified within the time limit mentioned, all other work shall be suspended until the concrete surfaces required to be finished are completed.

<u>Application</u>	<u>Finished Designation</u>
<u>Structures</u>	
For all concrete surfaces not exposed to public view and not to be waterproofed	Rough Form Finish
For all concrete wall surfaces exposed to public view	Grout Finish
Tops of footings	Float Finish
Horizontal construction joints	Left Rough
<u>Slabs & Miscellaneous Paving</u>	Floated Finish
<u>Incidental Works</u>	
Sidewalks, curb, combination curb and gutter, concrete paving, safety curb, median paving	Broom or Belt Finish

b. Rough Form Finish

Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those which are not exposed or not to be waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges, and other defects shall be thoroughly cleaned and, after having been kept saturated with water for a period of not less than 3 hours, shall be carefully pointed and trued with a mortar of cement and fine aggregate mixed in proportions used in the grade of the concrete being finished. Any excess mortar at the surface of the concrete due to filling form tie holes shall be struck off flush with a cloth. The mortar

patches shall be cured as specified under Curing. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its length with clean and true edges.

The resulting surfaces shall be true and uniform. All surfaces shall be repaired to the satisfaction of the County.

c. Grout Finish

All fins, projections, etc. shall be removed to the satisfaction of, and by means approved by, the County (stone, chipping hammer, sandblasting, etc.). No cleaning operations shall be undertaken until all contiguous surfaces to be cleaned are completed and accepted. Cleaning as the work progresses will not be permitted. The surface of the concrete shall then be saturated with water and kept wet for at least 2 hours. Proceeding by sections, a grout mix of 1 part Portland cement and 1½ parts fine sand with sufficient water to produce a grout having the consistency of thick paint shall be thoroughly rubbed onto the surface using burlap pads or cork floats completely filling all voids, pits, and irregularities. While the grout is still plastic, remove all unnecessary grout by working the surface with a rubber float or burlap. After this grout has dried sufficiently so that it will not smear, the surface shall be wiped off with dry, clean burlap so as to leave a clean uniform surface. This surface shall then be cured as required, except that only colorless liquid curing compound will be permitted for this method.

d. Floated Finish

After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after the first floating, planeness of surface shall be checked with a 10 foot straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a smooth surface. The slab shall then be refloated immediately to a uniform sandy texture.

e. Broom or Belt Finish

Immediately after the concrete has received a float finish, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

7. Curing

Except for buttresses, provisions shall be made for curing all concrete. Curing shall start as soon as concrete has set sufficiently so that curing applications will not damage the surfaces. Curing will also be required while protecting concrete against cold weather.

The following are methods to be used for curing:

- a. Two layers of burlaps shall be used. Successive strips of each layer shall be overlapped a minimum of 6 inches. The second layer shall be placed not less than 45 degrees to the first layer; or the 6 inches overlap of the second layer may be placed midway (one-half width) of this first layer. The layers of burlap shall be kept thoroughly saturated with curing water for the full time specified for curing.
- b. The material for liquid membrane-forming compounds shall have a fugitive dye or be white pigmented. The materials shall be thoroughly agitated before use and applied by sprayers.
- c. When curing concrete structural slabs, etc., burlap-polyethylene mats or white polyethylene sheets may be used atop the wet burlap on unobstructed flat and reasonably level surfaces.

The burlap-polyethylene mats or white polyethylene sheets shall be placed only on unobstructed flat and reasonably level surfaces. They will not be permitted on vertical surfaces, such as walls, columns, abutments, etc.

Adjacent mats or sheets shall be lapped no less than 1 foot. The ends shall be brought down around the sides of the concrete being cured and securely fastened to the satisfaction of the County to make an airtight seal that will be unaffected by wind.

The burlap-polyethylene mats must be placed on no less than one layer of wet burlap with the burlap side of the mat facing down. White polyethylene sheets, if used, must be placed on no less than two layers of wet burlap.

The burlap-polyethylene mats or white polyethylene sheets must remain in place for the same length of time as required for burlap mats. These protective coverings need not be wetted down; however, the covered burlap or cotton mats must be kept wet for the time interval required by the Specifications.

- d. The burlap must be thoroughly saturated just prior to placement. The requirement for keeping the concrete surfaces saturated at all times during the curing period, regardless of the covering, will be strictly enforced. This saturation of the surfaces must be employed even in areas where there is no ready water supply. The Contractor must furnish, at his expense, sufficient water to satisfy this requirement.

All vertical surfaces may be cured by leaving forms in place for 7 days. If forms are removed after 48 hours, then the remainder of the 7 days of cure shall be by method b.

Immediately after the finishing operation for sidewalks and slabs, the areas of future construction joints shall be covered with two layers of wet burlap which shall extend 6 inches outside the joint area. The finished

concrete surface shall then be sprayed with a liquid compound as specified in curing method b. The material shall be applied uniformly at the rate of 150 to 200 square feet per gallon, one half applied in a longitudinal direction and the second half in a transverse direction. After 1 day or as soon as the concrete may be walked upon without damage, the concrete shall be cured using method a or c for the remainder of the 7 day curing period.

All other horizontal surfaces shall be cured using either method a or c for a period of 7 days.

8. Prevention and Removal of Stains on Concrete

The Contractor shall prevent rust of unpainted structural steel, staining by bituminous materials, or any other substance from discoloring any portion of the concrete. The Contractor, therefore, shall devise and use construction procedures or methods that prevent staining of any of the concrete. If, however, any portion of the concrete is stained, the Contractor shall remove such stains and restore the concrete to its original color without damage to the concrete all at his expense and as approved by the County. No chemical solvents will be allowed unless previously approved by the County.

4.0 METHOD OF MEASUREMENT

Except for when used as a buttress, measurement for cast-in-place concrete of the mix number specified will be made on a unit area or volume, or a lump sum per structure basis. In establishing the breakdown between footing concrete and substructure concrete, the division line shall be the top of footing regardless of where the construction joint occurs.

A. UNIT PRICE

Measurement for cast-in-place concrete, when a unit price is provided for in the Proposal, will be made on an area or volume basis for the actual amount of concrete satisfactorily placed and accepted.

B. LUMP SUM

Measurement for cast-in-place concrete, when a lump sum price or prices per structure are provided for on the Proposal Form, will be made on the basis of a lump sum for all concrete included in the Project or on the basis of the number of structures satisfactorily placed and accepted.

C. Concrete for buttresses or any joint restraint will not be measured.

5.0 BASIS OF PAYMENT

A. GENERAL

1. Payments will be made at the unit and/or lump sum prices bid. The prices shall include all materials, forms, reinforcing steel, curing materials, sealing, caulking, and dampproof or waterproofing, and all necessary equipment, tools, labor, and work incidental thereto in accordance with the Contract Documents.

2. Payment will be made for contingent items when approved by the County.

B. UNIT PRICE

Payment for cast-in-place concrete will be made at the price bid per cubic yard for the various mix numbers specified.

C. LUMP SUM

1. Payment for cast-in-place concrete will be made at the lump sum price bid for all concrete on the Project, or for all concrete in each structure or structural unit as indicated in the Contract Documents.
2. To provide for unforeseen changes in planned dimensions affecting concrete on a lump sum basis, the Contract Documents may include an item(s) for contingent concrete. This item(s) shall be used only upon written direction of the County and applied only to referenced structure(s). If necessary changes in the planned dimensions result in an enlargement, then the pertinent lump sum price shall be increased by an amount obtained from the product of the increase in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. Should, however, the necessary changes result in a smaller structure than planned, then the pertinent lump sum price shall be reduced by an amount obtained from the product of the reduction in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. The unit price bid on the pertinent contingent concrete item shall include cost of all concrete, reinforcing steel, expansion material, dampproofing, membrane waterproofing, form work, incidental materials, etc. and work required to complete the structure(s) as revised.

- D. Concrete will not be paid for when used for joint restraint unless approved.

****END OF SECTION 03300****

**SECTION 03400
PRECAST CONCRETE UTILITY STRUCTURES**

1.0 GENERAL

A. DESCRIPTION

Precast concrete utility structures shall include, but not necessarily be limited to, furnishing and installing precast concrete structures, manholes, valve and meter vaults, grade rings, and other miscellaneous structures of the configuration and to the extent indicated and in accordance with the Contract Documents.

B. RELATED WORK INCLUDED ELSEWHERE

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Valves and Appurtenances: Section 02662
3. Water Services and Appurtenances: Section 02664
4. Sanitary Sewer Manholes: Section 02710

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for precast concrete utility structures.

B. CONTRACTOR'S OPTIONS

None.

C. DETAILED MATERIAL REQUIREMENTS

1. Portland cement concrete shall meet the requirements specified in Section 03300 except as modified herein. Portland cement for units to be used in sanitary sewer systems shall be type II.
2. Concrete Reinforcement

Concrete reinforcement shall meet the requirements specified in Section 03200.
3. Water shall be potable.

4. Joint Seals Between Sections

Joint sealing material for use in vaults shall be cold-applied preformed sealing compound that meets the manufacturer's recommendations and County approval.

5. Precast sanitary sewer manholes and appurtenances shall be as noted within this section and as specified in Section 2710.

6. Dampproofing and Waterproofing

Dampproofing and waterproofing the exterior of precast structures shall be as per the Contract Documents or the approved list of suppliers and materials for Water and Sewer construction.

7. Steps

Steps shall be as specified in the Standard Details.

8. Granular Bedding

Granular bedding beneath precast units shall meet the requirements of AASHTO M 43, No. 57, as specified in Section 02240.

9. Non-Shrink Mortar

Non-shrink cement mortar shall be as specified in Section 04100.

10. Underground Precast Concrete Vaults

Underground precast concrete vaults and appurtenances shall be as noted in this Section and to the Standard Details. See Approved Material List for vault to pipeline connections.

3.0 EXECUTION

A. DESIGN CRITERIA

1. General

a. Structural design for precast units shall be prepared by a Maryland registered Engineer for the precast concrete manufacturer. Units shall be designed for HS 20 load designation or 300 pounds per square foot live load, whichever is most critical for determining the concrete and steel stresses.

b. Where more than one standard is referenced for any given unit, should there be a conflict, the more stringent requirement as determined by the County, shall apply.

c. Unit configuration shall be as shown on the Plans and/or Standard Details.

- d. Distribution of earth loading and live load shall be in accordance with ASTM C 857 or ASTM C 890.
- e. Walls shall be designed using an equivalent fluid pressure of 83 pounds per cubic foot and a 2 foot surcharge. The units shall also be designed to resist all stress encountered during casting, handling, and erection.

2. Manholes

- a. Precast concrete manholes and grade rings shall meet the requirements of ASTM C 478 except that the minimum compressive strength of the concrete shall be 4000 psi. The maximum individual grade ring height shall be 3 inches.
- b. Joints shall meet the requirements of ASTM C 443, shall be self-centering, and shall form a uniform water tight joint.

3. Miscellaneous Water and Wastewater Structures

Miscellaneous water and wastewater structures not otherwise covered shall meet the requirements of ASTM C 913.

4. Underground Precast Concrete Vaults

Underground precast concrete utility structures shall meet the requirements of ASTM C 857 and C 858 except that the minimum compressive strength of the concrete shall be 4,000 psi at 28 days of age.

B. FABRICATION

- 1. The precast units shall be factory cast. Job site casting will not be permitted. Concrete in the precast elements shall be continuously placed to prevent formation of seams. The finished units shall be free of voids and cracks. Exposed corners and edges shall be beveled. All inserts shall be securely attached or embedded in their proper location.
- 2. Concrete strength of all precast units at 28 days shall be 4000 psi minimum, unless otherwise specified. It shall be the precast unit manufacturer's responsibility to insure that the specified concrete strength is maintained throughout production of the units. Mix design shall be those previously used by the manufacturer which have proven satisfactory for casting units similar to those specified and producing the required strength. All precast concrete shall be air entrained in accordance with AASHTO M154. Admixtures containing calcium chloride shall not be used.
- 3. Wall sleeves or gaskets for piping, sumps, steps, access hatches, and other inserts as shown on the Plans and/or Standard Details shall be cast into the structure or inserted at the place of manufacture.

C. PRODUCT HANDLING

1. No precast unit shall be shipped in less than 7 days from date of manufacturer, unless the unit has been tested and is shown to be in full compliance with the Specifications. Date of manufacture shall be stamped on each unit.
2. Precast sections shall be transported and handled with proper equipment to protect the elements from damage. Sections shall be handled by means of lifting inserts embedded in the concrete. Damaged sections that cannot be satisfactorily repaired by the manufacturer shall be replaced by new sections at no additional cost to the County.
3. Manufacturer shall identify each manhole section with an identification number that corresponds to the manhole number noted on the contract drawings.

D. INSTALLATION

1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
2. Precast units shall be installed where and as shown on the Contract Documents and Standard Details or as directed by the County.
3. Pipe connection, penetrations, and other appurtenances shall be installed as specified in the following sections:
 - a. Water Valves and Appurtenances; Section 02662
 - b. Water Services, Meter Settings, and Vaults; Section 02664
 - c. Sanitary Sewer Manholes; Section 02710
4. Field modifications of precast units, such as cutting or enlarging holes or slots, will not be permitted without the specific approval of the precast unit's manufacturer and the County. Permitted modifications shall be made by the manufacturer in strict accordance with County approval and the manufacturer's directions and recommendations.
5. Mating surfaces shall be cleaned of all foreign materials such as dirt, mud, stones, etc., and where appropriate, joint sealing materials applied prior to assembly of the units.
6. Grade rings shall be set on a full bed of mortar.

4.0 METHOD OF MEASUREMENT

Measurement for precast concrete utility structures will be made as specified in the "Contract Documents."

**SECTION 03500
FLOWABLE FLY ASH**

1.0 GENERAL

A. DESCRIPTION

1. Flowable Fly Ash fill shall include but not necessarily be limited to the filling of utility trenches, tunnels, and sleeves at the locations shown on the plans and in accordance with the Contract Documents.
2. Flowable Fly Ash fill should not be used indiscriminately in any application. It is intended for use in tunnels, sleeves and utility trenches located within roads. Records of each placement must be maintained.

B. RELATED WORK INCLUDED ELSEWHERE

1. Trench Excavation, Backfill and Compaction: Section 02250
2. Boring and/or Jacking Pipe: Section 02300
3. Tunneling: Section 02400

C. QUALITY ASSURANCE

The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for Flowable Fly Ash fill.

B. CONTRACTOR'S OPTIONS

None.

C. DETAILED MATERIAL REQUIREMENTS

1. Portland Cement

Portland cement shall conform to M 85, with the fineness and time of setting determined in conformance with T 153 and T 131 respectively.

2. Fly Ash

Fly Ash shall be Class F as defined by ASTM Specifications C-618 but with no limits on chemical or physical requirements except that it must be relatively free of calcium oxide when minimum strength is required.

5.0 BASIS OF PAYMENT

A. GENERAL

1. Payment for precast concrete utility structures, complete and in place will be lump sum or as dictated by the appropriate section. The prices shall include all materials, sealing caulking, waterproofing, and all necessary equipment, tools, labor, and work incidental thereto in accordance with the Contract Documents.
2. Payment will be made for contingent items when approved by the County.

B. LUMP SUM

1. Payment for precast concrete units will be made at the lump sum price bid for each structural unit as indicated in the Contract Documents.

****END OF SECTION 03400****

3. Water

Water shall be potable.

4. Admixtures

- a. Admixtures shall be as described in ASTM Specification C-494.
- b. Admixtures included in the mixture for the purpose of affecting setting and strength characteristics shall be permitted provided they have no adverse effects on strength development nor adverse effects on any equipment which the mixture may encapsulate, i.e., pipes, valves, conduit, etc.

5. Fillers

Fillers, if required, shall be natural aggregates with a maximum size not to exceed 3/4 inch and may include sands. Bottom ash shall not be used as a filler.

3.0 EXECUTION

A. FLOWABLE FLY ASH MIXES

1. Fly Ash shall be proportioned on the basis of its dry weight. When wet fly ash is used in the batch, the moisture content shall be measured by ASTM Test Method C-566 and the mix water shall be adjusted accordingly. Moisture in the stockpile shall be determined at intervals sufficient to insure accurate proportioning. Fly Ash shall be measured into the mix by weight or by an approved volumetric device.
2. Cementitious material shall be included in the mix in an amount sufficient to yield strength adequate for the specific application. The cementitious material shall be measured by weight or by an approved volumetric device.
3. Aggregate, when included in the mix, will be proportioned by dry weight or by an approved volumetric device. Moisture content will be determined by ASTM Test Method C-566.
4. Requirements for consistency will generally control the amount of water in the mix. Total water will be the water included with the fly ash and aggregate plus added water. Unless otherwise noted, the percentage of water in the mix will be expressed as a percentage of the total batch weight. Measurement of water may be by weight or volume.
5. Record of the material placed in each delivery shall be submitted to Worcester County. For each mix design, the record will include strength data, type of additives, unit weight, consistency and total water.
6. No material which will decompose and allow subsidence will be permitted as a constituent part of the mix.

7. The self leveling consistency of the flowable fly ash mixture shall have a flow less than 140 seconds when tested in accordance with Corps of Engineers Test Method CRD-C611.
8. Strength
 - a. Flowable Fly Ash fill for use in tunnels and sleeves shall meet a 120 day design compressive strength of 50 psi.
 - b. Flowable Fly Ash fill for use in trenches within state right-of-ways shall meet a 28 day design compressive strength of 100 psi.
 - c. Strength development within 3 days of placing may be measured in place with a penetrometer of the type described in ASTM Test Method C-403. Minimum strength before paving over the stabilized flowable fly ash with a wearing surface shall be 50 psi as measured by the penetrometer.
 - d. Mixtures not within State right-of-way must retain workability. They must be diggable with hand tools.

B. MIXING

1. Stabilized flowable fly ash may be mixed by ready mix truck, or other acceptable equipment or methods.
2. After water has been added to the fly ash, mixing shall be continuous until placement to prevent premature settling.
3. At air temperatures below 40 degrees F (10 degrees C), mix water should be heated to above 140 degrees F (60 degrees C). Temperature of the delivered material shall be between 50 and 90 degrees F (10 degrees - 32 degrees C).

C. PLACEMENT

1. Stabilized flowable fly ash should be placed in the excavation directly from the mixer wherever possible. When pumps or conveyors are needed for placement, premature settling must be avoided by minimizing the time in which there is no agitation.
2. Self-leveling mixes will ordinarily require no shoveling, raking, or brooming to place.
3. When stabilized flowable fly ash is placed in trenches with appreciable slope at the surface, removable dams shall be inserted at appropriate intervals in order to equalize the depth of material placed.
4. Stabilized flowable fly ash shall be protected from freezing for 24 hours after placement.
5. Flowable Fly Ash fill shall cure for a twenty-four (24) hour period (min.) prior to receiving a bituminous concrete surface.

6. Flowable Fly Ash fill shall only be placed to the limits noted on the Standard Details and Contract Documents.

4.0 METHOD OF MEASUREMENT

- A. Except when used as a contingent item or noted otherwise, measurement for flowable fly ash fill will not be made, as it will be included in the appropriate unit cost bid for the installation of pipe lines and/or filling of tunnels or sleeves.
- B. When used as a contingent item or noted otherwise, measurement for furnishing and installing flowable fly ash fill will be made on the basis of the volume of material accepted and satisfactorily placed to the lines, grades, and dimensions shown on the Standard Details, noted in the Contract Documents, or as directed by the County.

5.0 BASIS OF PAYMENT

A. GENERAL

1. Except when used as a contingent item or noted otherwise, payment for flowable fly ash fill will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.
2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. FLOWABLE FLY ASH

1. Payment for furnishing and installing flowable fly ash fill complete and in place will be made at the contingent prices established in the bid proposal. The price shall include all labor, material, equipment, necessary traffic control, and incidental items to complete the excavation and placement.
2. Payment for removal of unacceptable foundation material will be made under the pertinent contingent item.
3. Payment will not be made for any flowable fly ash fill which is used because of any error in the Contractor's operations, such as excavating beyond specified lines or grades, etc.

****END OF SECTION 03500****

DIVISION 4 - MASONRY

**SECTION 04100
MORTAR**

1.0 GENERAL

A. DESCRIPTION

Mortar shall include, but not necessarily be limited to, furnishing site mixed mortar for masonry, pipe connections, grouting, and other uses as specified in the Contract Documents or as directed by the County.

B. RELATED WORK INCLUDED ELSEWHERE

1. Removal or Abandonment of Existing Utilities: Section 02050
2. Water Valves and Appurtenances: Section 02662
3. Water Services and Appurtenances: Section 02664
4. Sanitary Sewer Manholes: Section 02710
5. Brick Masonry: Section 04200

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

1. The County will not furnish any materials for mortar.
2. The Contractor may purchase water from the County's potable water system in accordance with the current County policies and procedures.

B. CONTRACTOR'S OPTIONS

Not applicable.

C. DETAILED MATERIAL REQUIREMENTS

1. Water shall be potable.
2. Portland Cement

Portland cement shall meet the requirements of AASHTO M 85 with the fineness determined in accordance with AASHTO T 153 and the time of setting determined in accordance with AASHTO T 131.

3. Mortar Sand

Mortar sand shall meet the requirements of AASHTO M 45 deleting the requirements for fineness modules and deleterious substances.

4. Hydrated Lime for Masonry

Hydrated lime for masonry shall meet the chemical requirements of ASTM C 207, Type N.

5. Admixture

Only as approved by the County.

3.0 EXECUTION

A. MIX REQUIREMENTS

1. Mortar for Masonry

Mortar used for masonry shall be composed in accordance with one of the following:

- a. One part Portland cement, or masonry cement, two parts mortar sand by dry loose volume, and hydrated lime not to exceed 20% of the cement by weight.
- b. Pointing of masonry after the masonry has been laid shall not be permitted without the approval of the County. The mortar used for pointing of masonry shall be composed of one part Portland cement, one part mortar sand by dry loose volume, and hydrated lime not to exceed 20% of the cement by weight.

2. Mortar for Grout

Mortar used for grouting anchor bolts, pipe handrail posts and miscellaneous items shall be composed in accordance with one of the following:

- a. One part Portland cement and one part mortar sand by dry loose volume.
- b. An epoxy or polyester anchoring system may be used as approved by the County and in accordance with the manufacturer's recommendations. Strength values shall be as indicated on the Contract Documents.
- c. Nonshrink grout shall be used when specified. The grout shall have a minimum compressive strength of 5,000 psi in seven (7) days when tested with AASHTO T-106 except that the cube molds shall remain intact with a top firmly attached throughout the curing period. The nonshrink grout shall have a minimum expansion of 0.0 percent after seven (7) days when tested in accordance with AASHTO T-160.

B. MIXING

1. Mortar may be mixed in an approved mixing machine or manually in a tight box. The dry materials shall be mixed until the mixture assumes a uniform color. Water shall be added as the mixing continues until the proper consistency has been attained for the intended use.
2. Mortar shall be mixed only in quantities that satisfy immediate use. Retempering of mortar shall not be permitted.

4.0 METHOD OF PAYMENT

Mortar will not be measured.

5.0 BASIS OF PAYMENT

Mortar will not be paid for as a separate item but is considered incidental to other items of work. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

****END OF SECTION 04100****

**SECTION 04200
BRICK MASONRY**

1.0 GENERAL

A. DESCRIPTION

Brick masonry shall include, but not necessarily be limited to, furnishing and installing brick masonry above and below grade to the sizes and shapes and at the locations indicated in accordance with the Contract Documents or as directed by the County.

B. RELATED WORK INCLUDED ELSEWHERE

1. Removal or Abandonment of Existing Utilities: Section 02050
2. Boring and/or Jacking Pipe: Section 02300
3. Tunneling: Section 02400
4. Water Valves and Appurtenances: Section 02662
5. Water Services and Appurtenances: Section 02664
6. Fire Hydrants: Section 02666
7. Sanitary Sewer Manholes: Section 02710

C. QUALITY ASSURANCE

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any materials for brick masonry.

B. CONTRACTOR'S OPTIONS

None.

C. DETAILED MATERIAL REQUIREMENTS

1. Sewer brick shall be grade SM, have dimensions not exceeding 2 1/4" x 3 3/4" x 8", and meet the requirements of ASTM Designation C32. The bricks shall have a fine-grained uniform, and dense structure, free from lumps of lime, laminations, cracks, checks, soluble salts or other defects which may in any way impair their strength, durability, appearance, or usefulness for the purpose intended. Bricks shall emit a clear, metallic ring when struck with a hammer.
2. Mortar shall be as specified in Section 04100.

3.0 EXECUTION**A. ENVIRONMENTAL REQUIREMENTS****1. General**

- a. Cover completed work each day to prevent rain or melting snow from penetrating the mortar of upper courses. Do not uncover until immediately before new work is to be laid. Protect new masonry for a period of not less than 72 hours immediately following laying. This time period may be extended by the County.
- b. Spray masonry laid during the period from April to November, inclusive, with sufficient water so as to be moist, but not saturated with water just prior to use.

2. Cold Weather Protection

- a. No brick masonry work or pointing shall be done when there is frost in the brick or when the air temperature is below 40EF, unless the Contractor has on the project ready to use, if and when directed, suitable housing, covering, tarpaulins, etc. and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 40EF.
- b. Protect work by heating and maintaining the temperature of the masonry materials at not less than 40EF but not more than 160EF and maintaining an air temperature above 40EF on both sides of the masonry for not less than 72 hours. Work will not be permitted with or on frozen materials. When the temperature reaches or is above 40EF proceed as under warm weather conditions.

3. Hot Weather Protection

- a. During hot weather, protect masonry from direct rays of sun. Cover, and/or wet all finished work for a period of 7 days after laying.
- b. Do not erect masonry when the ambient air is warmer than 99EF in the shade and has a relative humidity of less than 40% unless the work is prevented from drying out for not less than 48 hours after having been installed.

B. GENERAL

1. Keep joints equal to the difference between the actual and nominal dimensions of the unit being installed.
2. Tothing of new work into existing work will not be permitted.

C. PREPARATION

1. Clean dirt, debris, oil, grease, and other foreign substances which would affect bond of mortar, from all surfaces to receive mortar.
2. Lay out brickwork to establish accurate spacing of bond pattern, to ensure uniform joint widths, and to locate openings, returns, and offsets. Arrange units in a manner which will result in few or no units to be cut.
3. Wetting Bricks
 - a. Brick having absorption rates in excess of 0.025 ounces per square inch per minute, when tested in accordance with ASTM C 67 shall be wetted, so that the rate of absorption does not exceed that rate.
 - b. Wetting methods shall ensure that each brick, immediately before being installed, is nearly saturated but brick surfaces are dry.

D. ERECTION

1. Workmanship
 - a. All brickwork shall be laid by competent mechanics and any workman not deemed to be such by the County shall be removed from the work at once.
 - b. Lay masonry plumb, true to line, with level and accurately spaced courses. Joints shall be not less than three-eighths ($3/8$) inch or more than one-half ($1/2$) inch wide.
 - c. Build in wood blocking, strips, grounds, wedges, pipe sleeves, frames, and similar items of material necessary to properly secure the work for other trades.
 - d. Remove mortar which has splashed or been smeared on finished surfaces with stiff bristle brushes as the work progresses.
 - e. Special care shall be taken in laying brick in inverts of manholes, transition sections, junction chambers, brick Ys and similar structures to insure a uniform flow of water through the sections. In such locations joints shall not exceed three-sixteenths ($3/16$) inch thickness and each brick shall be laid in full mortar joints on bottom side and end performed in one operation; no grouting or working in of mortar after laying the brick will be permitted.
2. Parging

Parge exterior masonry in contact with the earth with two coats of Portland cement mortar, each $3/8$ inch thick. The first coat shall be cross-scratched; the second coat shall be troweled smooth, beveled at the top, and coved out at the edge of the footing. Extend parging not more than 4 inches above grade, unless otherwise, and keep damp for at least 3 days.

3. Brick
 - a. Lay brick work in common bond. Fill all joints between bricks completely with mortar. Form bed joints with a thick layer of mortar, which shall be smoothed. The practice of buttering at the corners of brick and then throwing mortar or scrappings into the empty joints will not be permitted. Lay closure brick with a bed joint and with head joints. Place the brick carefully without disturbing the joints. Place the brick carefully without disturbing the brick previously laid. Properly bond each course. Dry or butt joints will not be permitted. Provide grouting where indicated.
 - b. Use sewer brick whenever brick construction is exposed to sewage flow. Lay sewer brick on edge so that the 2 1/4 by 8 inch side is exposed to the flow.
 - c. Channel configurations shall be constructed as per the Standard Details.

4.0 METHOD OF MEASUREMENT

Unit masonry will not be measured.

5.0 BASIS OF PAYMENT

Unit masonry will not be paid for as a separate item but is considered incidental to other items of work. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

****END OF SECTION 04200****

DIVISION 5 - METALS

**SECTION 05500
MISCELLANEOUS METALS**

1.0 GENERAL

A. DESCRIPTION

Miscellaneous metals shall include, but not necessarily be limited to, furnishing and installing anchors, fasteners, hardware, castings, utility specialities, and other miscellaneous metal items in accordance with the Contract Documents or as directed by the County.

B. RELATED WORK INCLUDED ELSEWHERE

1. Boring and/or Jacking Pipe: Section 02300
2. Tunneling: Section 02400
3. Water Mains: Section 02660
4. Water Valves and Appurtenances: Section 02662
5. Water Services, Water Meter Settings, and Vaults: Section 02664
6. Fire Hydrants: Section 02666
7. Sanitary Sewer Manholes: Section 02710

C. QUALITY ASSURANCE

1. The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.
2. All miscellaneous metal items and fabrications shall be anchored firm and tight, in true alignment with neat fits, and without distortions, unsightly fastenings, raw edges, or protrusions.

2.0 MATERIALS

A. GENERAL

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. MATERIALS FURNISHED BY THE COUNTY

The County will not furnish any miscellaneous metals.

C. CONTRACTOR'S OPTIONS

Not applicable.

D. DETAILED MATERIAL REQUIREMENTS

1. Whenever practicable, items shall be standard products, meeting the requirements specified herein, of a manufacturer regularly engaged in production of such items.
2. All fasteners, hangers, or other miscellaneous connections or accessories shall be of the same material or compatible with the item being fastened or hung.
3. Shapes and Bars
 - a. Mild steel shall conform to requirements of ASTM A 36.
 - b. Stainless steel shall conform to requirements of ASTM A 276, Type 304.
 - c. Aluminum shall conform to requirements of ASTM B 221, Alloy 6061-T6.
4. Plate, Sheet, Strip
 - a. Mild steel shall conform to requirements of ASTM A 36, or A 283, Grade C.
 - b. High strength steel shall conform to requirements of ASTM A 242.
 - c. Corrosion resistant steel shall conform to requirements ASTM A 242; 0.25 to 0.75 percent copper.
 - d. Stainless steel shall conform to requirements of ASTM A 240, Type 304.
 - e. Aluminum shall conform to requirements of ASTM B 209, Alloy 6061-T6.
5. Mild steel forgings shall conform to requirements of ASTM A 668, Class F.
6. Castings
 - a. Unless noted otherwise, gray iron shall conform to requirements of ASTM A48, and AASHTO Designation M306, Class 30 B.
 - b. Malleable iron shall conform to requirements of ASTM A 47, Grade 35018.
 - c. Ductile iron shall conform to requirements of ASTM A 536, Grade 60-40-18.
 - d. Nodular iron shall conform to requirements of ASTM A 220, Grade 45008.
 - e. Steel shall conform to requirements of ASTM A 27, Grade 65-35. The supplementary requirements of ASTM A 27 for tolerances and deviations shall also apply.

- f. Chromium alloy-steel castings shall conform to the requirements of ASTM A 743, A 744, and A 297. The grade shall be as specified in the "Special Provisions" for the particular use requirement of the casting.
 - g. Aluminum shall conform to requirements of ASTM B 108, Alloy ANSI 356.0, T6.
7. Bolts, nuts, washers
- a. General
 - i. Provide galvanized for use with galvanized material.
 - ii. Provide stainless for use with corrosion resistant metals.
 - b. Stainless
 - i. Bolts shall conform to requirements of ASTM A 320, Type 304.
 - ii. Nuts shall conform to requirements of ASTM A 194, Grade 8.
 - iii. Washers shall be Type 304.
 - c. Expansion bolts shall be the metal shield type.
 - d. Steel drive bolts shall be the split shank type.
 - e. Headed steel anchors shall be fabricated from cold finished carbon steel conforming to requirements of ASTM A 108.
 - f. Cast washers, ogee washers and special cast washers shall meet the requirements of ASTM A 47. Cast washers shall be mechanically or hot-dip galvanized. The coating shall meet the thickness, adherence, and quality requirement of ASTM A 153.
 - g. Bronze bolts, nuts, and washer shall meet the requirements of ASTM B 21, UNS No. C46400.
8. Hardware
- Spikes, wood screws, staples, brads, lag screws, carriage bolts, and other parts coming under the general heading of "Hardware" shall be composed of carbon steel and shall meet the requirements of FSS FF-N-105.
9. Checkered safety plate
- a. Aluminum shall conform to requirements of ASTM B 221, Alloy 6063, T6.

3.0 EXECUTION

A. FABRICATION

1. General

- a. Fabricate all work true to shape, size and tolerances as indicated in the Contract Documents and on approved Shop Drawings; with straight lines, square corners, or smooth bends; free from twists, kinks, warps, dents, and other imperfections.
- b. Thickness of the metal and details of assembly and support shall provide sufficient strength and stiffness to resist distortion during shipment, handling, installation, and under severe service conditions. Dress exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded. Construct connections and joints exposed to weather to exclude water.
- c. Provide sufficient quantity and size of anchors for the proper fastening of the work.

2. Fabricated Products

- a. Pipe wall sleeves in concrete construction shall be standard weight, black steel pipe, with anchors welded to exterior, size as required to accommodate passage of conduits, pipes, ducts, and similar items with proper clearance.
- b. Hatch Doors

Provide hatch doors that meet the requirements noted in the standard details and/or contract documents.
- c. Connections
 - i. Shop connections in weldable materials, not designed for service removal, shall be welded. All welding shall conform to AWS D1.1 requirements. Grind all exposed welds smooth. Remove weld, brazing, and solder spatter, flux, slag, and oxides from finished surfaces. Use sheet metal lock seams only when indicated on the Plans or approved shop drawings.
 - ii. Complete all provisions for bolted field connections in the shop unless otherwise indicated.
 - iii. Match exposed work to produce continuity of line and design. Fabricate and fasten metal work so that the work will not be distorted, the finish impaired, nor the fasteners overstressed from the expansion and contraction of the metal. Conceal fastenings whenever practicable.

- d. Castings and Forgings
 - i. Fabricate castings and forgings to the sizes and shapes indicated. Castings and forgings shall be uniform quality, true to pattern; strong, tough, of even grain; sound; smooth; without cold sheets, scabs, blisters and sand holes, cracks or other defects. Plugs, filled holes, and welding will not be allowed. Castings shall be of thickness and configurations shown on the Standard Details. Abrasive blast as required to remove scale and to achieve a uniform smooth clean surface. Paint with asphaltum or coal tar paint meeting requirements of AWWA C 203, where indicated. Provide raised letters where indicated.
 - ii. Valve boxes shall be Class 30B, round head, screw type consisting of snug fitting top, bottom sections, and screw type extension. Lid shall be removable only by lifting straight up from the shaft shoulder.
 - iii. Meter setting fittings, yokes, and appurtenances for 3/4 through 2-inch metered water supplies, and meter pit frames, lids, and covers shall be as specified on the Standard Details.
 - iv. Manhole frames and covers shall be cast from material meeting the requirements of ASTM A48, Class 30B. Weights, configuration, and lettering shall be as shown on the Standard Details.
- e. Miscellaneous anchors, strap anchors, clip angles, and plates, hangers, etc., and other items, together with all miscellaneous structural shapes required for construction of the work shown on the Plans, shall be furnished in accordance with the requirements of the Contract Documents.

B. PAINTING AND COATINGS

1. Where indicated, shop and/or field paint miscellaneous metal items according to the paint systems specified in the Contract Documents.
2. Galvanized touch up shall be zinc dust coating conforming to requirements of Military Specification P-26915.
3. Bituminous corrosion protection shall conform to requirements of Military Specification C-18480.
4. Coat aluminum accessories and items embedded in concrete with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete.

C. DELIVERY, HANDLING, AND STORAGE

1. Identify, and match mark if applicable, all materials, items, and fabrications; for installation and field assembly.

2. Wherever practicable, deliver items to job site as complete units, ready for installation or erection, with all anchors, hangers, fasteners, and miscellaneous metal items required for installation.
3. Provide adequate storage facilities at the job site for the protection and storage of all delivered materials. Handle and store in such a manner as to not damage factory finishes. The Contractor shall repair damaged finishes at no cost to the County.

D. ERECTION AND INSTALLATION

1. Erection and installation of miscellaneous metal items shall be in accordance with requirements specified elsewhere in the Contract Documents.
2. Miscellaneous metal items and fabrication shall be installed in their proper locations as shown or directed and shall be anchored, rigid and secure, plumb and level unless otherwise shown, and in true alignment with related and adjoining work.
3. The Contractor shall provide shims, washers, anchors, and such additional work as necessary to achieve a satisfactory installation.

4.0 METHOD OF MEASUREMENT

Miscellaneous metals will not be measured.

5.0 BASIS OF PAYMENT

Miscellaneous metals will not be paid for as separate items. The materials and their installation are considered incidental to the work required in the construction of specific structures that will be paid for under various items indicated in the Contract Documents. Payment will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

****END OF SECTION 05500****

PART 3
STANDARD DETAILS

Table of Contents

1.0 Standard General Details

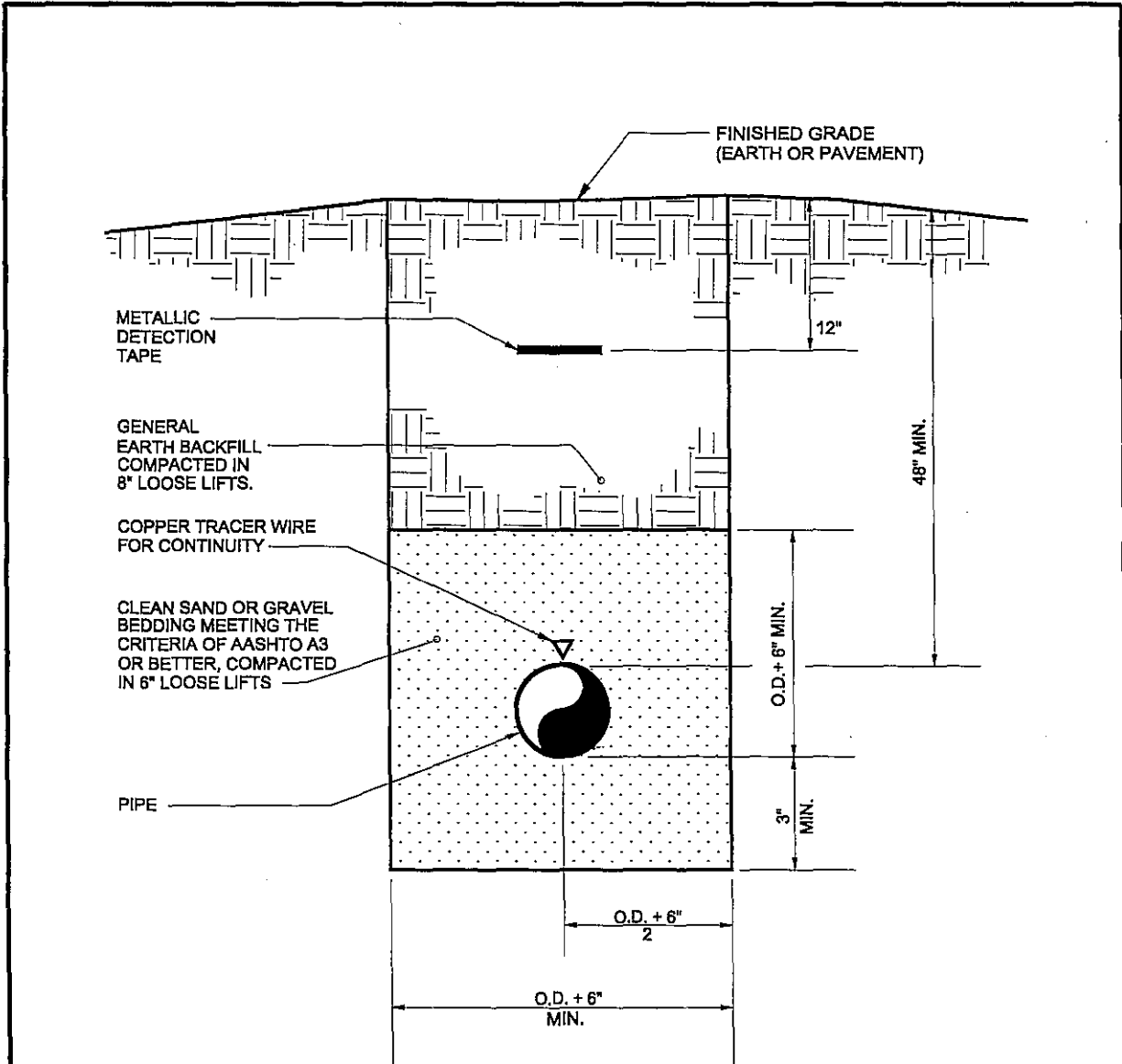
- G-1 Pipe trench/bedding
- G-2 Trench pavement repair detail
- G-3 Concrete encasement detail

2.0 Standard Water Details

- W-1 Continuity test station
- W-2 Typical fire hydrant settings
- W-3 Strapping fire hydrant and valve to main
- W-4 Trust blocks and vertical bend anchorage
- W-5 Gate valve and valve box detail
- W-6 Pipe crossing detail
- W-7 Cap and blow-off 4" mains and larger
- W-8 Standard water meter frame and cover
- W-9 Standard 1-inch service with ¾-inch meter
- W-10 Standard 1-1/2-inch service with 1-inch meter
- W-11 Standard 2-inch service with 1-1/2-inch
- W-12 Air release valve detail
- W-13 Typical combined domestic – fire supply service schematic

3.0 Standard Sewer Details

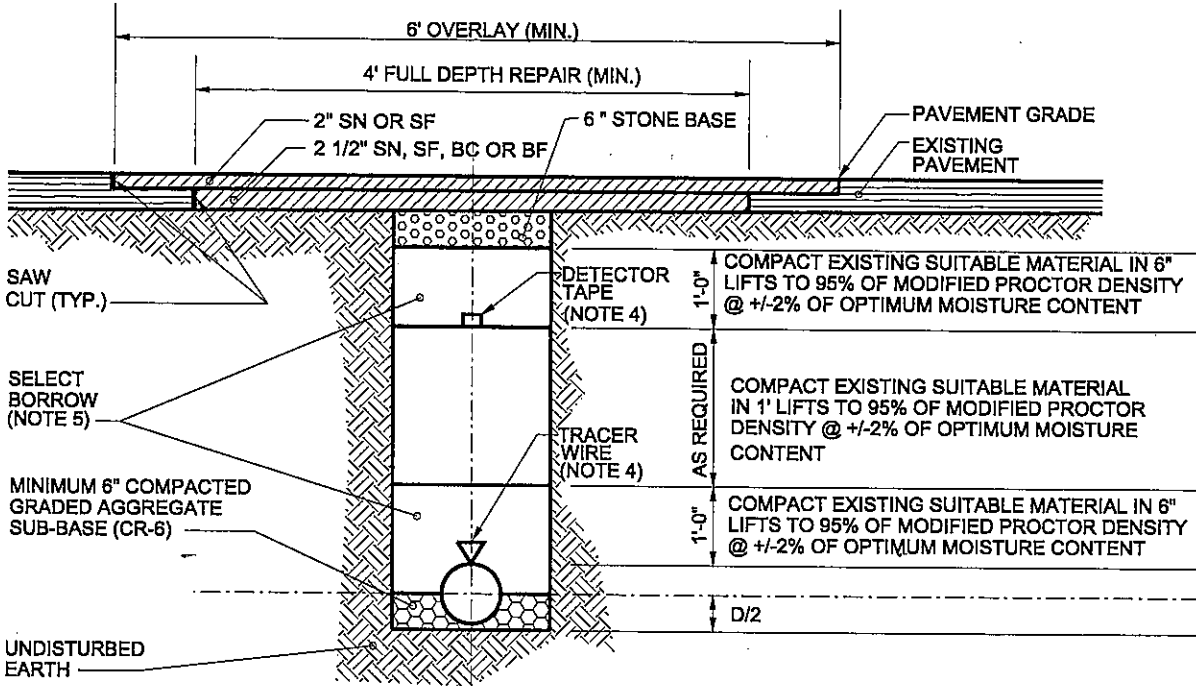
- S-1 Standard 48" ID precast manhole
- S-2 Inside drop connection
- S-3 Outside drop connection manhole
- S-4 Manhole construction over an existing sewer line (doghouse manhole)
- S-5 Standard frame and cover
- S-6 House service connection at main
- S-7 Drop house service connection at main
- S-8 Clean-out with frame and cover
- S-9 Sewage combination air valve in manhole
- S-10 Typical simplex grinder pump installation
- S-11 Low Pressure sewer service connection
- S-12 Low Pressure sewer terminal flushing connection
- S-13 Low Pressure sewer in-line flushing connection
- S-14 Typical grinder pump electrical service



NOTES:

- 1) MAXIMUM TRENCH WIDTH O.D. +12", NOT TO EXCEED MAXIMUM TRENCH WIDTH WITHOUT WRITTEN PERMISSION OF THE ENGINEER.
- 2) COMPACTION IN ROADWAY AREAS SHALL BE TO 95% MODIFIED PROCTOR DENSITY. AT +/- 2% OF OPTIMUM MOISTURE CONTENT.
- 3) COMPACTION IN NON-ROADWAY AREAS SHALL BE TO 90% OF MODIFIED PROCTOR DENSITY. AT +/- 3% OF OPTIMUM MOISTURE CONTENT.

<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>PIPE TRENCH / BEDDING</p>	<p>DETAIL No. G-1 Date NOV. 7, 2017</p>
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NOTES:

- 1) PAVEMENT REPAIR SHALL BE PERFORMED TO THE SATISFACTION OF WORCESTER COUNTY AND THE ENGINEER.
- 2) CONTRACTOR SHALL MEET ON-SITE WITH WORCESTER COUNTY DEPARTMENT OF PUBLIC WORKS, ROADS DIVISION AND THE ENGINEER PRIOR TO PERFORMING ANY WORK ON COUNTY ROADS.
- 3) ALL BACKFILL AND COMPACTION SHALL BE PERFORMED ONLY IN THE PRESENCE OF THE ENGINEER OR A REPRESENTATIVE OF THE WORCESTER COUNTY DEPARTMENT OF PUBLIC WORKS, ROADS DIVISION.
- 4) DETECTOR TAPE WILL BE PROVIDED FOR WATER, LP SEWER AND GRAVITY SEWER PIPE. TRACER WIRE WILL BE PROVIDED FOR WATER AND LP SEWER.
- 5) SELECT BORROW REQUIRED FOR ROAD LOCATIONS, AASHTO A3 OR BETTER.

Worcester County
Department of Public Works
Water & Wastewater Division

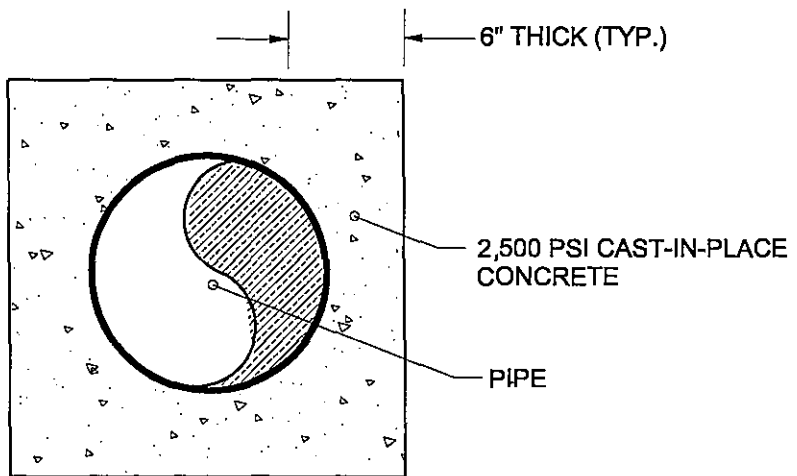


TRENCH PAVEMENT
REPAIR DETAIL

DETAIL No.

G-2

Date
NOV. 7, 2017

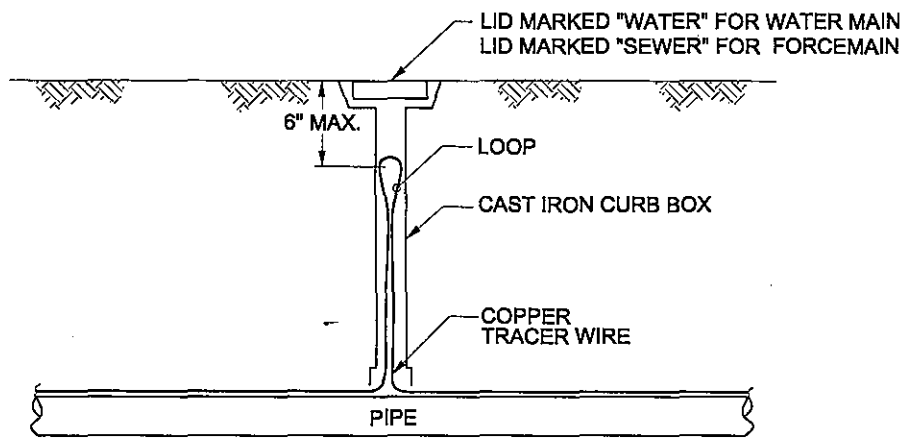


Worcester County
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 Water & Wastewater Division



**CONCRETE ENCASEMENT
 DETAIL**

DETAIL No.
G-3
 Date
 NOV. 7, 2017



Worcester County
 Department of Public Works
 Water & Wastewater Division

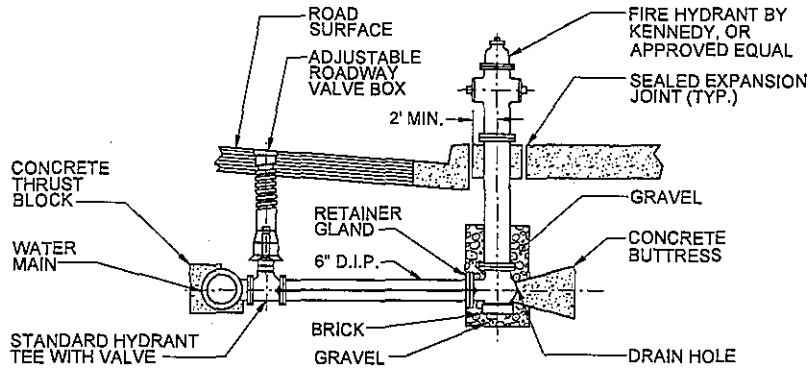


CONTINUITY TEST STATION

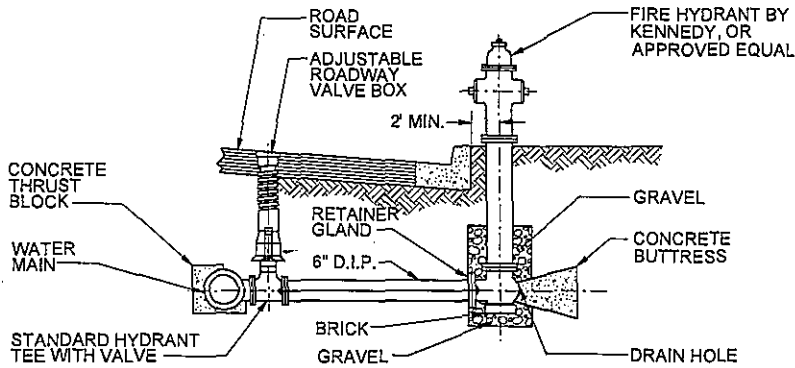
DETAIL No.

W-1

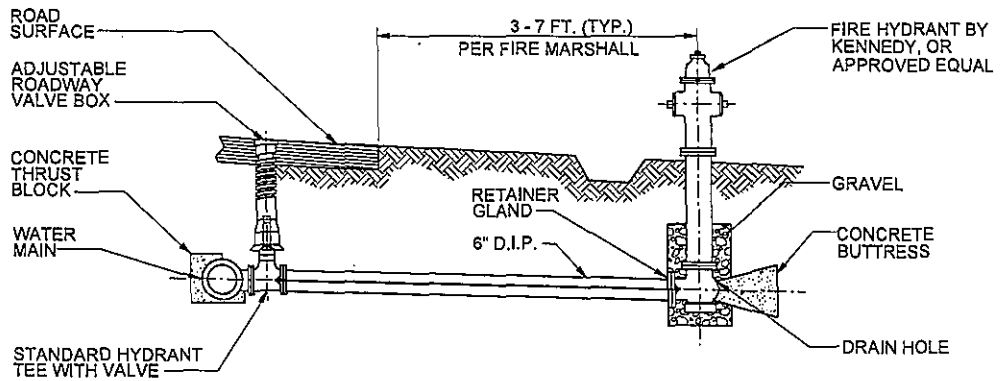
Date
 NOV. 7, 2017



INSTALLATION IN STREET WITH CURB & GUTTER AND SIDEWALK



INSTALLATION IN STREET WITH CURB AND GUTTER ONLY



INSTALLATION IN OPEN ROAD SECTION

Worcester County
Department of Public Works
Water & Wastewater Division

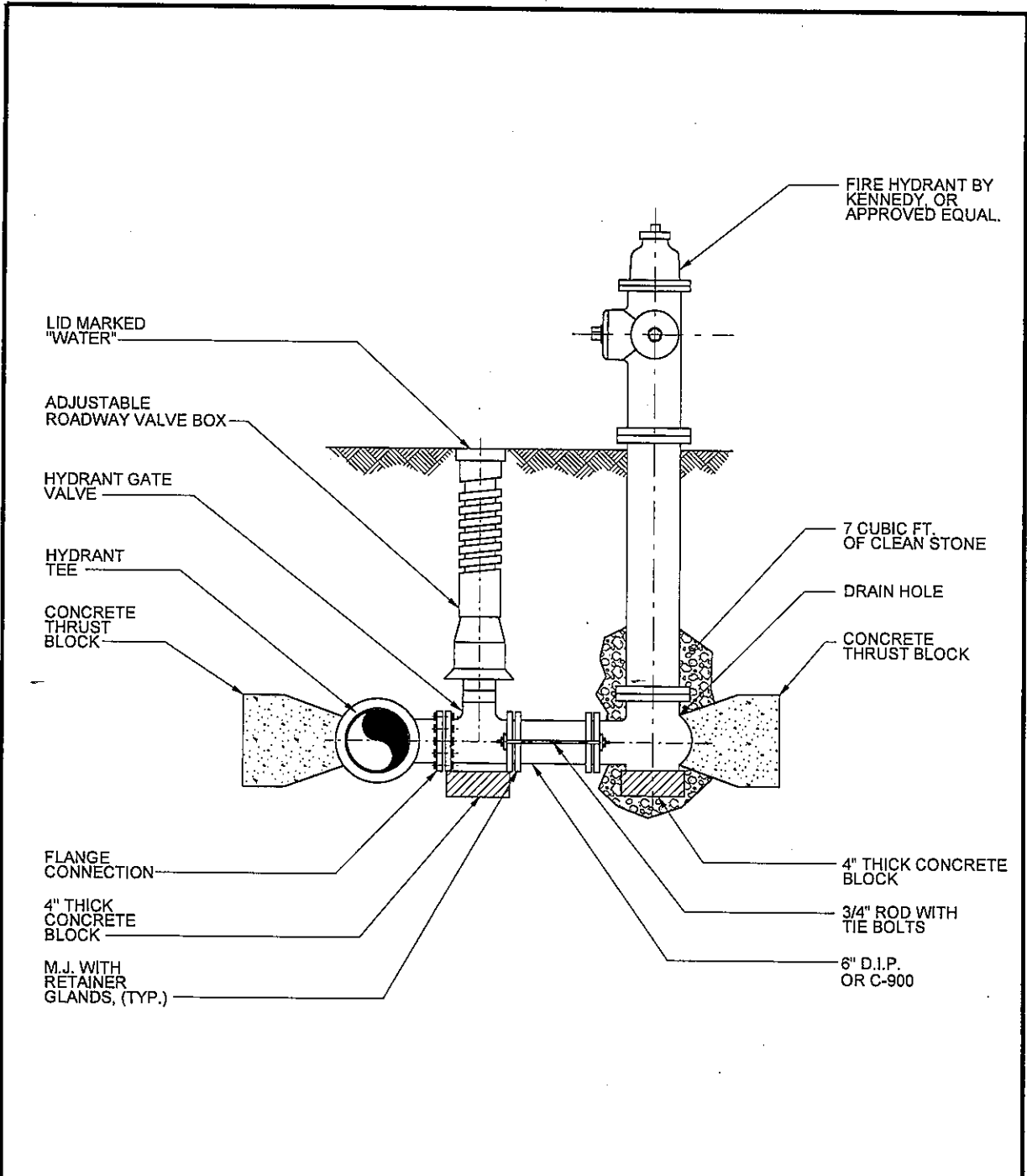


TYPICAL FIRE HYDRANT
SETTINGS

DETAIL No.

W-2

Date
NOV. 7, 2017



NOTES:



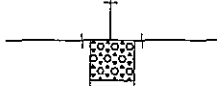
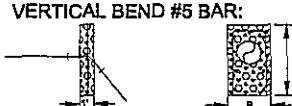
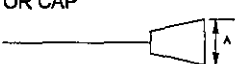
- 1) SEE DETAIL W-2 FOR SETTING DISTANCES.
- 2) SEE DETAIL W-3 FOR THRUST BLOCKS.

Worcester County
 Department of Public Works
 Water & Wastewater Division

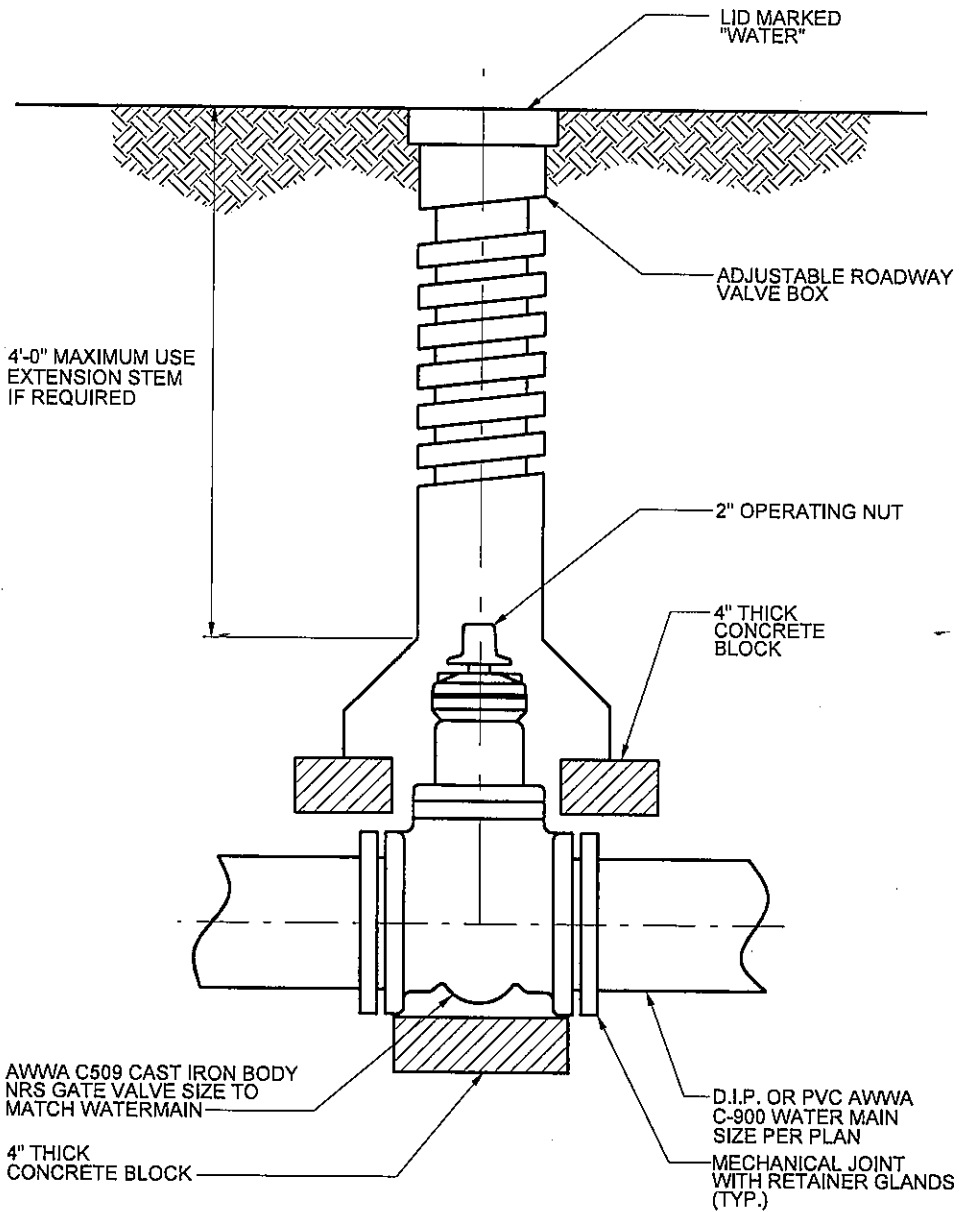


**STRAPPING FIRE HYDRANT
 AND VALVE TO MAIN**

DETAIL No.
W-3
Date
NOV. 7, 2017

DIAMETER (d) OF PIPE		6" OR LESS	8"	12" OR GREATER
HOR. ANGLE: \triangle FROM 10° TO 45° 	A:	0.75 FT	1.0 FT	1.5 FT
HOR. ANGLE: \triangle FROM 46° TO 90° 	A:	1.0 FT	1.5 FT	2.0 FT
TEE CONNECTION: 	A:	1.5 FT	1.75 FT	2.5 FT
VERTICAL BEND #5 BAR: 	A: B:	2.0 FT 1.5 FT	3.0 FT 2.0 FT	4.0 FT 3.0 FT
PLUG OR CAP 	A:	1.25 FT	1.5 FT	2.5 FT

- 1) ALL HORIZONTAL BENDS SHALL HAVE CONCRETE THRUST BLOCKS WITH MINIMUM BEARING AREAS AGAINST UNDISTURBED SOIL, AS SHOWN IN THIS DRAWING.
- 2) BEARING AREAS ARE BASED UPON UNDISTURBED SOIL WITH A MINIMUM BEARING CAPACITY OF 0.5 TONS PER SQUARE FOOT. FOR LESSER SOIL CAPACITY, THESE AREAS SHALL BE INCREASED ACCORDINGLY.
- 3) THRUST BLOCKS SHALL BE POURED DIRECTLY AGAINST TRENCH WALLS.
- 4) NO JOINT SHALL BE COVERED WITH CONCRETE.
- 5) CONCRETE SHALL BE OF A MINIMUM OF 2500 P.S.I. STRENGTH.



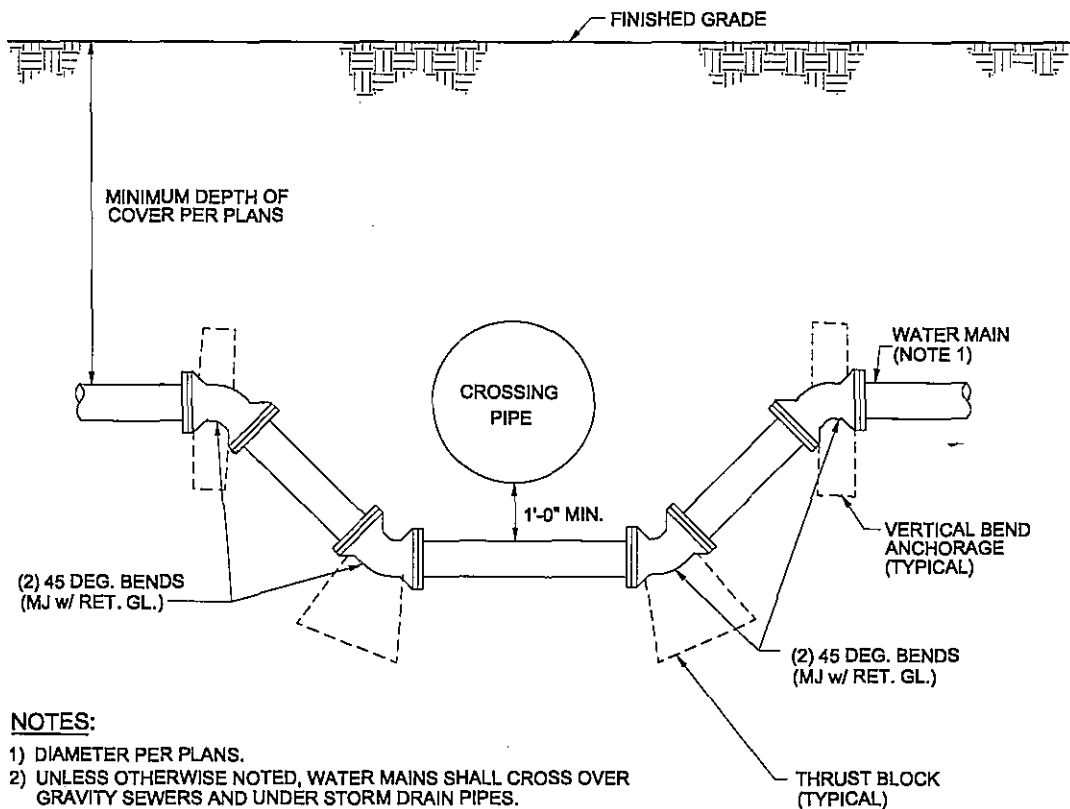
Worcester County
 Department of Public Works
 Water & Wastewater Division



GATE VALVE AND
 VALVE BOX DETAIL

DETAIL No.
W-5

Date
 NOV. 7, 2017



Worcester County
 Department of Public Works
 Water & Wastewater Division

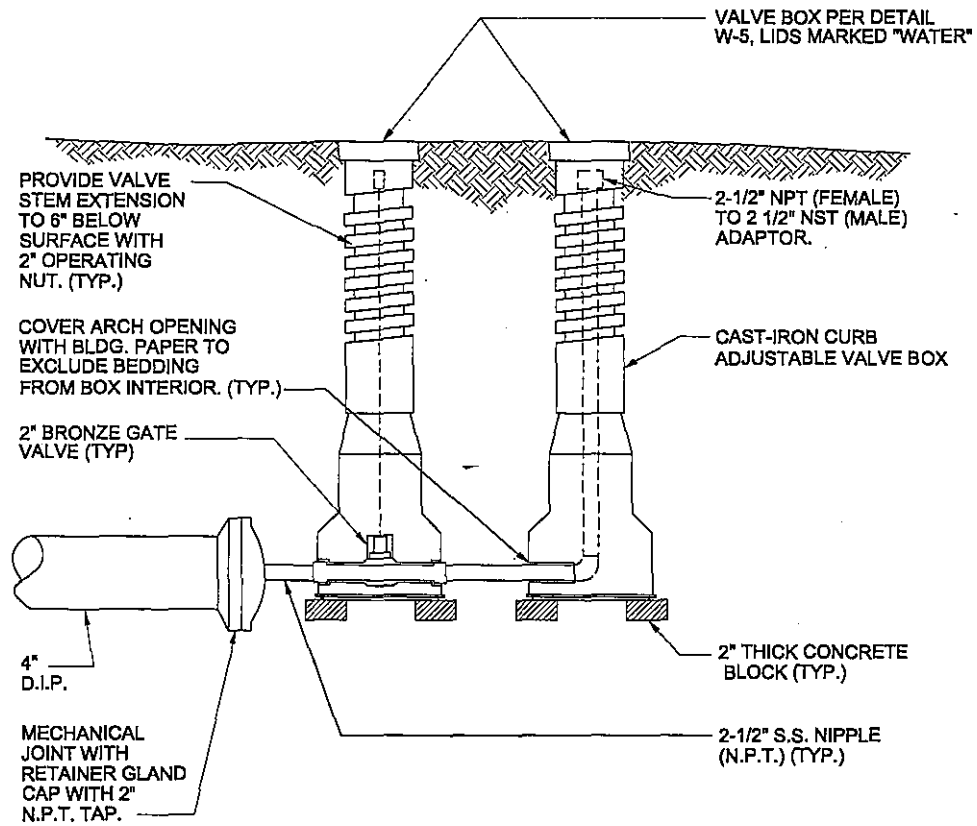


PIPE CROSSING DETAIL

DETAIL No.

W-6

Date
 NOV. 7, 2017



Worcester County
 Department of Public Works
 Water & Wastewater Division

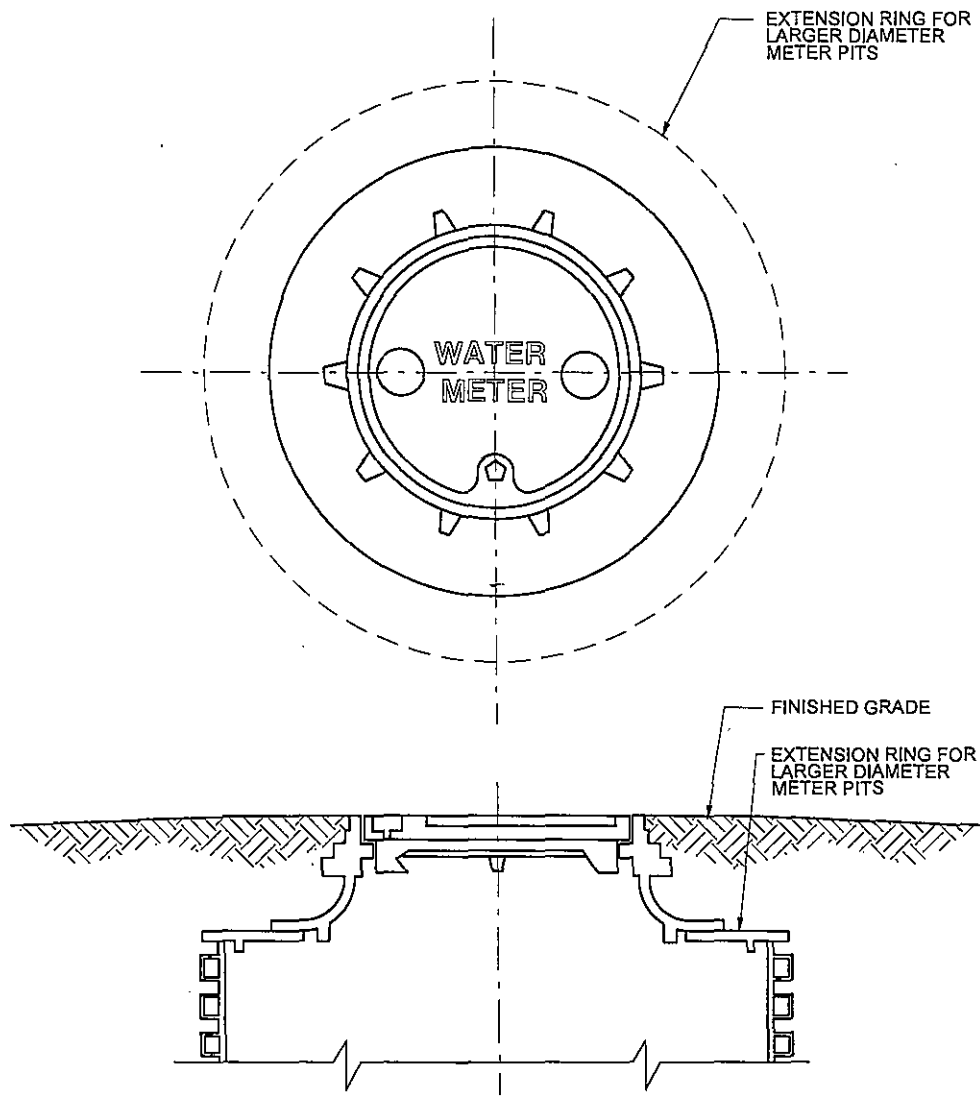


CAP AND BLOW-OFF
 4" MAINS AND LARGER

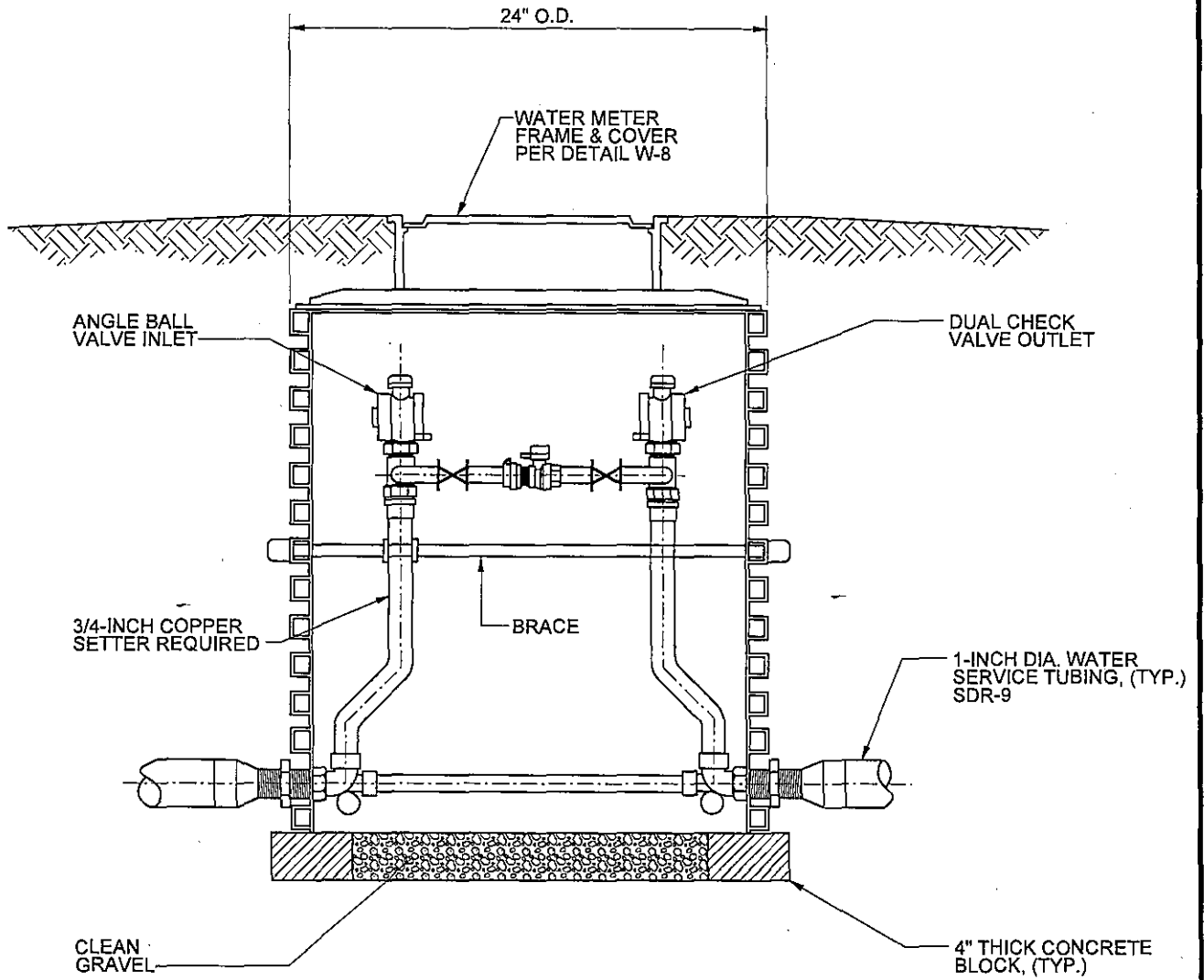
DETAIL No.

W-7

Date
 NOV. 7, 2017



<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>STANDARD WATER METER FRAME AND COVER</p>	<p>DETAIL No. W-8 Date NOV. 7, 2017</p>
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NOTES:

- 1) FOR 3/4 INCH WATER METER. WATER METER TO BE SPECIFIED BY ENGINEER AND APPROVED BY COUNTY.

Worcester County
 Department of Public Works
 Water & Wastewater Division

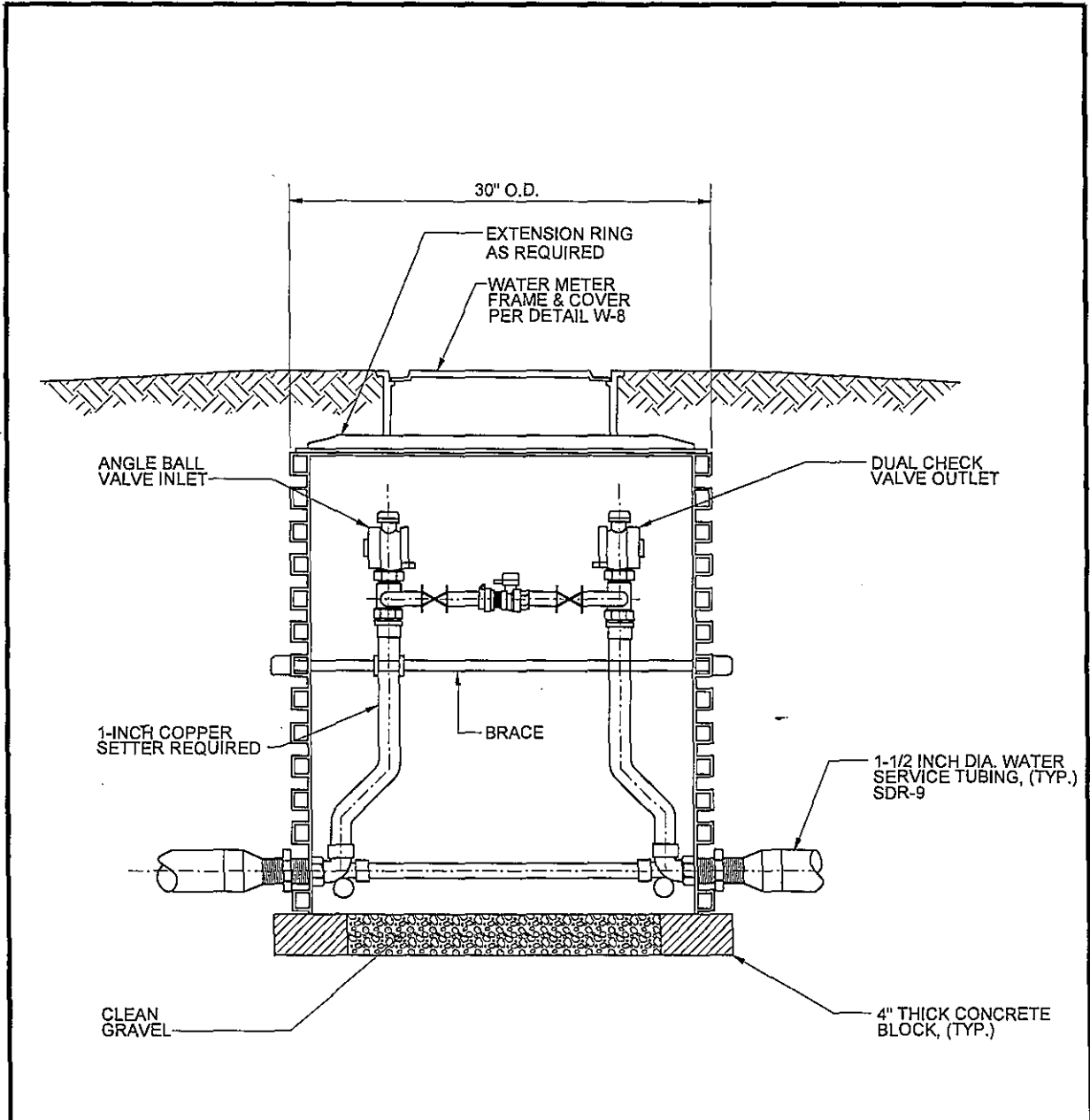


STANDARD 1-INCH SERVICE
 WITH 3/4-INCH METER

DETAIL No.

W-9

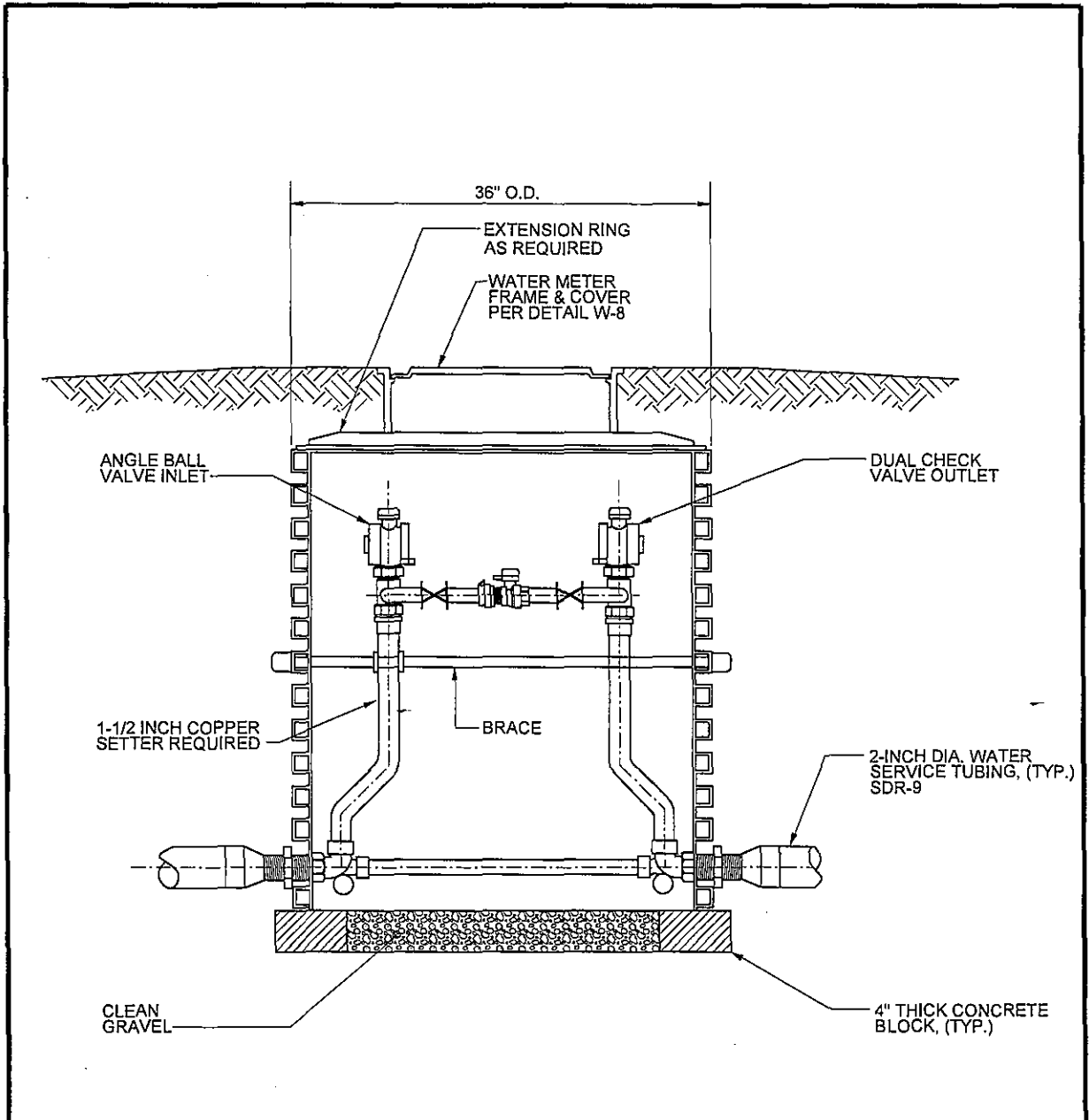
Date
 NOV. 7, 2017



NOTES:

- 1) FOR 1- INCH WATER METER. WATER METER TO BE SPECIFIED BY ENGINEER AND APPROVED BY COUNTY.

<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>STANDARD 1-1/2 INCH SERVICE WITH 1-INCH METER</p>	<p>DETAIL No. W-10</p>
			<p>Date NOV. 7, 2017</p>



NOTES:

- 1) FOR 1-1/2 INCH WATER METER. WATER METER TO BE SPECIFIED BY ENGINEER AND APPROVED BY COUNTY.

Worcester County
 Department of Public Works
 Water & Wastewater Division

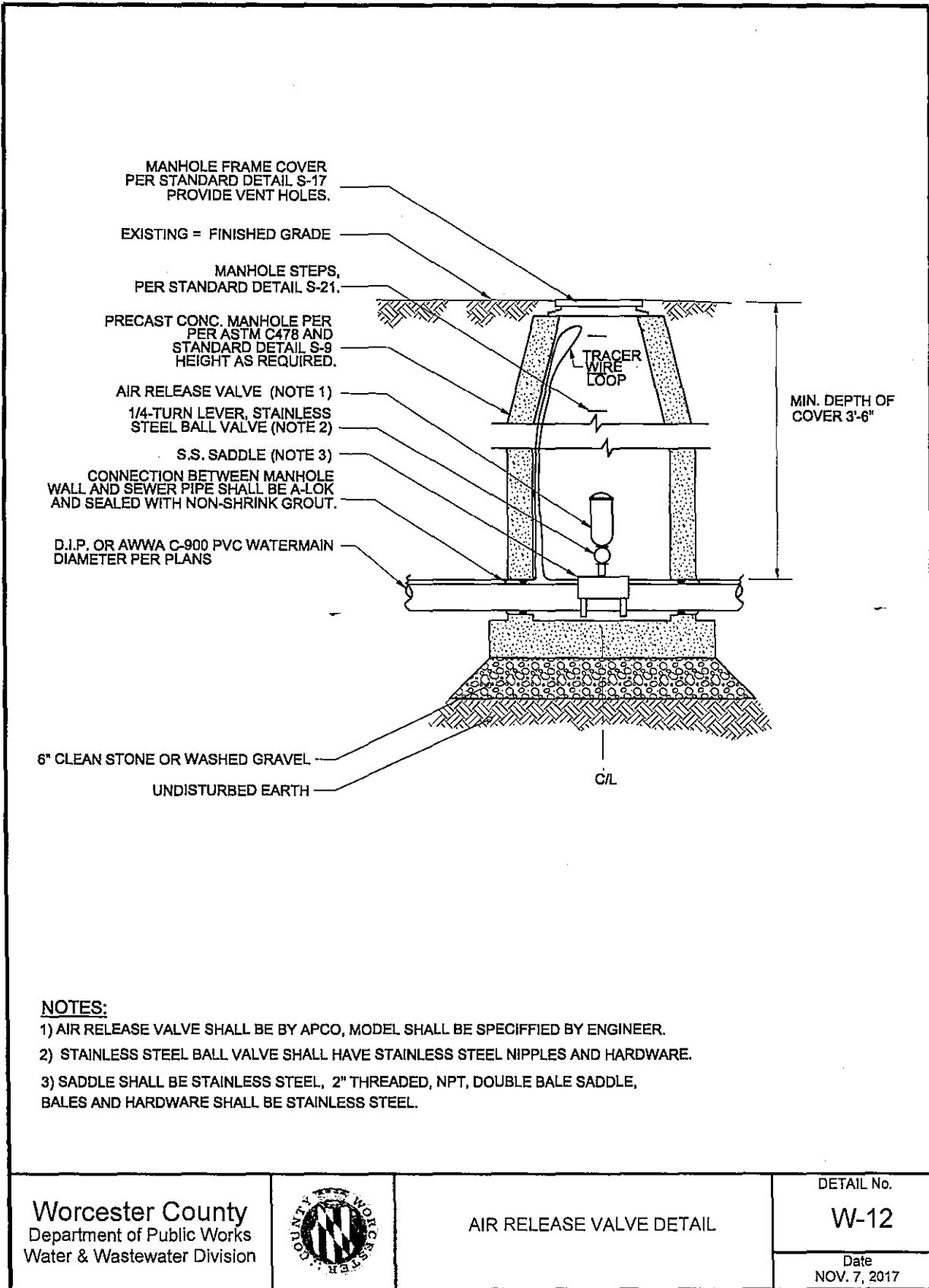


STANDARD 2-INCH SERVICE
 WITH 1-1/2 INCH METER

DETAIL No.

W-11

Date
 NOV. 7, 2017



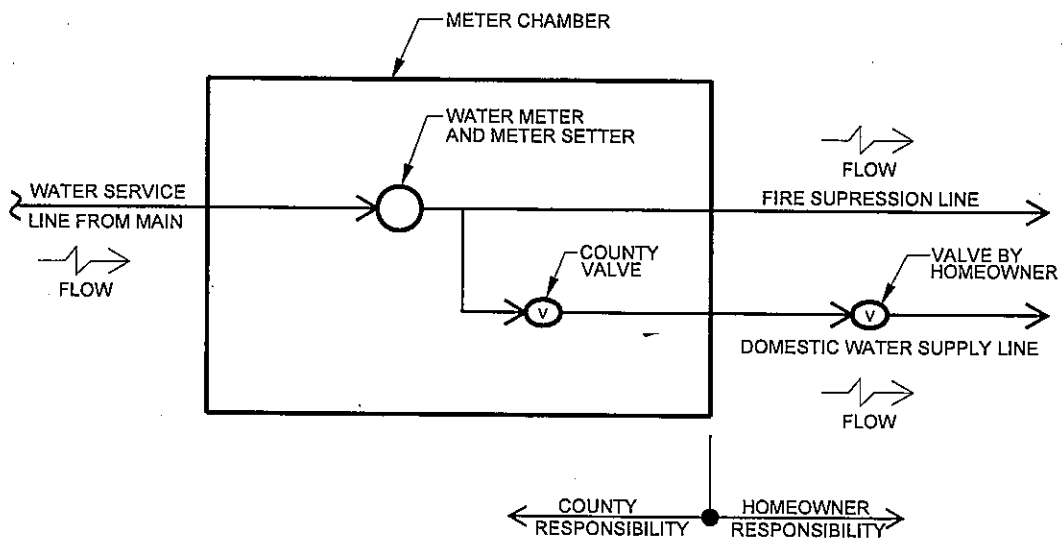
Worcester County
Department of Public Works
Water & Wastewater Division



AIR RELEASE VALVE DETAIL

DETAIL No.
W-12

Date
NOV. 7, 2017



INSTALLATION NOTES:

FIRE SERVICE LINES TO BE SIZED BY FIRE SUPPRESSION CONSULTANT.
 METER SETTER ASSEMBLY PER DETAILS W-8, W-9, W-10 AND W-11.

Worcester County
 Department of Public Works
 Water & Wastewater Division

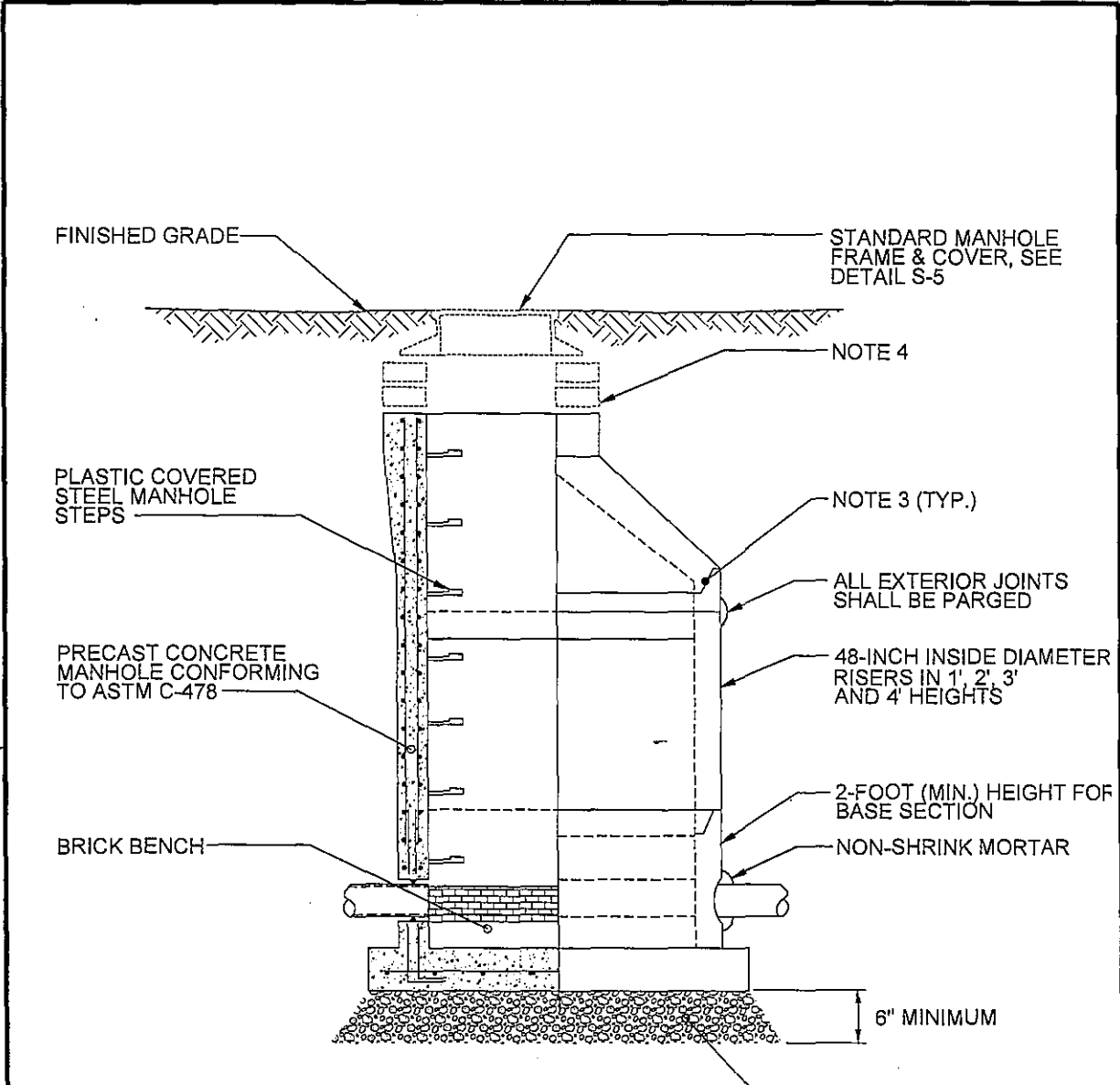


TYPICAL COMBINED
 DOMESTIC - FIRE SUPPLY
 SERVICE SCHEMATIC

DETAIL No.

W-13

Date
 NOV. 7, 2017



NOTES:

- 1) CONCRETE 4,500 P.S.I. AT 28 DAYS MINIMUM.
- 2) MANHOLE SHALL CONFORM TO ASTM C-478.
- 3) "O-RING" JOINTS MEET ASTM C-443.
- 4) MINIMUM TWO BRICK AND MORTAR COURSES OR GRADE ADJUSTMENT RINGS AS REQUIRED 2", 3", 4" & 6", PERMITTED.

<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>STANDARD 48" I.D. PRECAST MANHOLE</p>	<p>DETAIL No. S-1 Date NOV. 7, 2017</p>
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INFLUENT PIPE MAX. 15" DIA.
MAX. PIPE SLOPE OF 5%

2" OR PER
STANDARDS

"RECLINER" (OR EQUAL) INSIDE
DROP BOWL SECURED WITH
STAINLESS STEEL FASTENERS

"A-LOK" GASKET

SDR-35 PVC DROP PIPE SECTIONS
REMOVABLE / INSTALLED LOOSE
TO ALLOW FOR ROTATION

PRECAST MANHOLE
PER DETAIL S-1

INTERMEDIATE JOINT (NO GASKET)
PLACED 2' TO 4' DOWN FROM
INFLUENT PIPE, BELL SECTION
FACING UP.

STAINLESS STEEL STRAP
(1" WIDE MIN.) AND STAINLESS
STEEL ANCHOR BOLTS
TWO (2) MINIMUM REQUIRED

ALL DROPS REQUIRE A 90°
SWEEP FITTING AT THE BOTTOM
OF THE DROP TO AID FLOW

SOFFIT TO MATCH
WHERE POSSIBLE

BRICK FILL TO 0.8 DIA.
1" CLEARANCE BETWEEN
PVC PIPE AND BRICK
MODIFY BRICK BENCH
IF REQUIRED

2" MIN.

NOTES:

- 1) CONCRETE 4,500 P.S.I. AT 28 DAYS MINIMUM.
- 2) MANHOLE SHALL CONFORM TO ASTM C-478.
- 3) "O-RING" JOINTS MEET ASTM C-443.
- 4) MINIMUM TWO BRICK AND MORTAR COUNTS OR GRADE ADJUSTMENT RINGS AS REQUIRED 2", 3", 4" & 6" PERMITTED.
- 5) 48" DIAMETER MANHOLE MAY BE USED WITH ONE (1) 8" INSIDE DROP.
- 6) 72" DIAMETER MANHOLE REQUIRED WHEN TWO (2) OR MORE INSIDE DROPS.
- 7) DROP PIPE DIAMETER SAME AS INCOMING PIPE DIAMETER, (UP TO 8" DIA.),

Worcester County
Department of Public Works
Water & Wastewater Division

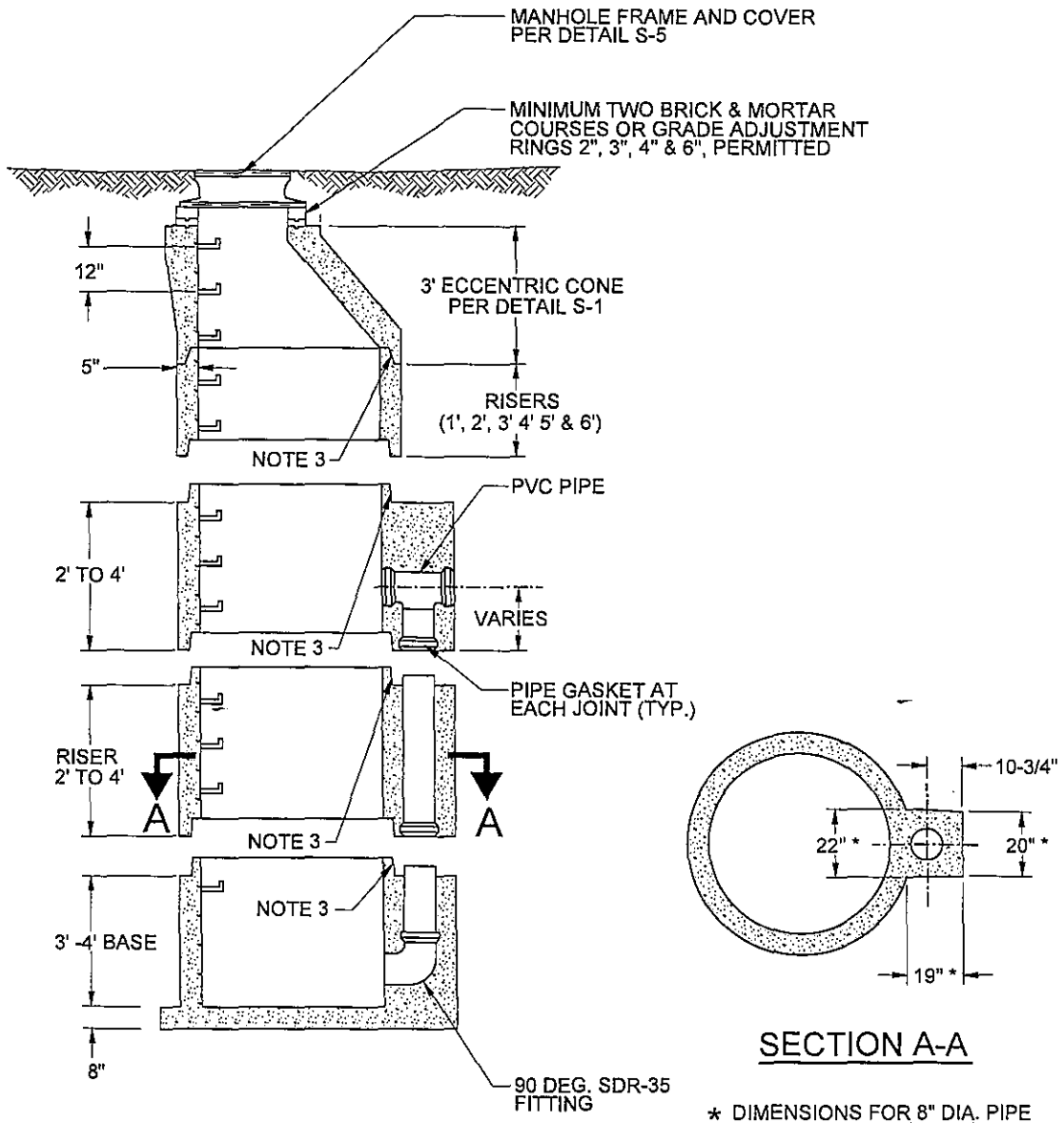


INSIDE DROP CONNECTION

DETAIL No.

S-2

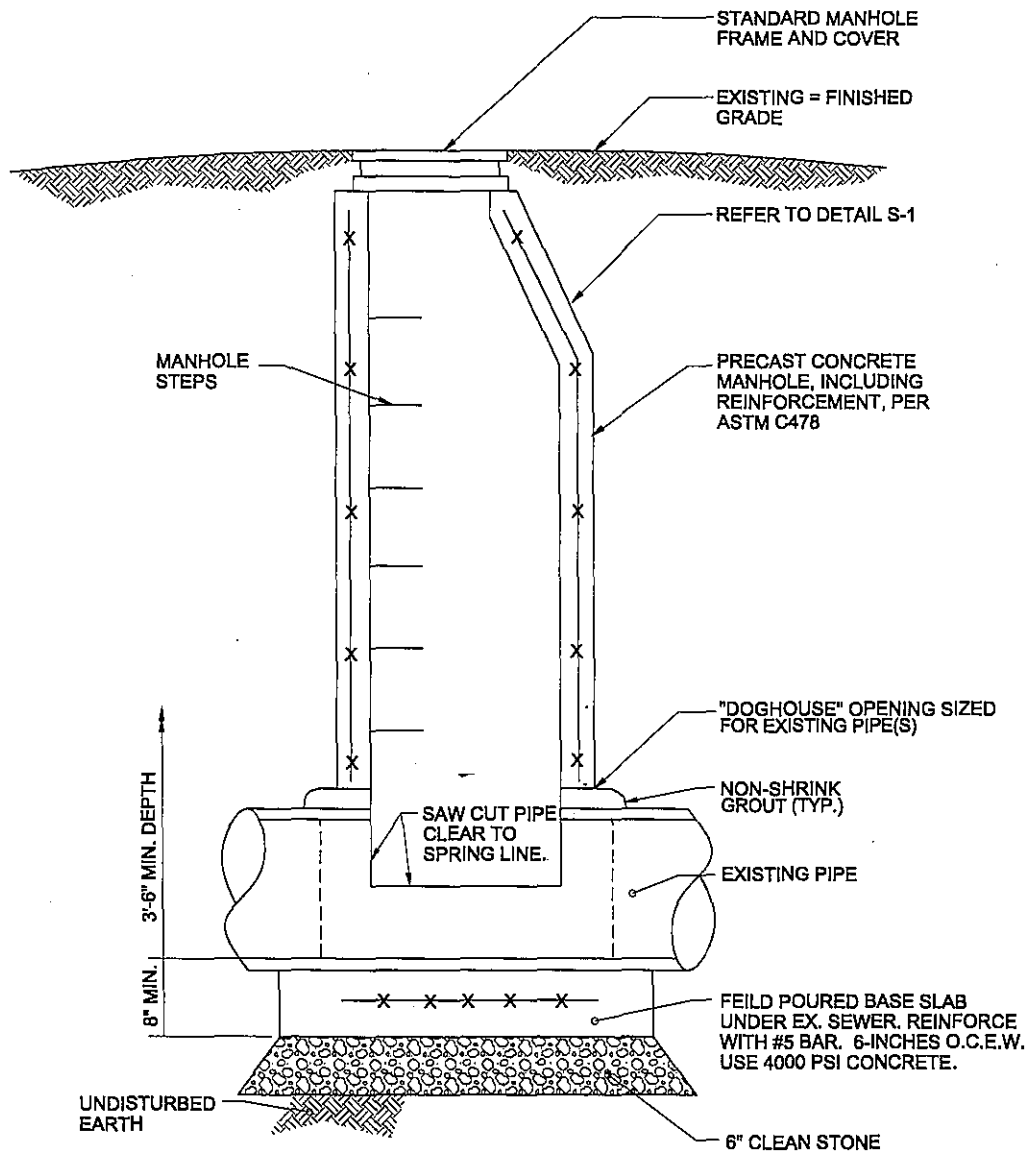
Date
NOV. 7, 2017



NOTES:


- 1) CONCRETE 4,500 P.S.I. AT 28 DAYS MINIMUM.
- 2) MANHOLE SHALL CONFORM TO ASTM C-478.
- 3) "O-RING" JOINTS MEET ASTM C-443.
- 4) SEE DETAIL S-1 FOR ALL MANHOLE DETAILS OTHER THAN THE PRECAST DROP MANHOLE.

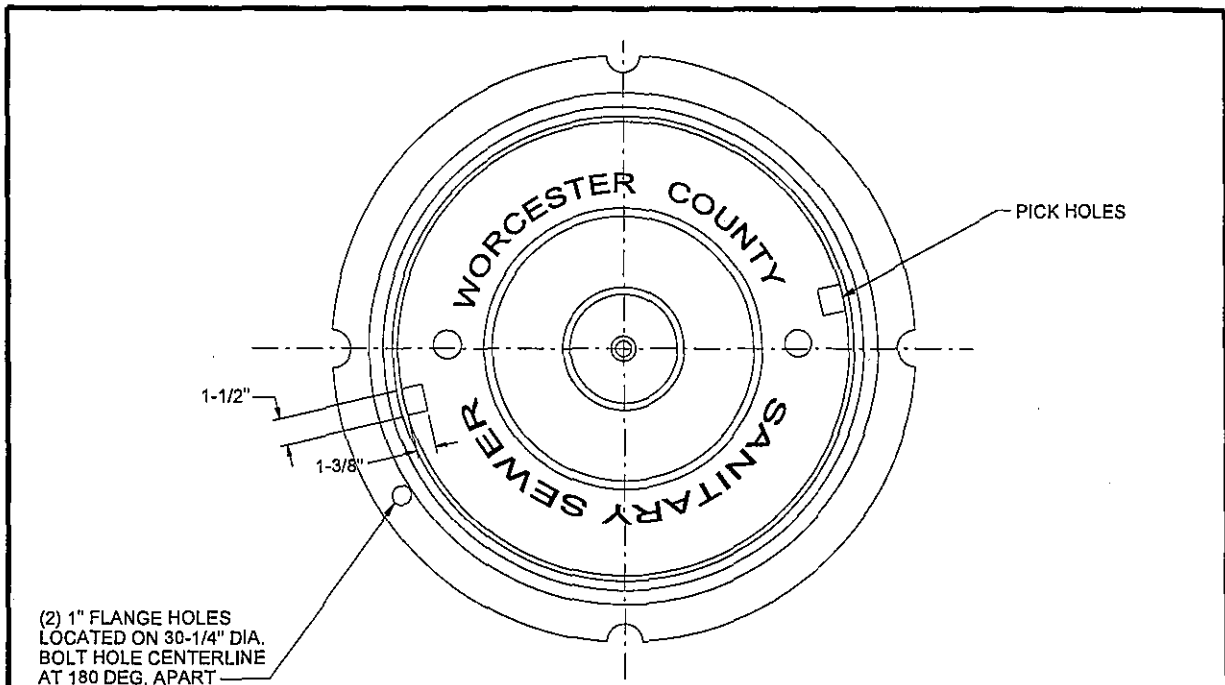
<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>OUTSIDE DROP CONNECTION MANHOLE</p>	<p>DETAIL No. S-3</p>
			<p>Date NOV. 7, 2017</p>



NOTES :

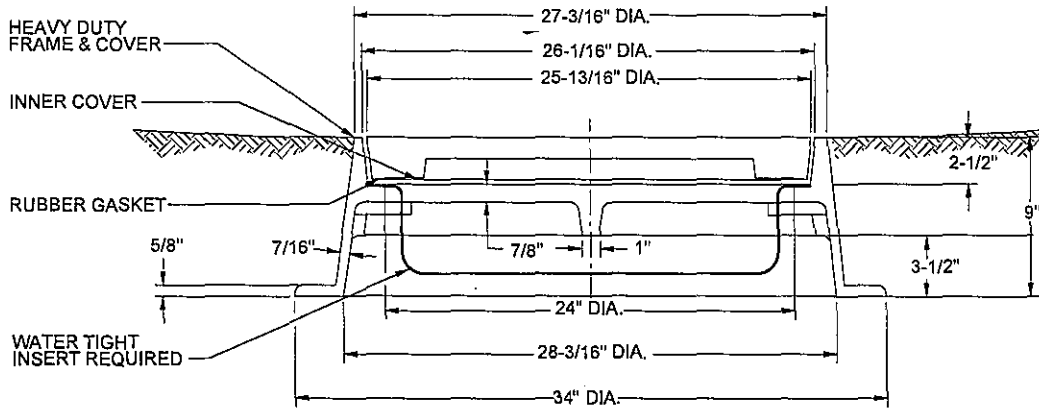
- 1) CONCRETE 4,500 P.S.I. AT 28 DAYS MINIMUM.
- 2) MANHOLE SHALL CONFORM TO ASTM C-478.
- 3) "O" RING JOINTS MEET ASTM C-443.
- 4) MINIMUM TWO BRICK AND MORTAR COURSES OR GRADE ADJUSTMENT RINGS AS REQUIRED
2", 3", 4" & 6" PERMITTED.
- 5) TYPE AND DIRECTION OF OUTLET PIPE(S) SHALL VARY TO SUIT EACH CASE.
- 6) INVERT(S) SHALL BE ALTERED ACCORDINGLY.

<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>MANHOLE CONSTRUCTION OVER AN EXISTING SEWER LINE (DOGHOUSE MANHOLE)</p>	<p>DETAIL No. S-4 Date NOV. 7, 2017</p>
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(2) 1" FLANGE HOLES
 LOCATED ON 30-1/4" DIA.
 BOLT HOLE CENTERLINE
 AT 180 DEG. APART

HEAVY FRAMES AND COVERS




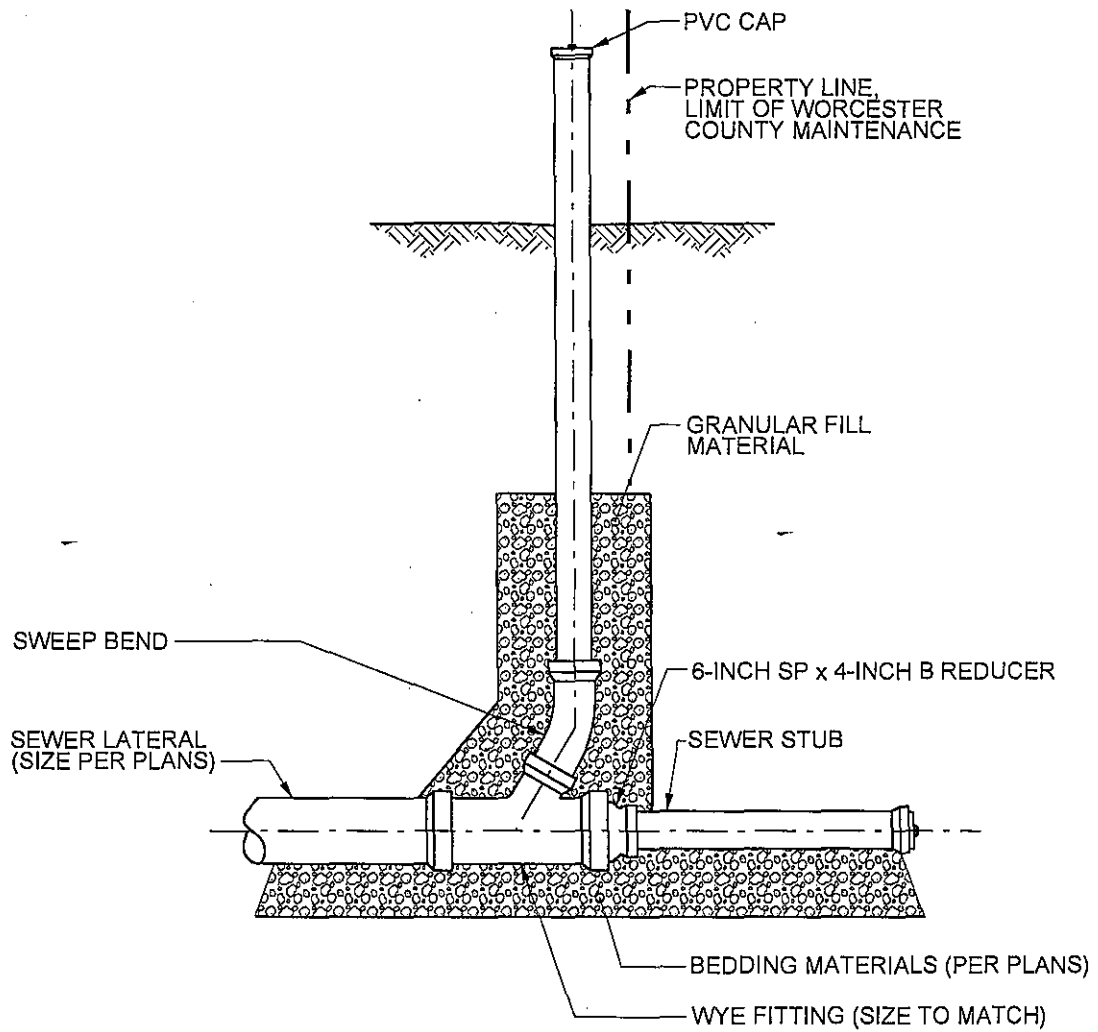
SECTION

FRAME & COVER - CAST IRON ASTM A-48, CLASS 30 AND DESIGN FOR H-20 LOADING

NOTES:


- 1) WHEN FRAME & COVER ARE USED FOR WATER VAULTS OR RELATED STRUCTURES, REPLACE "SANITARY SEWER" WITH "WATER".
- 2) STANDARD STRAIGHT WALL FRAME & COVER DOES NOT INCLUDE CAMS, BOLTS, BOLT HOLES AND RUBBER GASKET. WATERTIGHT STRAIGHT WALL FRAME & COVER INCLUDES CAMS, BOLTS, BOLT HOLES AND RUBBER GASKET.
- 3) DETAIL S-5 ACCEPTABLE EXCEPT WHEN SPECIFIC CONTRACT DOCUMENTS DICTATE OTHERWISE.

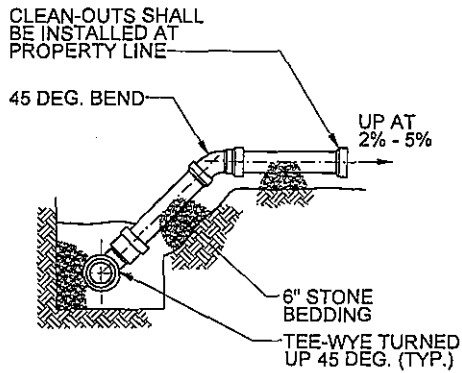
<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>STANDARD FRAME AND COVER</p>	<p>DETAIL No. S-5</p>
			<p>Date NOV. 7, 2017</p>



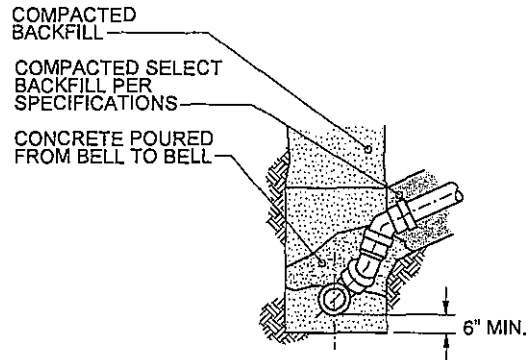
NOTES:

- 1) A 2-INCH x 6-INCH PLANK SHALL BE PLACED AT INVERT END OF SERVICE AND EXTEND 4 FEET ABOVE GRADE, PAINTED GREEN.

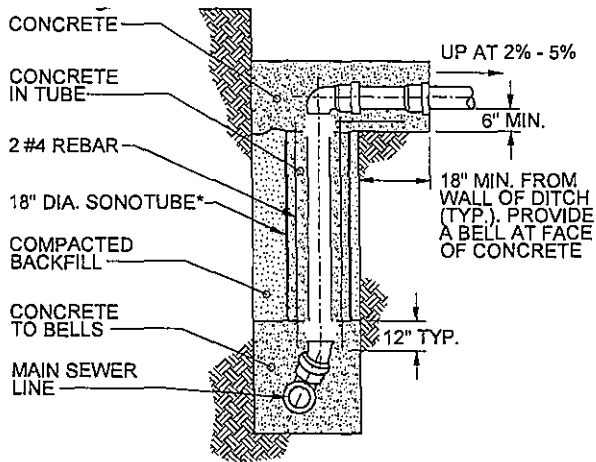
<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>HOUSE SERVICE CONNECTION AT MAIN</p>	<p>DETAIL No. S-6 Date NOV. 7, 2017</p>
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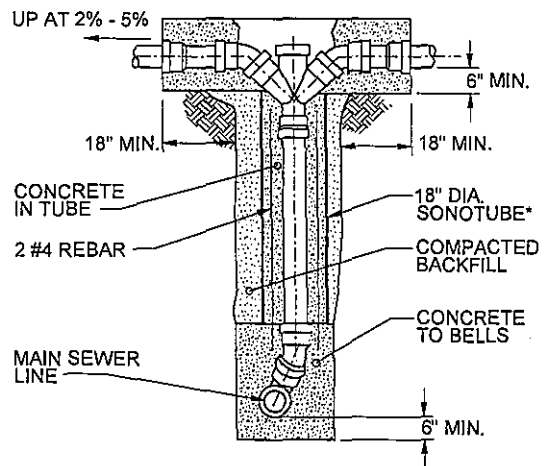
TYPE-A



TYPE-B



TYPE-C



TYPE-D

NOTES:

- 1) ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2,500 P.S.I.

Worcester County
Department of Public Works
Water & Wastewater Division



DROP HOUSE SERVICE
CONNECTION AT MAIN

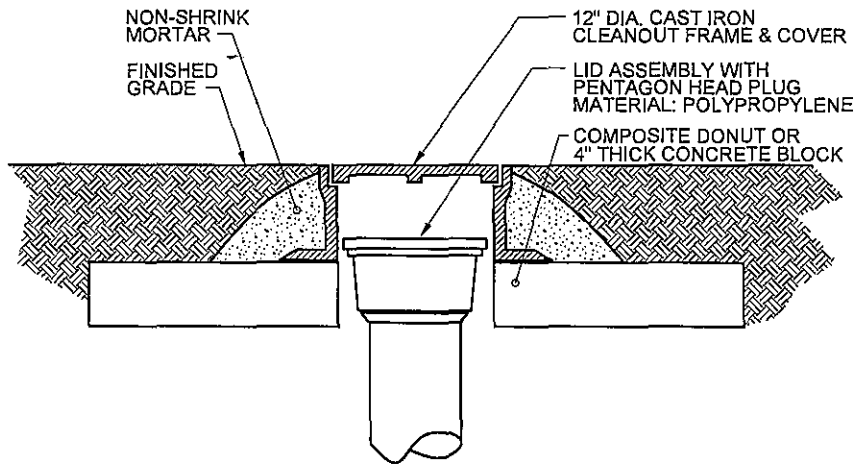
DETAIL No.

S-7

Date
NOV. 7, 2017



PLAN



SECTION

Worcester County
 Department of Public Works
 Water & Wastewater Division

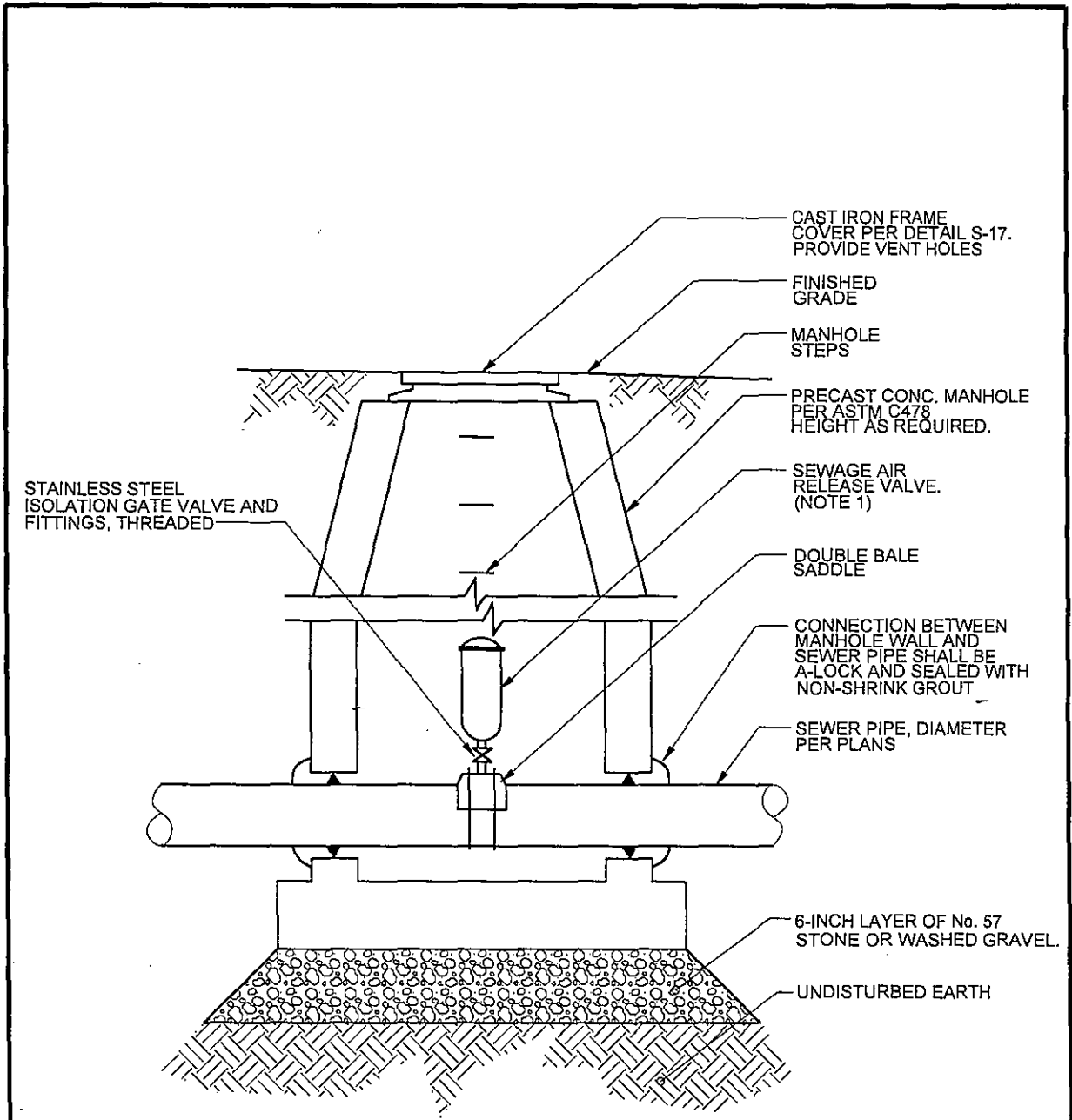


CLEAN-OUT WITH
 FRAME AND COVER

DETAIL No.


S-8

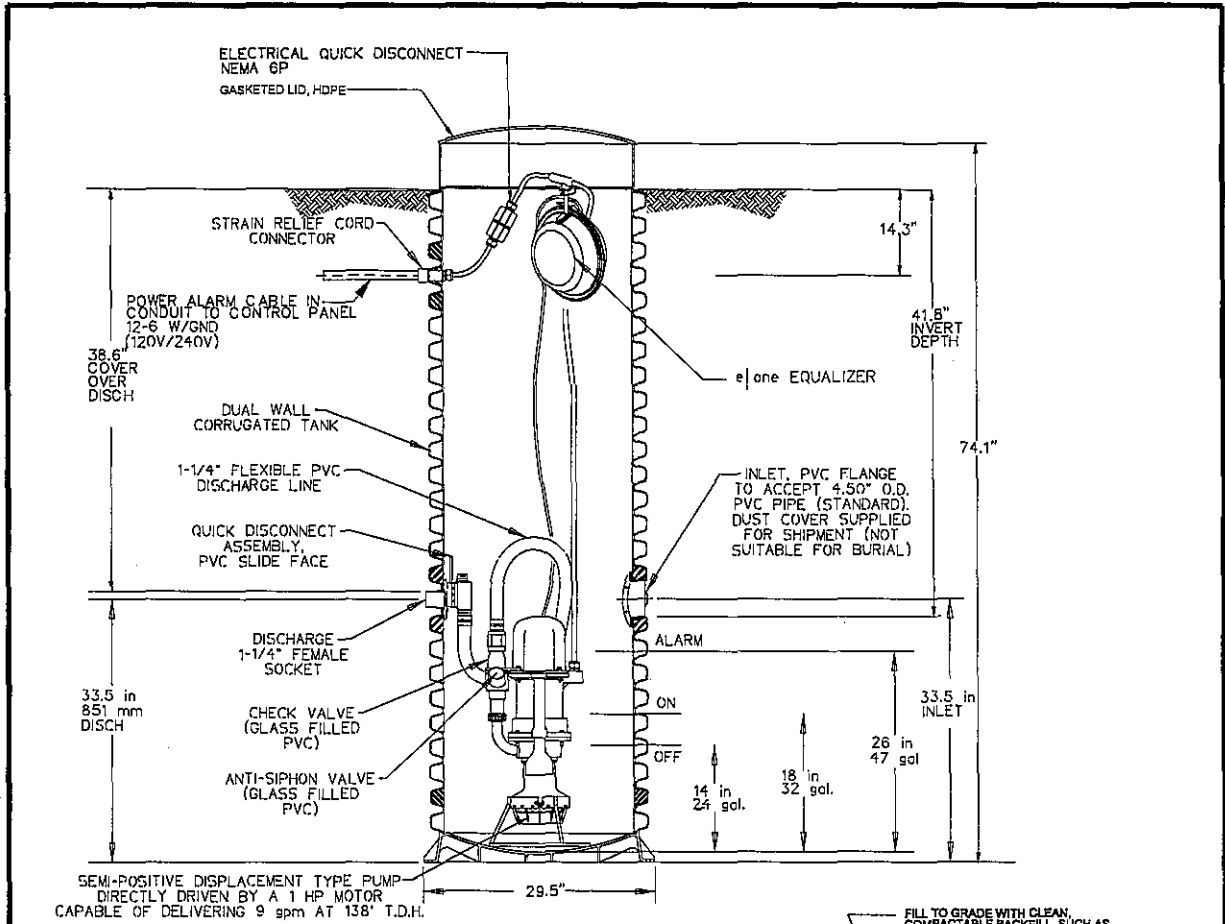
Date
 NOV. 7, 2017



NOTES:

- 1) AIR RELEASE VALVE SHALL BE APCO, MODEL SPECIFIED BY THE ENGINEER.
- 2) MANHOLE SHALL CONFORM TO ASTM C-478.
- 3) "O-RING" JOINTS MEET ASTM C-443.

<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>SEWAGE COMBINATION AIR VALVE IN MANHOLE</p>	<p>DETAIL No. S-9 Date NOV. 7, 2017</p>
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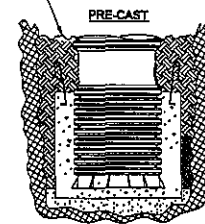
SEMI-POSITIVE DISPLACEMENT TYPE PUMP
DIRECTLY DRIVEN BY A 1 HP MOTOR
CAPABLE OF DELIVERING 9 gpm AT 138' T.D.H.

GRINDER PUMP NOTES

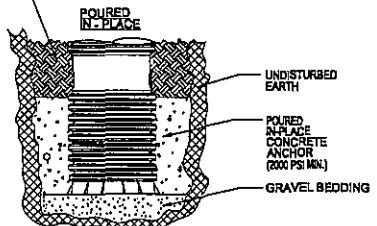
- 1) GRINDER PUMP UNITS SHALL BE A FACTORY MANUFACTURED SIMPLEX SEWAGE GRINDER PUMP STATION. GRINDER PUMP UNITS SHALL HAVE SINGLE, RETRIEVABLE, 1 HP GRINDER PUMP, CAPABLE OF PUMPING 9 GPM AT A HEAD PRESSURE OF 60 PSI. THE STATION CHAMBER SHALL BE PREMANUFACTURED FROM AN APPROVED POLYMER COMPOUND. THE STATION INLET SHALL BE 4" DIAMETER, NOMINAL, AND THE OUTLET SHALL BE 1-1/4" DIA., CAPABLE OF CONNECTING TO SCH 40 PVC. ALL ELECTRICAL EQUIPMENT SHALL BE UL LISTED AS AN ASSEMBLY. ALL EQUIPMENT SHALL BE CAPABLE OF OPERATING BURIED AND/OR SUBMERGED AND SHALL BE PROTECTED AGAINST FREEZING AND CONDENSATION. EACH PUMP UNIT SHALL BE CONTROLLED BY A SIMPLEX ALARM/DISCONNECT PANEL WITH ELECTRICAL REQUIREMENTS BEING 240 V, SINGLE PHASE, 60 HERTZ.
- 2) SIMPLEX ALARM/DISCONNECT PANELS SHALL BE MODEL 250 AS MANUFACTURED BY ENVIRONMENT ONE. UNITS SHALL BE NEMA 4X, UL LISTED AND SHALL BE FULLY COMPATIBLE WITH THE SELECTED GRINDER PUMP UNIT. PANELS SHALL HAVE BOTH AN AUDIO AND VISUAL ALARM WITH AN ALARM SILENCER. PANEL SHALL BE PAD-LOCKABLE. PANEL SHALL BE CAPABLE OF BEING MOUNTED ON THE EXISTING STRUCTURES.
- 3) POWER SUPPLY WIRING TO THE HOMEOWNERS POWER SUPPLY WILL BE PERFORMED BY THE HOMEOWNERS ELECTRICIAN.

NOTE: A CONCRETE ANCHOR OF 2000LBS (13.2CU. FT.) IS REQUIRED ON ALL MODEL 1010F 74" STATIONS.

FILL TO GRADE WITH CLEAN, COMPACTABLE BACKFILL, SUCH AS PEA GRAVEL OR CRUSHED STONE, 1/8" - 3/4" IN SIZE. CLAY AND SILTS ARE NOT ACCEPTABLE BACKFILL.



FILL TO GRADE WITH CLEAN, COMPACTABLE BACKFILL, SUCH AS PEA GRAVEL OR CRUSHED STONE, 1/8" - 3/4" IN SIZE. CLAY AND SILTS ARE NOT ACCEPTABLE BACKFILL.



Worcester County
Department of Public Works
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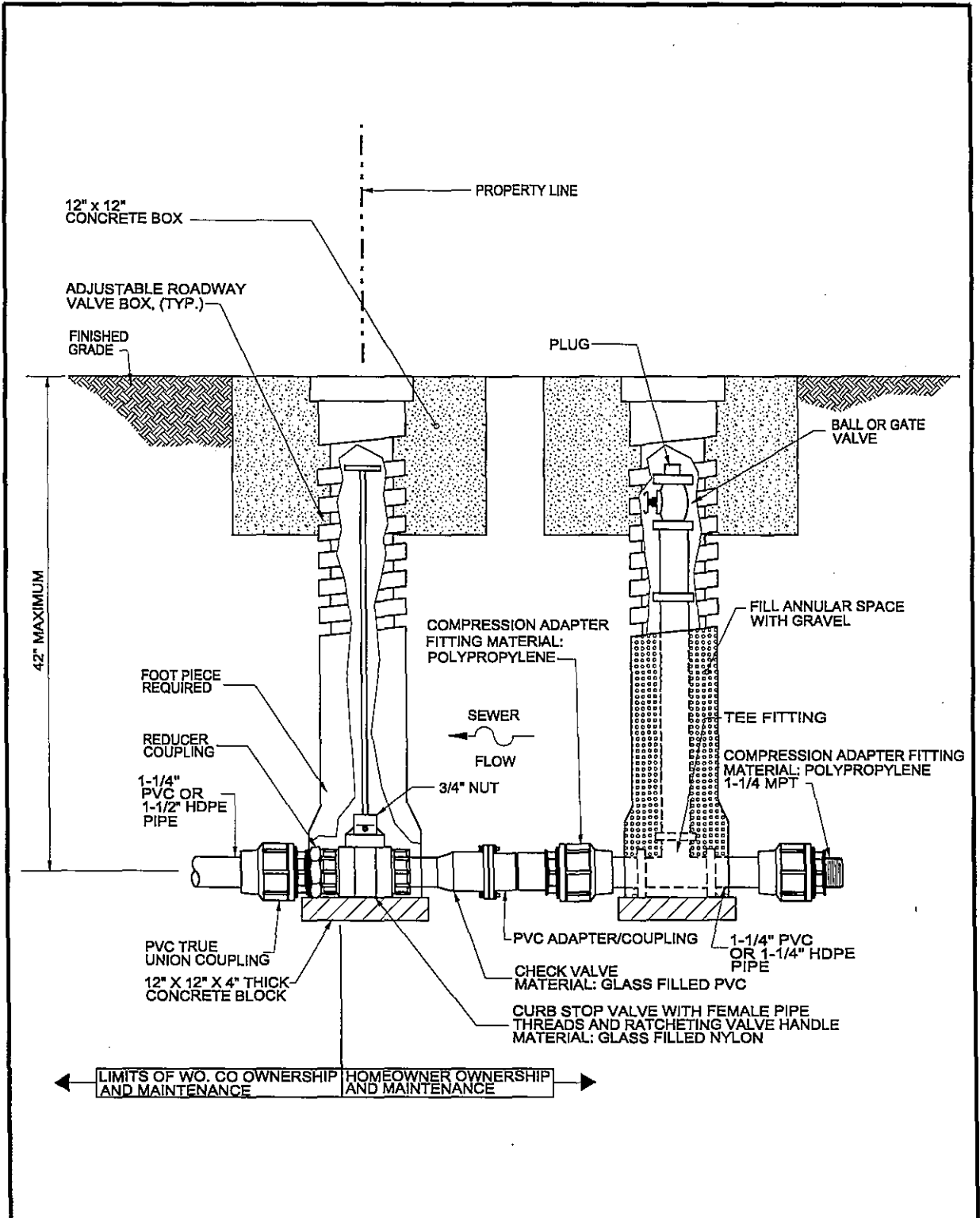


TYPICAL SIMPLEX
GRINDER PUMP
INSTALLATION

DETAIL No.

S-10

Date
NOV. 7, 2017

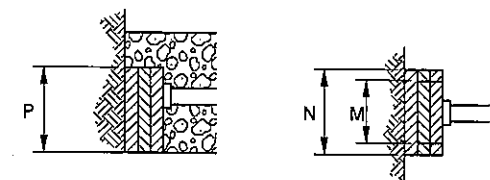
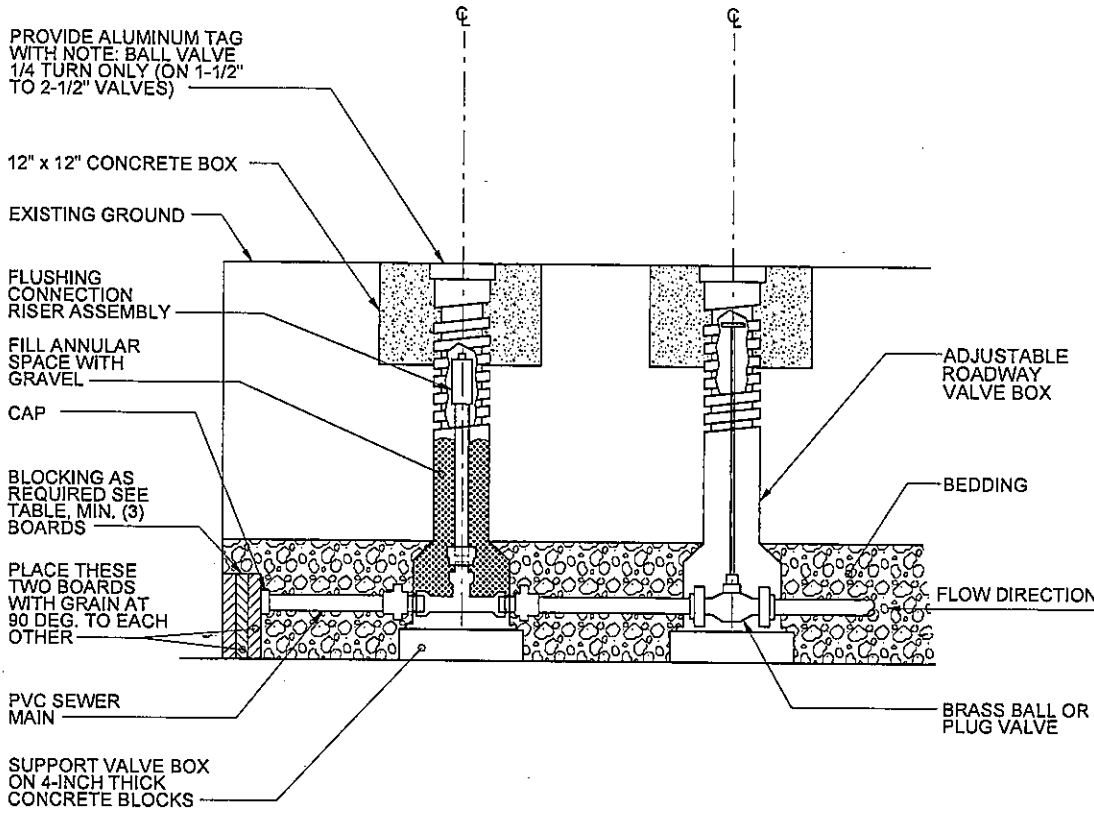


Worcester County
 Department of Public Works
 Water & Wastewater Division



LOW PRESSURE
 SEWER SERVICE
 CONNECTION

DETAIL No.
S-11
 Date
 NOV. 7, 2017



PIPE SIZE	M	N	P
1/4"	6"	6"	8"
1/2"	6"	6"	8"
2"	6"	8"	8"
2-1/2"	8"	8"	10"
3"	12"	18"	12"
4"	12"	18"	12"

BLOCKING DETAIL

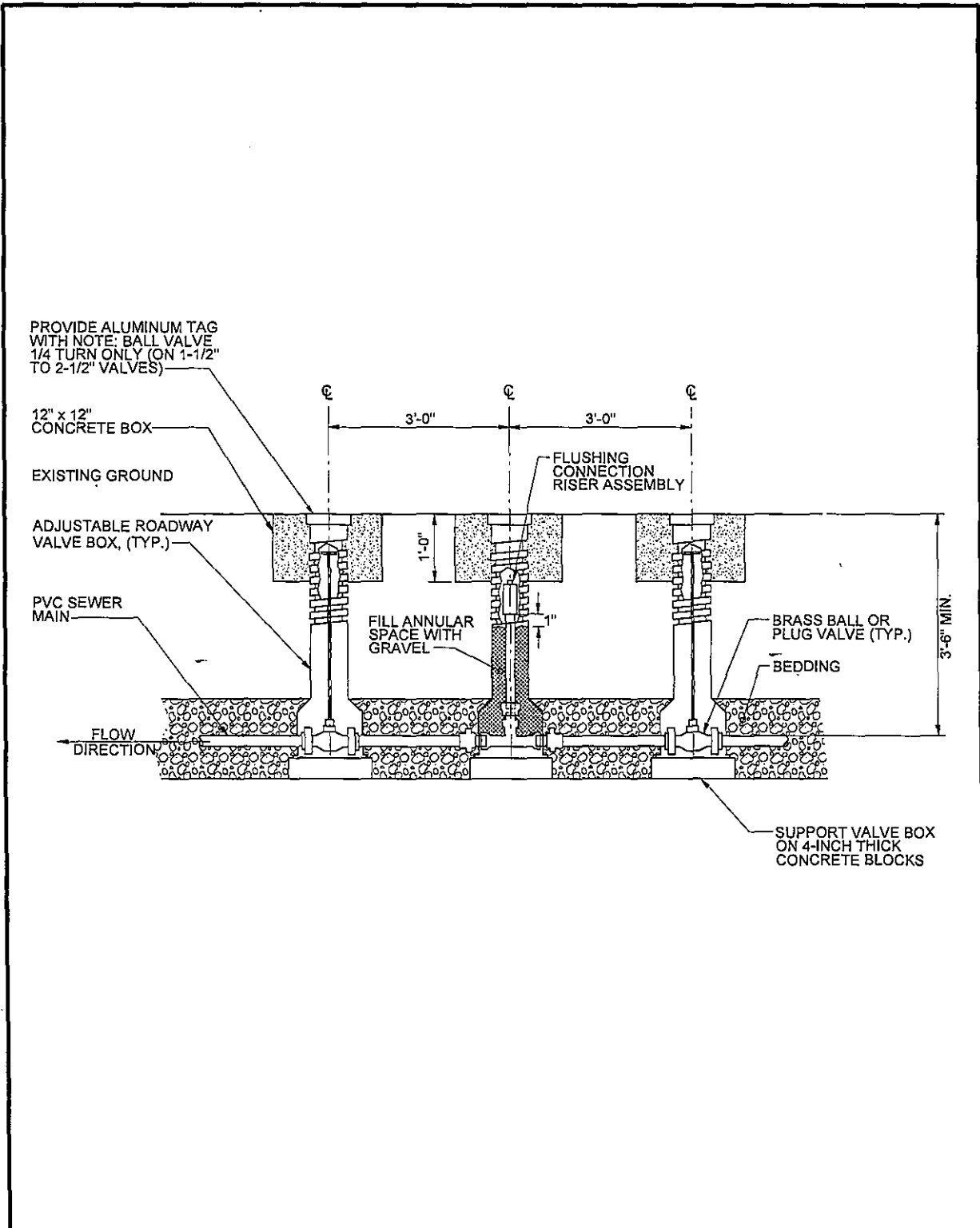
Worcester County
 Department of Public Works
 Water & Wastewater Division




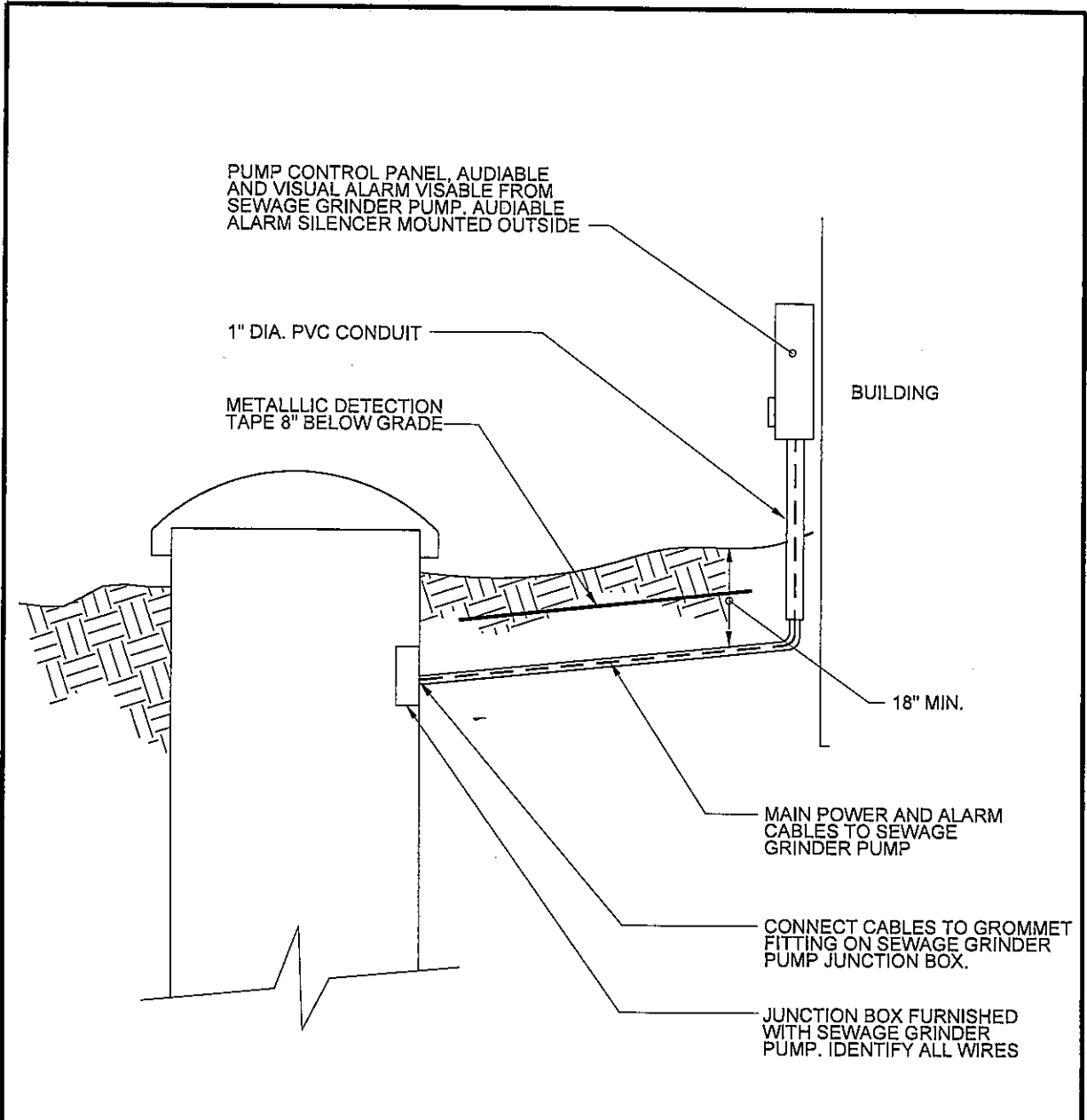
LOW PRESSURE SEWER
 TERMINAL FLUSHING CONNECTION

DETAIL No.
S-12

Date
 NOV. 7, 2017



<p>Worcester County Department of Public Works Water & Wastewater Division</p>		<p>LOW PRESSURE SEWER IN-LINE FLUSHING CONNECTION</p>	<p>DETAIL No. S-13</p> <p>Date NOV. 7, 2017</p>
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NOTES:

- 1) ALL ELECTRICAL WORK SHALL BE IN ACCORDANCE WITH THE N.E.C.

Worcester County
 Department of Public Works
 Water & Wastewater Division



**TYPICAL GRINDER PUMP
 ELECTRICAL SERVICE**

DETAIL No.
S-14

Date
 NOV. 7, 2017

PART 4
APPROVED LIST OF
SUPPLIERS AND
MATERIALS

PART 4 - APPROVED LIST OF SUPPLIERS & MATERIALS FOR CONSTRUCTION

4.1 GENERAL INFORMATION

- A. The following Approved List of Materials applies to the construction of the Water and Wastewater Division and is Part 4 of the Standard Specifications for the Worcester County Department of Public Works, Water and Wastewater Division.
- B. The Deputy Director of Public Works shall maintain the approved materials list.
- C. Any amendment of the list shall be the result of an evaluation and approval of a committee of operations, maintenance and engineering staff of the Water & Wastewater Division.
- D. The list shall be utilized by contractors, suppliers, designers and County staff when identifying materials which have been approved for use in the County water and sewer systems.
- E. The County reserves the right to have the products tested by an independent agency to assure that it meets the minimum requirements established in the Standard Specifications.
- F. In the event that the product does not meet the minimum requirements, the manufacturer will be responsible for all associated cost including, but not limited to, the test performed and any additional testing by Worcester County.
- G. The County reserves the right to modify the list as deemed appropriate based on performance of the product used.

4.2 APPROVED SUPPLIERS & MATERIALS FOR WATER MAIN CONSTRUCTION

1. PIPE, DUCTILE IRON (D.I.P)

U.S. Pipe & Fdy. T.R. Flex
Griffin Snap Lock
American Flex Ring
McWane N/A
Atlantic States N/A
Clow Super Lock
Special Thickness Class Note: 3" & above Class 52

2. PIPE, POLYVINYL CHLORIDE WATER

J. M. Pipe Company
E.T.I./ Uponor E.T.I.
National Pipe & Plastic
Diamond
NOTE: Rubber Ring Slip Joint Only
4" & larger DR-18 Class 150
2" SDR-21 Class 200

3. PIPE, WATER SERVICE (SDR 9; 1", 1-1/2", 2")

Halstead
Reading
Cerro
Mueller Tubing Company
Howell Metals

4. FIRE HYDRANT, 5-1/4" VALVE OPENINGS - MECHANICAL JOINT

M&H Reliant Style 929
Mueller Centurion A-423
Kennedy Guardian K-81-A
American B-84-B
Clow-Medallion-F-2545
U.S. Pipe Metropolitan 250 Model 94

5. RESILIENT SEAT/WEDGE VALVES MECHANICAL JOINT

Sizes thru 20" (AWWA C-509-94)
Kennedy Kenseal (4"-12")
Clow Series F-6100 (4"-12")
Mueller Series A-2360-20 (4"-12")

Sizes 16" Only (AWWA C-509-94)
U.S. Pipe Metroseal

Sizes 16" Only (AWWA C-515-99)
Kennedy Kenseal
Clow Series F-6100
Mueller Series A-2361-20

Note: Gearing required above 16"

6. PLUG VALVES

Milliken (4"-12")

7. BUTTERFLY VALVES (24" & Larger) (Valve Shafts-Horizontal)

Submit shop drawings.

8. VALVE, COMBINATION AIR/VACUUM RELEASE

1" on Mains thru 12"
Apco (Valve & Primer) 143-C 142
Valmatic 201-C 101
G.A. Industries 945, 930
Cla-Val Series 35

2" on Mains 14"-20" (Where Specified)
Apco 145-C 144
Valmatic 202-C 102
G.A. Industries 945, 930
Cla-Val Series 35

9. TAPPING SLEEVE ONLY

U.S. Pipe & Fdy (A.P. Smith)
M&H Valve
Clow 4"-16"-F-5205 (C.I., D.I.P., C-900)
Clow 4"-12"-F-5207 (A.C.)
Mueller 4"-12" H-619(A.C.)
Mueller 4"-24" H-615 (C.I., D.I.)
Tyler Pipe 4"-12" S-149 (for C.I.),
S-349 (for A.C.)

American Flow Control M.J. Sleeve - D.I. 4"-48"
JCM 432 (for A.C. Pipe)
Ford FAST (for A.C. Pipe)
Romac SST 16" & above (for A.C. Pipe)
Mueller 4"-24" H-304 (A.C.)
NOTE: M.J. for D.I.P., C.I.P., A.C., PVC

**10. FITTINGS-MECHANICAL JOINT- (Flanged for Interior Use) CEMENT/
EPOXY LINED - D.I., C.I**

U.S. Pipe & Fdy.
Griffin
Tyler Fdy.
Tyler Fdy./Union Fdy. (C.I. upon request)
Clow
HarCo-PVC - Slip Joint with restraints.
Union Fdy. (C.I. upon request)

NOTE: 6" - 12" Class 350 D.I (AWWA C-153) Class 250 Cast Iron (AWWA C-110)
16" Class 350 Ductile Iron (AWWA C-153) Class 250 Cast Iron (AWWA C-110)

11. VALVE BOX SCREW-TYPE 36"- 48" (5-1/4" for 3" Valves & Larger & Blow-off)

Bingham & Taylor
Capital Foundry of Virginia, Inc. #564s
FasTech, Inc.

12. CURB-BOX 92D SCREW-TYPE (2-1/2")

Bingham & Taylor
Ametek (County Use Only)
Capital Foundry of Virginia, Inc.

13. CURB-BOX LOCKING SCREW-TYPE (4-1/2")

Bingham & Taylor
Capital Foundry of Virginia, Inc.
#NH-138-H-UP
FasTech, Inc.

14. FRAME & COVER FOR VALVE VAULTS and AIR-RELEASE MANHOLE

East Jordan/B&C
Campbell Fdy.
E.A. Quirin Fdy.
Revised-4/17/01

15. METER VAULT (18"- 24" Pre-cast Concrete)

Mayer Brothers, Inc.
Davis Concrete

16. 18" METER FRAME & COVER

Vestal
Ford Meter Box Company A-32-C
Bingham & Taylor 180-18-A
MBC-Meters Box Covers Inc.
Capital Foundry of Virginia, Inc. #MB-890

17. RETAINER GLAND DUCTILE IRON-WEDGED

EBA Iron Mega-A-Lug
Uni-Flange/Ford Wedge Action-Series 1400

18. VALVE/METER VAULT, PRECAST CONCRETE, LARGE

Mayer Brothers, Inc.
Terre-Hill
Atlantic Precast
A.C. Miller
Wyoming
Davis Concrete

19. PIPE COUPLING-FOR D.I.P. C-900-AC

*Dresser - Style 153 4"-12"
*Ford - Style FC 2"-24"
*Smith-Blair - Style 441 2"-16"
*Viking-Johnson MaxiFit 1-1/2"-24"
*Viking-Johnson MaxiStep 1-1/2"-24"
*Romac - Style 501
*Submit shop drawing for A.C above 10".

NOTE: All couplings to be epoxy or nylon-coated.

20. PRE-CAST VAULT TO PIPE LINE CONNECTOR

Atlantic Pre-Cast – A-Lock (<18° grade)
– Z-Lock (<18° grade)
Terre-Hill Concrete Products – Dual Seal II
RX101 Water Stop
Hail Mary Rubber Company – Star Seal

21. ALUMINUM METER VAULT DOORS (H-20 Loading)

BilCo
Syracuse Castings
Just-Set Har. Co. Spec.

22. JOINT PROTECTOR (Steel End Ring Concrete Pipe)

Flex-Protex Pipe Ring Protectors
MarMac Mfg. Company

23. SERVICE SADDLE

Ford Style FC-202
Romac 202N
Smith-Blair 317 Nylon-Coated
Mueller DN2S or DE2S

- a. Specify type of pipe.
- b. All saddles to be epoxy or nylon-coated.

24. CORPORATION STOP, COMPRESSION JOINT

Above 1"
Ford FB-1000
Mueller B-25008
McDonald 4701-B-22

¾"-1"

Ford F-1000
Mueller H-15008
McDonald 4701-22

25. CORPORATION STOP FOR 2" PVC PIPE

Dresser "Quicktap" Service Connection Style 294

26. CURBSTOP, COMPRESSION JOINT

Ford B-44 Series
Mueller B-25209
McDonald 6100-22 Mac-Pak

27. FLANGE ADAPTOR

*Uni-Flange/Ford Series 400 (2"-48")
*Dresser Style 127
*Epoxy or nylon-coated.

28. OUTSIDE DOMESTIC WATER SERVICE COMPLETE (1")

See Standard Detail for material needed.

29. WATER METERS

Neptune

30. BACKFLOW PREVENTORS 3/4" - 2" [Application Varies]

Hersey Products, Inc.
Double Check Valve (F.D.C.)
Reduced Pressure Assembly (F.R.P. II) 2-1/2" - [Application Varies]
Hersey Products, Inc.

4.3 APPROVED SUPPLIERS & MATERIALS FOR SEWER MAIN CONSTRUCTION

1. PIPE, POLYVINYL CHLORIDE (PVCSP)

J.M. Pipe Company
E.T.I./Uponor E.T.I.
National Pipe & Plastic
Diamond
NOTE: 6" thru 15" Class SDR-35
4" Class SDR-26 Heavy Wall

2. PIPE, DUCTILE IRON - Slip Joint Restrained Joint

U.S. Pipe & Fdy. T.R. Flex
Griffin Snap Lock
American Flex Ring
McWane N/A
Atlantic States N/A
Clow Super Lock
Special Thickness Class NOTE: 3" & above Class 51

3. FORCE MAIN SEWER PIPE

2"-3" Rubber Ring Slip Joint - SDR 21, Class 200 PVC
3" - D.I.P. Class 52
4"-12" - DR 18 - C-900 PVC - D.I.P. - Class 52

Over 12"- D.I.P. - Class 52

NOTE: 1. Refer to Water Main Materials for all force mains.

4. MANHOLE, PRECAST CONCRETE

Atlantic Precast
Concrete Pipe & Products
Terre-Hill
Monarch Products Company, Inc.
Hanson Products

5. MANHOLE TO PIPE LINE CONNECTORS

A-Lok - Atlantic Precast
Dual Seal II - Terre-Hill Concrete Products
Press Seal Boot

6. BUILT IN-PLACE MANHOLE TO PIPE LINE CONNECTORS

A-Lok Field Kit - A-Lok Products
Z-Lok Field Kit - A-Lok Products
RX101 Water Stop

7. CORED MANHOLE GASKETS

A-Lok - A-Lok Products
Link-Seal - Thunderline Corp.
Z-Lok XP - A-Lok Products
Kor-N-Seal - National Pollution Control Systems, Inc.

8. PLUGS - SEWER (Wing-Nut)

Cherne Industries Inc. - "Gripper"
R.C. Graham - "Hand-Tite"
Circle Gas Manufacturing

9. FITTINGS Molded 2"-8" Fabricated 10"& Larger

HarCo-PVC Multi-Fitting-18"-36"
J.M.-Pipe Co.-PVC Freedom-10"-15"
Multi-Fitting-PVC Nyoplast-10"-36"
(Thru 15") B&H Inc.-10"-15"
Plastic-Trend-PVC G.P.K. Products, Inc.
Hersey Products, Inc. 10"-27"
D.I.P. (Cement-Lined)
G.P.K. Products, Inc.

10. PLASTIC STEP

M.A. Industries, Inc.

11. SADDLE

Pioneer Branch (Specify type pipe)
Geneco Sealtite (Specify type pipe)
Ford "CB" (Any type pipe)
Romac "CB" (Any type pipe)

12. FRAME & COVER(For Manhole-420-lb. Minimum, and Lamphole)

Emporia Fdy./Campbell

E.A. Quirin Bros.
East Jordan/BC
Capital Foundry of Virginia, Inc.
MH-138-H-SS
MH-138-H-UP
MH-1653

13. FRAME & COVER FOR MANHOLE (Straight Wall-320 lb. min.)

Neenah Foundry Company Frame Model No. 1565-2000
Lid Model No. 1565-5001
East Jordan Iron Works, Inc. Model No. 1545Z1

14. BRICK - SM GRADE

Boral Brick Co.
Glen-Geary Brick Co.
Cherokee of Maryland

15. GRADE RINGS (3" Maximum Height) w/STEEL REINFORCEMENT

Atlantic Pre-Cast
Terra-Hill Products
Davis concrete

16. MANHOLE PAINT FOR FRAME & COVER (Off-Site)

Lenmar AU91

17. CLEANOUT - PRE-FAB CONCRETE (Y Junction Box)

Davis Concrete
Atlantic Pre-Cast

18. ADAPTOR (From 6" House Connection to Cast-Iron Soil Pipe)

Fernco
Calder
IND Seal

19. PVC RISER PIPE - CLEANOUT (SDR-26 - Heavy Wall Sewer)

J.M. Pipe Company
E.T.I.
National Pipe & Plastic
Diamond

20. SOIL PIPE (Cast-Iron Heavy Duty) (Cleanout Riser 4")

Tyler
Charlotte

21. RETAINER GLAND-WEDGED

Ebba Iron Meg-A-Lug
Uni-Flange/Ford Wedge Action Series 1400

22. AIR & VACUUM VALVES

*G.A. Industries
*Apco
*Val-Matic

Cla-Val
*As per shop drawing.

23. MASTIC ROPE SEAL (3/4")

K.C. Snyder - "Rubber-Nek"
Press Seal Gasket Corporation

24. CLEANOUT - HUB & CAP (Penella Style 4" & 6")

Penella Industries - PVC w/Magnet
Jumbo Manufacturing Company - Cast Iron w/Gasket
Circle Gas Manufacturing Company - Cast Iron w/Gasket

25. STAINLESS STEEL OR PLASTIC MANHOLE INSERT w/RELIEF VALVE

Southwestern Packing & Seal Company - S.S. Rainstopper
Parson Environmental Products, Inc. - Stainless Steel Manhole Insert

4.4 APPROVED SUPPLIERS & MATERIALS FOR WATER AND SEWER MAIN CONSTRUCTION

1. STEEL CASING PIPE

Approved after shop drawing submittal.

2. LINER PLATE

Approved after shop drawing submittal.

3. DETECTOR TAPE (3" Non-Metallic)

Lineguard
Allen Systems
Linetec
Empire Level

4. TRACER WIRE (7 Strand 12# gauge solid copper No. 8 w/.045 PE Wall Blue)

All Manufacturers

5. SOLDERLESS SPLIT BOTTOM CONNECTORS

3M

6. SPLICING TAPE-UNDERGROUND

3M

**7. BITUMINOUS COATING
(Military Spec. C-18480)**

All Manufacturers

**8. COAL TAR EPOXY
(16 Mil D.F.T. Min)**

All Manufacturers

9. NON-SHRINK EPOXY GROUT

All Manufacturers

10. REPAIR CLAMPS - 4" - 16" Two-Section

Smith-Blair 262
Ford Style FS2
Romac Style SS2
Powerseal Style 3122 AS
16" Three-Section
Ford Style FS3
Smith-Blair Style 263
Romac Style SS3
Powerseal Style 3123 AS

11. 2-1/2" TRACER TEST BOX w/TERMINAL BLOCK

Bingham & Taylor – P-200 Test
Note: 1. Blue lid for water Green lid for sewer
2. Test location at fire hydrant

NOTE:

*The classes or designations of pipe shown on this list are the classes that are normally used in water and sewer construction in Worcester County. However, it is possible that the Contract Documents, Special Provisions and/or Plans may specify a class or designation that is different and/or greater than that shown on the list. In the event of such a discrepancy, then the Contract Documents, Special Provisions and/or Plans shall govern.