

DIVISION III GENERAL REQUIREMENTS FOR CONSTRUCTION

Section 300 General

All work performed by the contractor shall be performed in a skillful and workman like manner. The contractor shall employ no plant, equipment, materials, methods, or persons to which the Town objects.

Section 301 Surveys and Construction Stakeout

Unless otherwise specified, depending upon whether the project is funded by the Town or a developer, the Town's engineer or developer's engineer will furnish all boundary surveys and horizontal and vertical control information for establishment of lines, grades, and elevations for the guidance of the contractor.

All surveying for the Town of Keedysville water systems shall reference horizontal datum from MD State coordinates NAD 83/91 and vertical datum from U.S.G.S. NAVD 88.

Unless otherwise authorized by the Town, the contractor will furnish the Town with a survey of the construction work to be performed. The contractor shall provide competent personnel and the necessary materials and equipment for setting stakes and making measurements for the initial and subsequent stakeouts.

The contractor shall furnish all stake out effort necessary for the setting of batter boards, string lines, finish grade control, slope stakes, and other controls as necessary for construction.

Stakeout for water mains and appurtenances shall consist of horizontal layout at a fifteen foot offset from the pipe line and service connection. Stakeout shall indicate location and elevation for each fitting or appurtenance. Stakeout shall indicate the finished grade at the locations of all water meters. Stakeout shall be in such a way so as to avoid disturbance of the stakes until the excavation work is completed.

Bench marks for vertical control of water lines, shall be established at two hundred foot (200') intervals maximum.

Water line reference sheets shall be prepared for all mains, showing stationing of mains, fittings, service connections and appurtenances. Finish grade at each water meter location must be shown on the reference sheet. Bench marks with descriptions shall be incorporated on reference sheets. Three copies of these sheets, standard detail w-42, shall be furnished to the Town for approval prior to start of construction.

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Stakes shall have markings that correlate to the particular water pipe components that are indicated on the reference sheet. Stakes shall have markings that indicate the numerical elevation of the grade as well as a line marking the grade. Information on the stakes and reference sheets shall directly correlate with the information on the contract drawings. Stakes shall have markings that not only direct the contractor's crew on what is to be done, but also the markings must indicate to the inspector that what has been done is according to the drawings and reference sheet.

The contractor shall carefully preserve bench marks, reference points and stakes, and in case of willful or careless destruction, the contractor will be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

The contractor shall re-establish and replace any disturbed property monuments within the project limits of work at no cost to the affected property owner, easements holder, or the owner and shall furnish the owner with a property survey of the affected portions of the project site certifying that all disturbed property monuments have been accurately replaced.

Section 302 Excavation and Backfilling Scope of Work

The contractor shall furnish all plants, labor, material and equipment to perform all excavation of every kind required for the work under the contract. Contractor shall perform all filling and backfilling, shall construct all embankments and fills including furnishing, hauling, and placing all material required for constructing embankments and fills. Contractor shall perform all grading, shall remove all water, shall satisfactorily dispose of all unsuitable and excess materials. Shall furnish, install, and remove all sheeting, bracing, and shoring necessary to hold the sides of the excavations and to protect the work and existing structures and utilities. Contractor shall perform all incidental and appurtenant work required to satisfactorily complete the work as shown on the drawings and as specified.

Section 303 General

All excavation for pipes shall be in open trenches, except where and to such extent as the Town may authorize or direct that the same be constructed by tunneling, jacking or boring, or where such is specified herein or shown on the contract drawings. Trenches may be, in general, excavated and backfilled either by machinery, or by hand as the contractor may elect, provided however, that the Town shall be empowered, wherever such necessity exists, to direct that hand excavation shall be employed, and provided further, that excavation and backfilling by hand shall be done to the extent herein specified. The contractor shall have no claim for extra compensation due to the fact that hand, instead of machine, excavation may be made necessary from any cause whatever. Excavation shall be considered as the removal of all necessary solids from their present location to their final location, as shown on the plans as described in these specifications.

Section 304 Clearing and Grubbing

The work under this item shall include the furnishing of all labor, materials and equipment necessary to clear and remove from the site or dispose of in an approved manner, all perishable and objectionable materials, including stumps and roots, within the line of construction to be accomplished.

As herein used, perishable material shall include boards, fences, trees, brush, vines, shrubs, logs, stumps, roots, weeds, rubbish and other organic matter above the surface of the ground, but not sod or topsoil, although portions of sod and soil may be removed in connection with other materials.

All stumps shall be removed from areas to be occupied by structures, or areas that are to be finish-graded. They shall be cut off a minimum of one foot (1') below the finish grade of embankments or filled areas.

Section 305 Removal of Pavement and Storage of Trench Materials

The contractor shall clear and grub the surface and remove all surface materials of whatever nature over the line of the trench; he shall properly separate and classify the materials removed; and he shall store, guard and preserve said materials as may be required for use in backfilling, resurfacing, repaving, or for other purposes. All the rock, earth, sand, curbing, gutter and flagstones, and all sectional paving units which may be removed, together with all materials taken from the trenches, shall be removed from the street or roadway area to the approved waste area, or such other suitable place, and in such a manner as shall be approved or directed by the Town. The contractor shall be responsible for any loss of or any damage to, paving materials through his own or his employees' careless removal or neglectful or wasteful storage, disposal, or use of same.

The contractor shall remove all pavements, road surfaces, curbing, driveways, and sidewalks within the lines of excavation. Portland cement concrete pavements shall be opened by sawing and asphalt pavements by cutting to neat straight lines with other methods as will furnish a clean cut in the pavement and base without undue shattering. All concrete curbing, driveways or sidewalks within the lines of excavation shall be broken up and removed by contractor. All such work as above designated shall be done at the contractor's expense and in accordance with the rules and regulations of the Town. The use of "pear" or weight dropped on pavement for breaking will not be allowed except by written permission of the Town.

The contractor shall remove paving of such width only as is necessary for the excavation of the trench, and in case the contractor removes the paving for a greater width than is deemed necessary or in case the contractor removes or disturbs any paving on account of settlement, slides or cave-ins or in making excavation outside the lines of the work without the written order of the Town, the cost of permanently replacing the paving so removed shall be borne entirely by the contractor.

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In case more material is excavated from any trench than can be backfilled over the completed water line or can be stored within the limits of the right-of-way, leaving space for drainage as herein provided, the excess material shall be removed to some convenient place, provided by the contractor. The contractor shall at his own cost and expense, bring back so much of the material so removed, as may be required to properly backfill the trench, if of the proper kind; or, if so directed by the Town, the contractor shall, at the contractor's own cost and expense, furnish such other suitable material as may be deemed necessary.

When it is necessary to haul soft or wet material over the streets or roads, the contractor shall provide suitable water tight vehicles approved by the Town for the purpose.

Section 306 Removal of, Stockpiling and Replacement of Surface Materials

From all areas where excavations or fills are to be made, or where grading is to be performed, sod and topsoil shall be removed. Sod shall be cut in suitable strips and carefully removed and stored for subsequent use. During the period of storage, the sod shall be kept suitably protected and watered.

Where seeding, sodding, or grading of areas is called for on the drawings or by these specifications, or where the topsoil or loam, or overburden is unsuitable for use in embankments, dams, or filled areas, the topsoil shall be removed and stockpiled for future use, or where unsuitable for use, as called for above, shall be discarded to such areas approved by the Town and/or the Washington County Soil Conservation District, where applicable, otherwise it shall become the property of the contractor and shall be removed from the site.

In placing topsoil for sodding or seeding, all roots, logs, sticks, weeds, and other debris shall be removed. Stones or rocks that can be removed by garden rakes, as normally used, shall also be removed. The topsoil shall be spread to a minimum depth of four inches (4"), and shall be well raked and graded to drain, and water holes shall be filled in to leave the area level or to the lines and grades indicated on the drawings. Final raking shall take place at the time sodding or seeding is to be completed.

All shrubbery and trees located in the right-of-way, or easements, which would interfere with the construction, shall be removed by balling in burlap. Upon completion of all excavation and backfill the shrubs and trees shall be replaced. The contractor shall replace all shrubs and trees that are not thriving at the end of one growing season.

Section 307 Excavation Unclassified

All excavation, unless otherwise specified, shall be unclassified and shall include all material of any kind encountered, whether earth, rock, concrete, old foundations or other obstacles, hard or soft material, wet material, silt, water or other material, unless and except as shown on the drawings, no subsurface explorations have been made to determine the character of the material at the site of the work.

Section 308 Trench Excavation General

The contractor shall excavate, protect and backfill all trenches that may be necessary for completing the work to be performed under the contract. All excavation shall be in open trenches, except where and to such extent as the Town may authorize or direct that the same be done in tunneling, boring and jacking, or where such is specified in the special conditions or contract plans. The use of excavation machinery shall be permitted except in places where operation of same will cause damage to trees, buildings, or the existing water/sewer systems above or below ground; in which case hand methods shall be employed. No tunneling, boring, or forcing shall be allowed without special permission from the Town. The excavated material in nonpaved areas must be stored in such a manner so as not to encroach on private property, endanger the work, obstruct sidewalks, or interfere with proper drainage. In roadways and paved areas, all excavated material must be immediately removed from the work area to an approved waste site location. Trenches shall be, in general, excavated either by machinery or by hand as the contractor may elect, provided, however, that the Town shall be empowered, wherever such necessity exists, to direct that hand excavation shall be done to the extent hereinafter specified. The contractor shall have no claim for extra compensation due to the fact that hand, instead of machine, excavation may be made necessary for whatever cause.

The contractor shall perform all excavation of every description regardless of whatever substances encountered, to the depths indicated by the drawings, as specified herein or as directed by the Town. All excavated materials not required or permitted for backfill shall be removed and wasted or otherwise disposed of as directed or specified.

A. Removal of Water

1. The contractor shall, at all times during construction, provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such a manner as shall not interfere with the prosecution of the work or the proper placing of concrete or other work, and in such a manner as will provide against the flotation of any structure, or pipe, without flooding such structure or pipe.

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2. The contractor shall build all dams and other devices necessary and provide and operate pumps, or well-point systems, of sufficient capacity for continuous dewatering of the excavations. The contractor shall provide for the disposal of the water removed from excavations, in such manner as shall not cause injury to the public health, to public or private property, to any portion of the work completed or in progress, or produce any impediment to the use of highways, roads, lanes and streets by the public.

3. All discharge areas of pumping devices shall be in full compliance with the Washington County Soil Conservation District's regulations and specifications.

B. Excavation below sub-grade

1. The term "sub-grade" as used herein shall mean the bottom of the excavated trench, ready to receive bedding material.

2. When excavation is carried below the sub-grade without the direction of the Town's representative, the excavation is to be brought back to sub-grade with materials and in a manner approved by the Town.

3. If the contractor excavates to the grade shown on the plans and the Town representative finds on inspection of this sub-grade that it will not sustain the loads to which it will be subjected, the Town representative may then direct further excavation and backfill with specified materials, at no cost to the Town.

4. When the bottom of the trench is found to include unsuitable material, such as refuse, organic matter, etc. Such material shall be removed and to a minimum of at least 6 inches below the bottom of the pipe. The material removed shall be replaced with clean, stable backfill material and the bedding material installed. When potentially corrosive materials are encountered, the pipe should be encased in polyethylene wrap to protect the pipe.

Replacement of unsuitable material below sub grade shall consist of 1/2-inch to 1-1/2-inch size stone granular material.

5. When the bottom of the trench or sub grade is found to consist of a material that is unstable to such a degree that it cannot be removed, a foundation for the pipe and appearances shall be constructed using piling, treated lumber or concrete. All concrete encasements and cradles shall be placed to within one foot (1') of a pipe joint at both ends. The contractor may be required to furnish and install encasements or cradles to greater limits than shown on the contract documents to meet the above which shall be at the contractor's expense.

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C. Width and Depth of Trenches

1. Sides of trenches shall be kept as nearly vertical as possible and shall be excavated to a width as required by MOSHA or as specified and be true to line from the bottom of the sub grade to the top of the existing ground.
2. The depth of the excavation for the water line or other structure herein specified shall be such that they can be built to proper grade.
3. Should the contractor excavate beyond the limits herein specified, that excavation alongside or below the sub-grade of the water line shall be completely filled with materials approved by the Town.
4. Wherever necessary to prevent caving, trenches shall be adequately sheeted and braced. Trench sheeting shall remain in place until pipe has been laid and backfill completed to a minimum height of one foot above the crown of the pipe.
5. All sheeting shall be raised and/or removed as backfilling is completed and no sheeting is to remain in place without the written permission of the Town representative.
6. Sub-grade of pipe trenches shall be taken to mean a horizontal plane six inches (6") below the underside of the pipe barrel or other structure as shown on the standard detail drawings herein.

D. Length of open trench

1. The Town shall have the right to limit the amount of trench opened in advance of pipe laying and the amount of pipe laid in advance of backfilling, but in no case shall more than two hundred feet (200') of trench be opened at any one place in advance of the completed water main. Trench excavation shall be fully completed, except for the shaping of the bottom of the trench, at least twenty feet (20') in advance of the pipe placement, and shall be kept free from obstructions, except that at the close of work at night, or at the discontinuance of work, the pipe laying shall be completed to within five feet (5') of the end of the opened trench. In all streets, roadways, and residential areas, all open trenches must be suitably bridged at the end of the work day. The amount of pipe laid in advance of backfilling shall not exceed one hundred feet (100').
2. The Town representative shall be empowered, at any time, to require the refilling of open trenches over completed pipelines, if, in his/her judgment, such action is necessary, and the contractor shall thereby have no claim for extra compensation, even though to accomplish said refilling he is compelled temporarily to stop excavation or other work at any place.
3. If work is stopped on any trench for any reason except by order of the Town, and the excavation is left open for an unreasonable length of time (in the opinion of the Town) in advance of construction, the contractor shall, if so directed, refill such trench, at his own cost, and shall not again open said trench until he is ready to complete the structure therein.

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E. Accommodation of Traffic

1. Streets shall not be unnecessarily obstructed, and the contractor shall take such measures at his own expense, as may be necessary to keep the street or road open and safe for traffic.
2. Streets, roads, and alleys shall not be completely closed during construction unless authorized in writing by the Town or SHA or Washington County Roads Department or the entity having title to the roadway.
3. The road on one side of the line of work shall be kept open at all times. Driveways shall be made accessible to property owners at all times.

F. Bridge across Open Trenches

1. In narrow or congested streets or alleys, when so directed, the contractor shall complete his work up to a point designated by the Town representative before opening the work ahead.
2. The contractor shall in all cases arrange his work so as to cause the least inconvenience as determined by the Town.
3. The contractor shall construct and maintain such adequate and proper bridges over excavations as may be necessary or as directed for the safe accommodation of pedestrians or vehicles. The contractor shall furnish and erect substantial barricades at crossings or trenches, or along the trench, to protect the traveling public.
4. Roadways and sidewalks shall be kept clean, clear and free for the passage of vehicles or pedestrians, unless otherwise authorized in writing by the Town. A straight and continuous passageway on sidewalks and over crosswalks, at least three feet (3') in width, shall be preserved free from all obstructions.
5. Where deemed necessary, such additional passageway as may be directed shall be maintained free of obstructions.
6. Under no circumstances shall the contractor obstruct fire hydrants or the use of hydrants.

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G. Accommodation of Drainage

1. Gutters, sewers, drains, and ditches shall be kept open at all times for surface drainage. No damming or ponding of water in gutters or other waterways will be permitted, except where stream crossings are necessary and then only to an extent which the Town shall consider necessary. The contractor shall not direct any flow of water across or over pavements, except through approved pipes or properly constructed troughs, and he shall, when so required, and At his own cost and expense, provide pipes or troughs of such sizes and lengths as may be required, and place the same as directed. The grading in the vicinity of trenches shall be controlled so that the ground surface is properly pitched to prevent water running into the trenching.

2. In open water courses, ditches, or pipes, encountered during the progress of the work, the contractor shall provide for the protection and securing of a continuous flow in such courses or pipes and shall repair any damage that may be caused by construction.

H. Obstructions Shown on Drawings

Certain information regarding the reputed presence, size, character and location of existing underground structures may be shown on the contract drawings. There is no certainty of the accuracy of this information. The location of underground structures shown may be inaccurate and other obstructions than those shown may be encountered. The contractor hereby distinctly agrees that the Town is not responsible for the accuracy of the information given; that he shall have no claim for delay or extra compensation due to inaccuracy, insufficiency or absence of information regarding obstructions either revealed or not revealed by the drawing. 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 pipe or other underground structure is not as indicated on the drawings, or in case any pipe or other underground structure is encountered that is not shown on the drawings.

I. Removal of Obstructions

1. Should the position of any pipe, conduit, pole, or other structures, above or below the ground, be such as to require it's removal, realignment, or change due to the proposed construction of the water main; the extra work shall be performed by the contractor or by the owner of the obstruction, without costs to the Town. The contractor shall not be entitled to any claim against the Town for damage or extra compensation due to the presence of said structure, or due to any delay in the removal or rearrangement of the same.

2. The contractor shall, without extra compensation, break through and reconstruct, if necessary, the invert or arch of any sewer, culvert, or conduit that may be encountered, if the said structure is in such a position that, in the judgment of the Town representative, the contract intent requires its removal, realignment or complete reconstruction.

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3. The contractor shall not interfere with any persons, firms, or corporations, or with the Town in protecting, removing, changing, or replacing their pipes, conduits, poles, or other structures; but he shall offer said persons, firms, or corporations, or the Town, to take all such measures as they may deem necessary or advisable for the purpose aforesaid, and the contractor shall thereby be in no way relieved of any of his responsibilities under the contract. At railway or railroad track crossings, any expense to which the owner of the trackage is put, in shoring up tracks, or in maintaining traffic shall be borne by the contractor, whether same is billed directly to him, or the Town. Should any such bill be unpaid by the contractor, before final payment under the contract is made, the Town shall be empowered to pay said bill and retain the amount thereof, from any monies due, or become due to the contractor.

4. Except when trees are in rights-of-way or in immediate proximity to the trench, they shall not be cut down except by authorization of the Town or project developer, and the contractor shall have no claim for the extra compensation owing to the fact that he may be required to excavate by hand, or tunnel in the vicinity of trees that must be left standing.

J. Change of Trench Location

1. In case the Town shall direct that the location of the trench be changed from that shown on the drawings, due to 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 damage, provided that the change is made before the excavation is begun. If, however, such change, made at the direction of the Town involves the abandonment of excavation already made, such abandoned excavation, together with the necessary refill, will be classed as miscellaneous excavation and refill, in the case where the full width of trench has not been abandoned. If the full width of trench has been abandoned, the excavation and refill shall be classed as excavation and refill for trenches of the size and depth indicated, if such is included in the contract proposal.

2. In the event the trench is abandoned in favor of a new location at the contractor's request, the abandoned excavation and refill shall be at the contractor's expense.

K. Miscellaneous Excavation

1. The contractor shall do such miscellaneous excavating work as may be necessary or directed. Such excavation shall be subject to the same conditions and requirements as specified for trench excavation.

2. Miscellaneous excavation shall include the digging of test pits, or excavation for any special structure outside the trench, that may not be shown on the drawings or described in the specifications, where such excavation is performed at the direction of the Town representative.

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3. Test pits shall be dug by the contractor wherever directed. Their depth and size shall be such as shall be required by the Town. Test pits may be dug by the contractor, without being directed to do so, along the lines of the trenches as shown on the drawings, in advance of the excavation, for the purpose of satisfying himself as to the location of underground obstructions or conditions, at his own expense.

L. Unauthorized Excavation

All excavations carried outside of the lines and grades shown, together with the removal of the excavated materials, shall be at the contractor's expense. All such spaces shall be filled by the contractor, at his own expense with concrete or other suitable materials as shall be directed by the Town, except that under concrete structures, all space resulting from unauthorized excavations shall be refilled with concrete.

M. Embankment

1. Where embankment is necessary to support the foundations of the water lines, it shall be made to the height, width and slopes shown on the plans. The entire embankment, or such portion thereof as may be deemed necessary by the Town, shall be made prior to the construction of the water line or the foundation thereof, at such time and in such order as the Town may direct; and the embankment and the water line and it's appurtenances which may be laid therein, shall be maintained by the contractor, at his own cost and expense, until the completion of the period of twelve (12) months from and after the date of the certificate of completion and acceptance.

2. After carefully clearing and grubbing the ground, removing all loose rock and stone, and all muck and improper material, to such depth as the Town representative may determine, the embankment shall be built up of good loam, gravel or sand, or other selected and approved material, free from all stones above four inches (4") in diameter, and not containing in any place a proportion of stones exceeding one (1) part stone to three (3) parts earth.

3. In case material which is unsatisfactory for the foundation of any embankment is encountered, said material shall be removed to such depth, and for such length and width as may be directed by the Town representative. The material for embankment shall be deposited in layers of not more than eight inches (8") in thickness, each layer shall be separately compacted with heavy roller having a weight of not less than 5000 pounds per inch of width of the roller, or where such rollers cannot be used, by heavy pavers, rammers or mechanical tampers. The embankment shall be watered during rolling if so required. No breaks or irregularities in the distribution of the material or the formation of the layers will be allowed. The whole embankment shall be carried up evenly to the height given by the Town in such a manner as to make a compact and solid foundation. When pipe is to be laid in a fill, the embankment shall be brought to a height of at least three feet (3') above the proposed top of the pipe before the trench is excavated. The embankment shall then be excavated to the proper configuration and grade and the pipe placed therein.

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N. Pipe Trenches in Fill

Where pipes are to be laid in areas of fill or embankment, the fill or Embankment shall be made prior to laying pipe. After the fill or embankment is in place the pipe trench shall be excavated to sub grade or to natural ground if lower than sub grade. Where it is necessary to excavate below sub grade, that portion of the trench above natural ground and below sub grade shall be filled with gravel or crushed stone as specified herein.

O. Rock Excavation

1. Unless otherwise directed by the Town, rock shall be fully taken out at least twenty-five feet (25') in advance of pipe laying, and to a point at least six inches (6") below the invert of the pipe and to a width not to exceed the width of the trench, for the size of pipe to be laid therein.

2. The space below the outer bottom of the pipe shall be filled with crushed stone or concrete, as directed by the Town representative. If rock below the specified grade therefore is shattered due to excessive drilling or blasting, and, if in the opinion of the Town, it is unfit for foundations, such shattered rock shall be removed and the area backfilled to proper grade with material acceptable to the Town, at the expense of the contractor.

3. Where air release manholes are excavated in rock, they shall be excavated to a point twelve inches (12") from the outside of the exterior lines of the masonry and to a depth of six inches (6") below the outside bottom of the masonry.

4. Rock appearing in miscellaneous excavations, or where future pipes are to connect with those laid under the contract, the excavation shall be in accordance with the directions of, and to the lines prescribed by the Town.

5. All excavated material which is unfit for refilling shall be immediately removed from the site of the work.

Section 309 Use of Explosives and Blasting

The contractor shall provide all labor, materials, equipment, and services necessary for, and incidental to, the use of explosives and blasting for excavation.

Failure to comply or to complete in accordance with any specifications set forth will be sufficient grounds for suspension of privilege to blast. The contractor shall not be entitled to any claims or any additional compensation which shall arise from the suspension of the blasting.

Wherever rock is encountered in the excavation, it may be removed by means of explosives, however, the contractor shall be solely responsible for injury to persons or property that may result from his use of explosives, and the exercise of, or failure to exercise control on the part of the Town shall in no way relieve him of responsibility for injury or damage resulting from their use.

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All blasting shall be performed under the supervision of a competent blasting expert, and subject to the state, county or local regulations for blasting, including NFPA 495, explosive materials code, latest edition.

Blasting for excavation shall be permitted only after securing the written approval from the state fire marshal who shall fix the time during which blasting may be performed and what protective measures must be used to insure safety of adjacent property. The contractor shall be responsible for any damage resulting from blasting. The contractor's method for procedure relative to blasting shall conform to state and county laws and local municipal ordinances.

The contractor shall submit a blasting design to the Maryland State Fire Marshal for approval. The state fire marshal is empowered to regulate the character and strength of explosives used, and the manner of their use and storage. Handling and storage of explosives shall be in accordance with federal regulation 18 U.S.C., chapter 40, sections 841-848.

Only small amounts of explosives shall be kept at any one place and shall be kept under lock. The key for the lock is to be only in the hands of a licensed blaster. Great care shall be taken in handling dynamite and similar explosives especially during freezing weather.

The contractor shall use the utmost care in the use of explosives necessary for the prosecution of the work, so as not to endanger life or property.

All explosives shall be transported and stored in a secure manner, and in accordance with local, state and federal laws, all vehicles and such storage places shall be marked clearly "dangerous - explosives", and shall be in the care of competent watchmen at all times.

Controlled blasting techniques shall be used. Modify the blasting round as necessary to achieve the best obtainable results and to keep the air blast over pressure, vibrations and noise within the limits of COMAR 12.03.01.09 "control of air blast and ground vibrations for blasting operations. Exercise all possible care in drilling and blasting operation to minimize over break and blast damage of adjacent unexcavated ground. It shall be the contractor's responsibility to produce a satisfactory excavated surface by determining the proper relationships of the factors of burden, spacing, depth of charge, amount of any type of explosive, hole size and delay pattern, and other necessary considerations to achieve the required results.

Blasts shall be made only during daylight hours and all blasts shall be carefully confined and adequately covered, to prevent injury to persons and to protect adjacent structures and pipes against damage. Before exploding each blast, ample warning shall be given to permit all persons to reach positions of safety. The contractor shall control fly rock and material so as to prevent damage to persons or structures. Rubber tire and/or steel mats shall be used prior to blasting.

Equipment used for drilling of holes shall have a positive means of dust control to the Town's approval.

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Whenever any pipe main or conduit is encountered in the trench, the right is reserved to direct that all rock within five feet (5') of the same is to be removed by some method other than blasting.

The contractor shall complete, maintain and submit permanent blast reports including logs of each blast in the Town. Logs shall be available for inspection by the Town at all times. Reports may be accrued for one (1) week and must be submitted within five (5) days after the end of each week. Complete reports after each blast to include the following information:

- A. Name of company of contractor
- B. Date, time and limits of blast by station.
- C. Name, signature, social security number and State License number of qualified blasting foreman in charge of work.
- D. Type of material blasted
- E. Number of holes, burden, and spacing
- F. Diameter and depth of holes
- G. Type of explosives used
- H. Total amount of explosives used by weight and number of cartridges, type, strength and manufacturer of explosives.
- I. Maximum amount of explosives per delay period of 8 MSEC or greater.
- J. Method of firing and type of circuit
- K. Direction and distance in feet to nearest dwelling, public building, church, commercial or institutional building, either owned or leased by the person conducting the blasting.
- L. Weather conditions including wind direction and velocity.
- M. Height or length of stemming
- N. If and where mats or other protection was used so as to prevent fly rock
- O. Type of detonators used and delay period used
- P. Seismograph records including seismograph readings when required shall contain:

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1. Name and signature or individual operating the seismograph
2. Name of individual analyzing the seismograph records
3. Seismograph reading

Q. The maximum number of holes per delay period or 8 MSEC or greater

R. The person taking the seismograph reading shall accurately indicate the exact location of the seismograph, if used, and shall also show the distance of the seismograph from the blast.

Blasting within existing development

1. All blasting will be monitored by the contractor and at the expense of the contractor, to control vibrations in the vicinity of roadways, structures and utilities. Blasting controls and techniques shall meet the following requirements:

Peak particle velocity shall not exceed one inch per second in the vicinity of structures and utilities and other objects subject to damage from the blasting operation. Particle velocities in excess of these limits shall be classified as out-of-control blasting and shall not be permitted.

2. The monitoring device shall be capable of measuring the velocity parallel and transversely to the direction of the blast and vertically. The equipment shall be capable of providing a permanent record of all recordings.

3. Monitoring instruments shall be placed directly on bedrock at a sufficient number of locations to develop attenuation curve. At least five percent of the measurements shall be made within ten feet (10') of the blast.

4. The contractor shall furnish to the Town a certification of calibration for each monitoring instrument used on the project.

5. The contractor shall furnish to the Town a certified list of qualified personnel to operate field instruments.

6. All data obtained from monitoring equipment shall be interpreted by an independent firm and a report to be forwarded directly to the Town on a timely basis.

7. Failure to comply or to complete in accordance with any specifications set forth will be sufficient grounds for suspension of privilege to blast. The contractor shall not be entitled to any claims or any additional compensation which shall arise from the suspension of the blasting.

8. Any damage resulting from lack of control during the blasting operation shall be the responsibility of and repaired at the expense of the contractor.

Blasting within New Development

Although it is strongly recommend by the Town, the contractor shall have the option of using blast monitoring equipment and procedures as specified herein before.

Blasting within state highway right-of-way

All blasting within the Maryland State Highway right-of-way shall be in strict accordance with the SHA's "standard blasting plan within state highway right-of-way."

Section 310 Responsibility for Condition of Excavation

The contractor shall be responsible for the condition of all excavations made by the contractor. All slides and cave-ins shall be removed without extra compensation at whatever time and under whatever circumstances they may occur.

The neglect, failure, or refusal of the Town to order the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to order sheeting, bracing, struts, or shoring to be left in place, or the giving or failure to give orders or directions as the manner or methods of placing or driving sheeting, bracing, jacks, wales, ranger, etc. Shall not in any way or to any extent relieve the contractor of any responsibility concerning the condition of excavation or of any of his obligations under the contract, nor shall any delay, whether caused by any action or want of action on the part of the contractor, or by any act of the Town, or his agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary; relieve the contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of his obligations under the contract relating to injury or persons or property, nor entitle him to any claim for extra compensation.

Section 311 Sheeting, Bracing and Shoring

The contractor shall be responsible for properly supporting the sides of all trenches and excavations with sheeting, timbering or other supports so as to furnish safe and acceptable working conditions. Bracing shall be arranged so as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength. If, however, the Town representative is of the opinion that at any point sufficient or proper supports have not been provided, the contractor shall provide additional or stronger supports at his own expense, but the furnishing of such additional supports shall not relieve him from his responsibility for their sufficiency.

The contractor shall furnish all labor, materials and equipment and perform all operations required for sheeting, bracing, and shoring of excavations and for constructing timber foundations as ordered by the Town, as shown on the drawings and as specified.

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All planks used for sheeting and sheet piling and all timber used for braces, shores and stringers or waling-strips shall be sound, straight, free from cracks, shakes and large or loose knots, and of the required dimensions throughout. Planks shall be tongued and grooved and splined if so required.

Material for sheet piling, sheeting, bracing and shoring shall be furnished and driven to set in place by the contractor where necessary or wherever ordered by the Town representative whether the same is or is not considered necessary by the contractor. If, in the opinion of the Town representative, the material furnished by the contractor is not of proper quality, of sufficient size, or not properly placed to insure the safety of the work or of adjacent structures and property, the contractor shall, upon notice from the Town, forthright procure, furnish, and set in place or drive other and satisfactory material in a satisfactory manner; if the contractor shall fail or neglect to do so, the Town may order all or any part of the work to be stopped until such material is so furnished and used or placed; and the contractor shall not be entitled to claim, demand or receive any compensation for larger size or better quality or different disposition of material ordered by the Town, nor any compensation or allowance of any kind whatsoever for, or on account of any damage or delay resulting from such stoppage of the work.

Any sheeting, sheet piling, braces or shores shall be driven or put in place by men especially skilled in such work, and shall be so arranged that they may be withdrawn as the excavation is backfilled, without injury to the water line, pipe, or structure and its appurtenances, and without injury to, or settlement of adjacent structures and pavements.

Sheeting, sheet piling, bracing, and shores shall be withdrawn and removed as the excavations are being backfilled, except where and to such an extent as the Town shall order in writing, that the same be left in place, or where the Town shall permit the contractor to leave the same in place, at the contractor's own cost and expense.

In withdrawing sheeting and sheet piling, special care shall be taken to insure that all voids or holes left by the planks as they are withdrawn are filled with satisfactory material and thoroughly rammed with thin rammers provided especially for that purpose.

The contractor shall cut off any sheeting or sheet piling left in place whenever and at such points as the Town shall order, and shall remove from the work the portion cut off, but he shall not be entitled to any compensation for such cutting off or removal.

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Section 312 Protection of Property and Structures

The contractor shall, at the contractor's expense, sustain in their places, and protect them from direct or indirect injury, all pipes, tracks, walls, buildings, and other structures or properties in the vicinity of his work, whether above or below the ground, or that may appear in the trench. He shall at all times have sufficient quantity of timber and planks, chains, ropes, etc. on the ground and shall use them as necessary for sheeting the excavations and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened.

The contractor shall take all risks attending the presence or proximity of pipes, poles, tracks, walls, buildings, and other structures and properties, of every kind and description, in or over his trenches, or in a vicinity of his work, whether above or below the surface of the ground; and he shall be responsible for all damages and assume all expenses for direct or indirect injury, caused by his work, to any of them, or to any person or property by reason of injury to them, whether such structures are or are not shown on the drawings.

Where necessary, in order to keep one side of the street or roadway free from any obstruction or to keep the material piled alongside of the trench from falling on private property outside the right-of-way, a safe and suitable fence shall be placed alongside the trench.

In the event of encountering quicksand, subsurface streams or similar dangerous contingencies, or where passing especially heavy buildings or any structures which by their construction or position might bring a great pressure upon the trenches, the right is reserved by the Town to direct that such buildings, or structures, shall be under pinned, or supported and protected, or that special sheeting shall be driven in such a manner and to such depth, as may be directed, or that only a short length of trench shall be opened at one time, and furthermore, if necessary that the trench shall be securely sheeted and braced on all sides, after the manner of a shaft, and that the permanent work shall be constructed in the same and the shaft backfilled before another opening is made. Any work done as above directed shall be at the cost and expense of the contractor.

The Town reserves the right under such conditions to stop the excavation or any other part of the work, and to require the contractor to complete the water line installation and the backfilling up to such a point as the Town may direct before proceeding further with the excavations; and the contractor shall not thereby become entitled to demand or to receive any allowance or compensation.

Section 313 Pipe Bedding and Encasement

The term "encasement" refers to three successive layers of granular material. The layers are: first, the six inch (6") layer of granular material underneath of the pipe, i.e. bedding; second, the layer of granular material that comes up to the top of the pipe; and third, the layer of granular material that comes up to twelve inches (12") over the top of the pipe. See standard detail W -1.

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Starting at the sub grade, trenches shall be filled for their entire width with compacted granular material, to a depth of six inches (6") below the barrel of the pipe. Prior to placing the pipe into the trench, the bedding material shall be thoroughly compacted by means of mechanical tampers the full width of trench, screened to a uniform plane on grade and recompactd where grade has been disturbed by 2" or more by refill. After the pipe has been placed to the proper grade and alignment, backfill around both sides and up to a 12" horizontal plane above the crown of the pipe with granular material as shown in standard details. Areas along side and over the installed pipe installed must be tamped in such a manner so as to provide compaction to 80% of the maximum density.

Section 314 Backfilling of Trenches-General

The backfilling includes all backfilling, ramming or rolling as required, the re-grading of adjacent disturbed areas, the replacing of drains and other surface and sub-surface structures, the placing and maintenance of temporary sidewalks and driveways, furnishing of suitable backfill material, if necessary, re-sodding lawns and replacing trees and shrubbery damaged by the contractor and all appurtenant work incidental thereto.

All lumber, rubbish and debris shall be carefully removed from spaces to be backfilled around all structures and from the areas to be filled. All trenches and excavations shall then be backfilled to the original ground surface, or as directed.

No backfilling shall be performed prior to the time that joints in pipelines are set, inspected, measured, and approved.

All excavations in stabilized and non-stabilized surface areas must be backfilled or satisfactorily bridged at the end of each day's work. Partially excavated or open trenches will not be permitted.

Puddling and/or jetting of trenches with water will not be permitted. The original surface of the trench shall be restored to the full satisfaction of the Town.

Trenches shall be carefully backfilled without causing shock to the pipe and to prevent after-settlement. The backfill shall be of specified materials, selected especially for the purpose.

If concrete buttresses have been installed, the buttress must undergo a minimum of twenty four (24) hours of curing time before backfilling over the buttress.

Every precaution shall be taken in the backfilling of excavations to prevent material so placed from falling directly upon or against any pipe, conduit or other structures in such a way as to cause the displacement of or damage to said pipe, conduit or structure. The backfilling, filling and embankments shall be brought up evenly and all eccentric loading shall be avoided.

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As the trenches are filled in and the work completed, the contractor shall, at his own cost and expense, remove and dispose of all surplus earth, stone or other material from the work, in such manner and at such point or points as he may select or provide, subject to the approval of the Town; or he may deposit the same, either with or without rehandling, at any points on the line of the work covered by the contract, if so directed by the Town; and shall leave all roads, sidewalks and other places free, clear and in good order. In case the contractor shall fail or neglect to do so, or to make satisfactory progress in doing so, after the receipt of a written notice from the Town, the Town may remove such surplus material and clear the roadways, sidewalks and other places, and the cost of said work shall be charged to the contractor.

Should there be a deficiency of proper material for refilling; the contractor shall furnish the same at his own cost and expense.

No material of unsatisfactory character shall be used in refilling, and the contractor shall not permit the trench to be used as a dumping ground for refuse.

No backfilling shall be made during freezing weather except by permission of the Town and no fill shall be made when the material already in the trench is frozen, nor shall frozen material be used in backfilling.

Backfilling may be accomplished using mechanical or power equipment, except that sufficient number of persons shall be employed to spread the backfill in layers of eight (8") inches (6") When working within SHA right-of-way and to 95% compaction and to thoroughly tamp same before the next layer is spread. Backfill shall be to a point not less than two feet (2') above the top of the pipe before any backfill is deposited directly from a machine bucket, cars or other vehicles. Only hand tampers shall be used within the two foot dimension directly above the pipe.

Every precaution shall be taken to avoid the tamping operation from contacting the main pipe and causing the concrete liner to break loose from the inside wall of the pipe.

Backfill of trenches in state and county roads, or areas to be accepted or maintained by same shall be in accordance with the requirements of the State Highway Administration and County Engineer, respectively.

Section 315 Backfilling of Trenches Open Areas

1. Fill material for trenches in open areas shall have a maximum density of not less than 100 pounds per cubic foot as determined by ASSHTO T99, method a. The top 12 inches of backfill material shall contain no rocks larger than one inch (1") at the greatest dimension. Material from two feet above pipes to 12 inches below the surface shall contain no more than 25 percent rocks, none of which being larger than four inches (4") in the greatest dimension.

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2. Backfilling is done in layers not to exceed eight inches (8") in thickness. Mechanical tampers shall be used so as to obtain maximum compaction of the material. Care shall be taken to carry the fill up evenly on opposite sides of the water line. The density of each layer of the backfill shall not be less than 90 percent per AASHTO T99.

3. If in the opinion of the Town representative, the material excavated from the trench is not of such character that satisfactory compaction can be obtained by tamping, the contractor shall remove the existing material to an approved waste area and obtain approved borrow material consisting of dry concrete sand meeting requirements ASTM C33, placed up to one foot (1') below finished grade and topped with earth meeting requirements of paragraph 302.15, 2-a below.

Section 316 Backfilling of Trenches in Paved Areas

1. A paved area is defined as those sections where water main pipe or laterals are installed in a paved public right-of-way or in a paved privately owned area, or in an area intended to be paved.

2. Fill material for trenches in paved areas shall conform to the fill material for trenches in open areas up to the top twelve inches (12") below the pavement base course. The top twelve inches (12") of backfill shall meet one of the following requirements:

A. Soil having a maximum density not less than 105 pounds per cubic foot as determined by AASHTO T99, method a, with liquid limit not exceeding 30; a plasticity index not exceeding 6; containing no stones larger than three inches (3") in the greatest dimension.

B. Special backfill, crushed stone, or bank run having a maximum dry weight not less than 115 pounds per cubic foot as determined by AASHTO T99, method a, with a liquid limit not exceeding 30; a plasticity index not exceeding 6; conforming to MSHA gradation CR 6, or gravel SB 11.

3. Backfilling is done in layers not to exceed eight inches (8") in thickness. Mechanical tampers shall be used so as to obtain maximum compaction of the material. Care shall be taken to carry the fill up evenly on opposite sides of the water line. The density of each layer of the backfill shall not be less than 95 per cent except for the top foot which shall be 100 per cent per AASHTO T99. Under state highway pavement, top one foot shall be 95 per cent per AASHTO T180 and remainder, 92 per cent per AASHTO T180.

4. If in the opinion of the Town representative, the material excavated from the trench is not of such character that satisfactory compaction can be obtained by tamping, the contractor shall remove the existing material to an approved waste area and obtain approved borrow material consisting of dry concrete sand meeting requirements ASTM C33, placed up to one foot (1') below finished grade and topped with earth meeting requirements of Section 316, 2-b above.

Section 317 Warning Tape

The contractor shall furnish and install six inch (6") wide continuous detectable tape over the entire length of each water main and service connection piping. The tape shall be installed twelve (12") above the top of the pipe. The tape is to be installed after backfilling and before final restoration. The tape shall be blue in color and bear black letters stating:

CAUTION WATER LINE BELOW**Section 318 Backfilling of Structures**

Special care will be required in backfilling around structure walls. In backfilling on both sides of foundation walls, the backfill shall be placed equally on both sides of the wall so that there is no uneven pressure against the wall surface. In backfilling against walls having one (1) surface exposed, the contractor will be responsible for damage to walls caused by backfilling prior to the completion of floors or other portions of the structure tending to brace the walls in their final position. Special precautions shall be taken to prevent the placing of heavy load upon this fill, or the infiltration of excessive water into the fill, prior to the time that the materials in the wall construction reaches the contemplated strength of the wall to resist the pressure imposed thereon. Prior to backfilling, all dunnage, refuse, and foreign materials shall be removed from the area to be backfilled.

Section 319 Clearing Street, Clean-Up and Repairs/ Existing Developments

The contractor shall remove excavated material not being utilized, immediately upon removal from trench. All construction materials and equipment during non-working hours must be stored so as not to impede traffic either direction. During working hours, material and equipment shall not impede a minimum of one-way traffic at all times. The streets during working hours shall be kept free of surplus material and in a convenient condition for travel.

The contractor shall be responsible for maintaining the streets, driveways, parking areas, etc. In clean and dust free condition in so far as the dust and dirt relates to his work. At the end of each day's work, the work area(s) shall be swept (hand or mechanical) until area is clean and free of dirt and debris.

For service line construction only, as herein before mentioned, the contractor may store, during the work day, excavated material from the trench that is suitable backfill material to the extent of the amount required to complete backfilling of the same lateral or the amount required until the end of the day's work; whichever is first. All excess material must be removed to the approved waste area.

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The contractor shall be responsible for maintaining the streets during the construction period. Temporary asphalt base paving (cold mix) shall be used, and maintained, to provide a smooth riding surface over trench areas until such time the trench areas in existing paving are permanently restored.

The contractor at his own expense shall repair any and all damage he has caused to the streets, sidewalks, shrubbery, lawns, ornamental works, real property, etc. and shall save free and harmless the Town from all suits for damages to person or property arising from or caused by this construction.

Before final acceptance of the work the contractor shall remove all equipment and material from the site; restore and/or repair all property, private or public, to a condition equal to or better than originally found.

Section 320 Maintenance of Refilled Excavations

The contractor shall maintain, at his expense, all refilled excavations in proper condition until the end of the one (1) year period following the date of acceptance of the work by the Town. All depressions appearing in the refilled excavations shall be properly refilled. If the contractor shall fail to do so within a reasonable time after the receipt of written notice from the developer and/or the Town, the Town may refill said depressions and the expense thereof shall be the responsibility of the contractor. In case of emergency the developer and/or the Town may refill any dangerous depression without giving previous notice to the contractor, and the expense of so doing shall be the responsibility of the contractor.

The contractor shall be responsible for any injury or damage that may result from improper maintenance of any refilled excavation, at any time previously to the end of the above mentioned one (1) year period.

Section 321 Tunneling, Jacking and Boring

All methods of tunneling, jacking or boring shall be performed to the requirements and satisfaction of the agency issuing the permit, and/or having jurisdiction over same.

All construction methods and materials proposed for use in tunneling, jacking, or boring shall be submitted to and approved by the Town prior to construction.

Section 322 Soil Borings and other Soil Data

The Town may have had subsurface test borings made in the area in which the work is to be performed. Such borings whether or not contained in the contract documents, are not to be considered a part of this contract and are not to be relied upon by the contractor, it being understood that the test borings were conducted solely for the benefit of the Town. The results of these borings are maintained in the Town offices and may be inspected by the contractor.

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The Town, however, neither warrants nor guarantees the accuracy or completeness of such tests nor that the conditions actually encountered in the prosecution of the work under this contract will be the same as the conditions indicated by the test borings. Each bidder shall determine to the bidder's own satisfaction the type of soil and other material the bidder will encounter in the work to be done under this contract.

Section 323 Maintenance of Traffic

The contractor shall be responsible for maintaining a normal through traffic flow. The contractor shall prepare a plan and submit it to the Town prior to or during the preconstruction meeting. Maintenance of vehicular and pedestrian traffic shall be in accordance with the appropriate jurisdictional agencies.

Section 324 Water Line Construction Methods

Scope of work - the contractor shall furnish all plans, labor and materials required for the construction of water lines and appurtenances including jointing materials and joints, laying pipe, fittings, detection tape, concrete encasements, granular foundation, testing, and incidental work necessary to complete the work as required by the contract documents.

The water mains shall be laid and maintained to the lines and grades established by the plans and specifications for the contract. Piping systems, valves and other appurtenances shall be installed where required by the contract, and unless otherwise directed by the contract, installed in accordance with component manufacturer's recommendations. Components should be, adequately supported and anchored, free from undue stress and leakage as required by the contract.

Piping and fittings for water mains shall be made from ductile iron. Ductile iron piping shall be installed in accordance with AWWA C600-05.

Pipe material shall comply with applicable ANSI, AWWA, or ASTM standards specified hereinafter and all other requirements of the specifications.

Water main pipe must be installed, undergo tests, and be accepted prior to installation of service taps.

A. Laying Pipe - Bell & Spigot

Following the trench excavation and preparation of crushed stone bedding, as specified herein under the section entitled "excavation and backfill", pipe laying shall proceed.

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All pipe and appurtenances shall be carefully lowered into the trench piece-by-piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.

Pipe shall be laid with ends abutting and true to line and grade and shall be carefully centered, so that when completed the pipe will form a conduit with uniform flow characteristics. Wood blocking of pipe shall not be allowed.

Each length or section of pipe shall be carefully inspected before installation and those containing cracks or other defects shall be removed from the site or destroyed. Extreme care must be exercised to prevent breakage when pipe is handled, bells and spigots shall be carefully cleaned before pipes are lowered into trenches. The pipes shall be lowered so as to avoid unnecessary handling in the trench. In laying pipe, special care shall be taken to insure that each length shall abut against the next in such a manner that there shall be no shoulder unevenness of any kind along the inside of the pipe. Before joints are made, each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses prepared where required to accommodate bells and joints. No pipe shall be brought into position until the preceding length has been thoroughly backfilled and secured in place. The interior of all pipes shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work. The open ends of all pipe and fittings shall be provided with a stopper carefully fitted so as to prohibit animals, dirt and other substances from entering into the pipe. The stoppers shall be kept in the end of pipe at all times when laying is not in actual progress.

Under no conditions shall pipe be laid in water or on sub grade into which frost has penetrated, nor at any time when the Town representative shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation, unless all required precautions as to minimum length of open trench and promptness of refilling are observed. In all cases water shall be kept out of the trench until concrete cradles or support, where used, and materials in the joints have hardened.

Whenever a pipe requires cutting, the cutting shall be performed in a neat and workmanlike manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe. Flame cutting of pipe by means of an oxyacetylene torch shall not be allowed.

Whenever necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, the amount of deflection allowed shall not exceed that required for the satisfactory assembly of the joint. Any such necessary deflection shall be made only in accordance with the approval of the Town, and in accordance with applicable standard detail w-8.

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Water main pipe shall be installed in such a way that no portion of the main exterior is less than one foot (1') from another utility, such as a sewer line or gas line. Any joints in a water main that are within ten feet of another utility that is crossing the water main, the joints in the water main shall be restrained with megalugs.

Walking or working on the completed pipeline except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a height of at least two feet (2') over the top of the pipe.

No pipe shall be laid within twenty five feet (25') of any place where blasting is being performed. In all cases the end of the pipe shall be provided with a stopper, carefully fitted to the pipe to prevent any substance or animals from entering. In rock excavation, the end of the pipe shall be carefully protected from all blasts, and the excavation shall be fully completed at least ten feet (10') in advance of the laying of the pipe.

If, at any time before the completion of the contract or warranty period any broken pipes or any defects are found in the water lines or in any of their appurtenances; the contractor shall cause the same to be removed and replaced by proper material and workmanship, without compensation.

Where pipe connects with structures such as vaults, etc. there shall be a pipe joint or coupling within one foot (1') maximum of the limit of the structure.

Minimum depth of cover is forty two (42") measured from finished grade to top of pipe.

B. Laying pipe - Mechanical Joint

The last eight (8") inches outside of the spigot and inside of the bell of mechanical joint pipe shall be thoroughly cleaned of foreign matter. The cast iron gland shall then be slipped on the spigot end of the pipe. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland. All of the bolts shall be inserted in the joint and the nuts screwed up tightly with the fingers. All nuts shall be tightened with an automatic cut-off torque wrench. The torque setting for various sizes of bolts shall be as follows:

<u>Size, Of Bolt (inches)</u>	<u>Torque Setting (lb./ft).</u>
5/8	55
3/4	80
1	110

Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on all parts of the gland.

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C. Joints

Before joints are made, the contractor shall thoroughly clean and inspect all bell and spigot ends for defects.

Where gasket joints are used, the gasket shall be removed, if possible, from the retainer, thoroughly cleaned and checked for defects, and then reassembled. Gasket shall be fully seated in retainer and facing in the correct direction. Lubricant shall be used and as specified by the manufacturer, for potable water systems.

All joints shall be watertight and any leaks or defects discovered shall be immediately repaired.

D. Fittings

All tees, crosses, bends, etc. shall be mechanical joint ductile iron fittings and shall be installed at the locations indicated on the drawings, or as directed by the Town.

All fittings, such as valves, tees, crosses, bends, valves, reducers, caps, crosses, etc. shall be installed with mechanical wedge-action restraints as specified herein or as shown in the standard detail drawings or as directed by the Town. Concrete thrust blocks shall also be required unless the pipe joints are restrained the appropriate distance from each fitting or valve as required by section 310.

Install at least two feet (2') of straight pipe between all fittings. When megalugs are used on tee fittings, no joints are permitted within five (5') feet of the tee, as measured on centers. Provide enough straight pipe to maintain a horizontal distance of five feet (5') from center of tee to center of valve.

In the event concrete blocking or buttresses are used together with megalugs, the buttresses require a minimum of twenty four (24) hours of curing time before backfilling and a minimum of five (5) day of curing time before main can be pressurized for leakage testing.

E. Gate valves, valve boxes, air release valves and 2" blow-off assemblies

Gate valves and valve boxes shall be placed along the water mains where shown on the drawings or where designated by the Town and shall be buttressed or anchored in accordance with the standard details or as shown on the drawings. All main line valves shall be restrained to the connecting pipe with mechanical restraints such as megalugs.

Where valves are placed on the end of a pipe line, a 2-foot minimum length of pipe shall be placed between the valve and the concrete buttress.

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A valve box and cover shall be placed over all valves as shown on the standard detail, W-9, and drawings for direct burial. The valve box shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished grade or 1/4-inch below the pavement. The box shall not rest directly on the valve, but rather be adequately supported by compacted granular material as shown on std. Detail W-9.

Boxes shall be of the wide mouth or wide bell style, so as to avoid contact with the valve body or causing weight to bear on the valve body or adjoining pipe.

Valve boxes shall be installed plumb.

F. Fire Hydrant Installation

Fire hydrants shall be installed at locations shown on the drawings or as designated by the Town. Do not install hydrants in a swale.

The pipe connecting the hydrant to the water distribution system shall be six inch (6") diameter, ductile iron. The trench and bedding shall be equal in all respects to 6-inch water distribution piping. Forty two inches (42") minimum cover shall be provided.

The gate valve shall be located on the 6-inch line connecting the hydrant to the water main as shown on the standard detail drawing. Where the 6-inch pipe is connected to the water main by a tapping sleeve and valve, the tapping sleeve and valve shall serve as the required gate valve on the 6-inch line connecting the Hydrant to the water main. An additional intermediate gate valve shall not be required.

Movement of pipe, gate valve and hydrant shall be restrained by both 3/4 inch rods or mechanical restraints and concrete thrust blocks as shown on std. Detail W-17. Fire hydrant shall be installed plumb. Neither blocks nor mechanical restraints alone are sufficient, both must be provided. However, unlike blocks for the water main pipe which require five (5) days of curing time, after waiting 24 hours for the concrete at the hydrant to cure, the hydrant can be backfilled and the hydrant and associated main pipe may be immediately pressurized for leakage testing.

One third cubic yard of 3/4-inch gravel shall be placed under and around the hydrant base. This gravel shall provide drainage for the hydrant.

The hydrant shall be painted red and paint shall be maintained during the guarantee period.

G. Hydrant Marker

Fire hydrants shall also be furnished with a spring-mounted reflective fiberglass rod marker.

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H. Pressure Reducing Valve and Vault (mainline)

When pipes on different pressure zones are interconnected, a division valve (normally closed) or a pressure reducing valve and vault shall be installed as per std. Details, W-23, W-24 and W-25.

I. Thrust Blocking & Restraints

All water main valves, plugs, caps, tees, horizontal and vertical bends, reducers, crosses, etc. shall be provided with mechanical restraints. Concrete thrust blocking shall also be provided unless the pipe joints are restrained the minimum appropriate distance from each fitting or valve as required by section 310.

Concrete blocks shall be installed as shown in the standard details with the dimensions called for. Vertical and horizontal thrust blocks shall be made of concrete having a compressive strength of not less than 2,000 PSI after 28 days. The blocks shall be placed between solid ground and the fitting(s) to be anchored. The blocking shall, unless otherwise specified or shown, be located so as to contain the resultant force in such a way that the pipe and fitting joints will be accessible for repair.

Where field conditions prohibit installation of effective thrust blocking, pipe joints shall be restrained by mechanical harness rods and clamps or mechanical joint restraints. Such configurations shall be installed as directed by the Town's engineer. Mechanical restraint components shall be made of corrosion-resistant material or suitably protected against corrosion.

Pipe joined with mechanically restrained joints can not be deflected more than five (5) degrees or more than the restraint manufacturer's recommended limit, which ever is less.

Concrete thrust blocks require a minimum of twenty four (24) hours of curing time before backfilling can begin and five (5) days of curing time before the main can be pressurized for leakage testing. However, since fire hydrants have both concrete blocking and mechanical restraints, the main pipe in the vicinity of the fire hydrant can be pressurized immediately after backfilling, if no other non-hydrant blocks are involved with the main section.

If contractor desires to initiate the use of mechanical restraints, such as megalugs or uni-flanges, in lieu of concrete thrust blocking, see section 310.

J. Cradles and Encasements

Where required by the Town representative, pipes shall be placed on a formed concrete cradle. Unformed concrete shall be placed around pipes for haunching and encasement. Concrete for cradles shall have a minimum strength of 2500 P.S.I. at 28 days (class b).

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Concrete shall be placed in trenches to support pipes and to the dimensions shown on the standard details or the drawings. Concrete for bedding and encasement shall have a minimum strength of 2500 P.S.I. at 28 days (class b).

In placing concrete cradles and encasements, the methods used shall be such as to prevent mud, earth, clay or other foreign materials from becoming mixed with the concrete.

In no case shall "dry-mix" concrete be placed in the trench without permission of the Town.

Section 325 Connection to Existing Water Main

Connection to an existing main shall be performed in strict accordance with the specifications herein, mde requirements and under the direction of Town's representative. The contractor shall furnish all fittings, material, labor, etc. to make the connection to the satisfaction of the Town regardless of whether such fittings and materials are shown on the plans. The contractor shall consult the Town's office in this regard prior to start of any work under the contract.

The contractor and/or his sub-contractor shall be held liable for any damage to existing water lines where such damage is due to negligence and will be required to make the necessary repairs as well as to pay for any damages caused by the lines being out of service.

Connection to an existing line, or main, shall be coordinated with the Town. Where temporary shutting off a section of existing line is required, the Town shall be notified at least 72 hours in advance of the desired connection date. Contractor shall notify Ms. Amy Simmons, Town clerk, at 301-432-5795. The Town clerk will notify the customers of the shut down. The contractor is prohibited from operating valves on water systems in service without written authorization from the Town or Bobby Mose, Town of Boonsboro's Superintendent. Bobby Mose is at telephone 301-730-5425.

Section 326 Testing For Acceptance

All installed water lines shall be tested in the presence of a Town representative together with a representative of the contractor in the manner prescribed in the "testing" section of these standard specifications. It is the intent that the described testing procedures are to be systematically carried out as an integral part of the pipe-laying procedures. Failure to accomplish successful testing results will be considered as non-completion of construction.

Section 327 Construction Methods for Service Connections

Scope of work - the contractor shall furnish all plant, labor and materials and perform all operations required for the construction of water service connection and appurtenances including all pipe casing, service saddles, corporation stops, meters, meter vaults, pressure reducing valves, concrete, granular backfill, testing and incidental work required for a complete and functional installation as shown on the drawings and standard details.

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Included in this section are specifications which shall apply to service connections that are installed to both an existing water main as well as a new water main.

In both cases, the water main shall be uncovered and cleaned, a service saddle shall be installed when required, the main tapped, the service connection installed to the property line in either an open cut trench or by boring/jacking and the use of casing piping.

Bedding for copper and polyethylene service connection tubing shall be silica sand.

Service connections constructed under the full width of the paved surface, regardless of construction method, shall be installed within a casing pipe from edge or paving to edge of paving or as required by the governing agency. Casing for service piping 2" and smaller shall be SCH. 40 PVC as specified in division IV, section 413, "materials". The casing pipe shall be sealed at each end with approved end seals.

A water meter vault with meter, yoke, shut off valve, and angle dual check valve shall be installed at the property/easement line. A capped stub of service connection piping shall be installed to extend 2' beyond the meter vault to facilitate the property owner's connection by the plumber.

Water service connections shall be installed as shown in the standard details and shall be laid in accordance with the specifications herein for water line pipe.

Water service installation can begin after the water main has been accepted for service. All tapping of the water main for service connections is done when the main is at normal full system pressure.

Section 328 Standard Water Service

A. Standard Water Service

Standard water service refers to water service for a single family residence or where a meter of 5/8 x 3/4 size is to be installed. Unless otherwise specified, all components shall be manufactured by the Ford Meter Box Company.

B. Service Saddles

Service saddles shall be used with (existing) PVC pipe, 4" and larger. The service saddle shall be manufactured with an approved tapped and threaded opening, capable of accepting a corporation stop and service lateral of the size and type designated to be served.

Service saddles that employ two clamps around the pipe are preferred to those that provide only one clamp.

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C. Tapping Sleeves

Tapping sleeves shall be used with ductile iron pipe, measuring in size from 4" and larger and of the class as specified herein. The tapping sleeve shall be manufactured so as to be capable of withstanding a working pressure of 200 P.S.I. It shall possess a recessed outlet flange capable of withstanding a working pressure of 125 P.S.I.

D. Tapping Valve

Tapping valves shall conform to the same specifications as gate valves described herein, except that one connecting end shall be flanged with recess to match the tapping sleeve.

E. Type "K" Copper Service Pipe

"K" copper service pipe shall be used where designated on the contract drawings or as indicated in the specifications and can vary in I.D. size from 3/4" to 2" diameter.

Water service copper tubing must be one continuous piece of with no fittings or splices in lengths less than 100 feet.

F. Blank

G. When installing corporation stops, the main shall be tapped at a 45-degree angle to the horizontal.

H. Service Fittings

Fittings for copper service piping shall be of the pack joint style.

Fittings for PE C.T.S. piping shall be brass compression type fittings. Stainless insert stiffeners shall be used with these fittings. Service piping shall be installed as a continuous length of tubing. Joining of short sections of pipe by use of couplings is prohibited. Couplings may be used only when the service length exceeds the standard length of tubing.

I. Meter Settings

All meter settings for service pipe less than 1-1/2" diameter shall be with a yoked arrangement. All meter settings for 1-1/2" and 2" diameter service pipe shall be with a flanged arrangement. The materials composing both meter settings shall be described more particularly in section 305 and presented in the standard details.

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J. Pressure Reducing Valves

When specifically required by the contract drawings, pressure reducing valves shall be used in a single or tandem arrangement, with 3/4" through 2" service pipe, when the water pressure to the customer's system is in excess of the pressure rating of that system. They shall have female inlet and outlet threads. They shall be installed with the meter in either of the two types of meter settings by means of various yoke, piping, and valve arrangements in one of the approved meter vaults. In both the single and tandem meter settings, the pressure reducing valves shall connect to the appropriate service piping by means of compression fittings. See standard detail W-16.

K. Water Meters

Water meters of 5/8 x 3/4 in size are obtained thru the Town. Water meters for 3/4" through 2" service piping shall be of the disc type. Meters shall be installed on a meter setting, in a meter vault, with or without a pressure reducing valve at the right-of-way/easement line of the property. Meters shall range in size from 5/8" x 3/4" through 1-1/2" and are capable of flow rates from 20 to 100 G.P.M. water meters shall have a readout in gallons on a six digit odometer type dial.

Water meters of size 3/4 x 5/8 must be obtained from the Town.

Meter vaults can range in diameter from 18" to 36" and are generally 36" in height. They are constructed of either precast concrete, or P.V.C. material. Vaults house the meter, yoke, and pressure reducing valve, and backflow preventer at the customer's property or easement line. Vaults shall be equipped with either single or double lids capable of use in traffic or non-traffic areas. Meter vault lids must be obtained from the Town.

Section 329 Materials

Service connections shall consist of various types and kinds of materials, as shown on the contract drawings or specified under the section entitled "materials". It shall be the contractor's responsibility to prove material compatibility so as to provide the Town with an integrally sound and operational facility. Generally, where the main line and service lines are constructed under the same contract, they shall be of materials proven to be compatible and accepted by the Town.

For reasons of galvanic corrosion, ductile iron water mains should be used with copper water service lines and not with PE lines. Similarly, PVC water mains should be used with polyethylene service lines.

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Section 330 Installing Pipe

Following the trench excavation and preparation of the granular bedding material by the contractor, as specified in the section entitled "excavation and backfill," pipe laying shall proceed toward the property or easement line. Each section of pipe shall be carefully inspected before installation and those containing defects or damage shall be removed from the site or destroyed. Care must be exercised to prevent damage to the pipe when it is handled. Any pipe joints that must be made will be performed in strict accordance with the pipe manufacturers' specifications. The interior of the service pipe shall be kept clean and free of any foreign matter from the time it is received on the job site until it is put into service. The open ends of all pipe and appurtenances shall be provided with a plug or stopper so as to keep dirt and other substances from entering.

Under no conditions shall service pipe be laid in mud or water or on sub grade into which frost has penetrated, nor at any time when the Town representative shall deem that there is the formation of ice or the penetration of frost at the bottom of the excavation, unless all precautions as to minimum length of open trench and promptness of refilling are observed.

Walking or working on the completed pipeline except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a height of at least two feet (2') over the top of the pipe.

In rock excavation, the end of the pipe shall be carefully protected from all blasts, and the excavation shall be fully completed at least five feet (5') in advance of the laying of the pipe.

If, at any time before the completion of the contract or warranty period, any broken pipes, or any defects are found in the water service lines or any of their appurtenances, the contractor shall cause the same to be removed and replaced by proper material and workmanship, without compensation.

All joints shall be watertight and any leaks or defects discovered shall immediately be repaired.

Section 331 Testing for Acceptance

All installed water services shall be tested in the presence of a Town representative in a manner acceptable to the Town. It is the intent that the testing procedure is to be carried out as an integral part of the pipe-laying procedure. Failure to accomplish successful testing results will be considered as non-completion of construction.

Section 332 Laboratory Tests

The materials listed below shall require advance and periodic laboratory tests as indicated, and shall be sampled in accordance with the methods of the ASTM and as directed by the Town. Preliminary samples of materials for advance laboratory tests shall be submitted at least two (2)

weeks prior to starting delivery of such materials to the site of the project.

The testing laboratory shall furnish both the Town and the contractor with two (2) copies of the reports showing the results of such tests and the reports shall be considered as sufficient evidence of the acceptance or rejection of quality of the materials tested. The specifications for and the method of testing will be found under the detailed specifications for the particular method involved. All samples shall be properly packed when shipped and shall be identified with a tag and marked to indicate the producer, place of production, location where material is to be used, and the portion of these specifications under which submitted.

Liber 11 Folio 0314

Acts, Ordinances,
Resolutions - Towns
Clerk of the Circuit Court
Washington County

MATERIAL	TEST FREQUENCY SIZE	SAMPLE Size	SHIPPING CONTAINER
Cement	ADVANCE AND EACH 400 BBL From each Source of supply	8 LBS.	CANVAS SACK.
FINE AGGREGATE STONE	ADVANCE, FIRST SHIPMENT, Then, each 200 Tons	STONE	STRONG SACK.
COURSE AGGREGATE &	ADVANCE, FIRST SHIPMENT Then, each 200 Tons	STONE Gravel 50 lbs SLAG 80 LBS	STRONG SACK.
CONCRETE CYLINDERS	ADVANCE, THEN EACH 50 cu yds	3 CYLINDERS PER TEST 1 BROKEN AT 7 DAYS, 2 AT 28 DAYS	WOOD
BRICK	ADVANCE, THEN EACH LOT OF 50,000 OR LESS FOR EACH GRADE	5 BRICKS	WOOD
JOINT COMPOUND	EACH SHIPMENT	5 LBS.	SEALED CAN
PVC PIPE	ADVANCE, AND AS REQUIRED BY ENGINEER, WITH TEST SPECIMENS LIMITED TO A MAX OF 0.5% OF SIZE AND STRENGTH	NOT LESS THAN 2 PIECES FOR EACH SIZE	SEALED CAN
DUCTILE AND CAST IRON PIPE	ADVANCE, AND AS REQUIRED BY ENGINEER, WITH TEST SPECIMENS LIMITED TO A MAX OF 0.5% OF SIZE AND STRENGTH	NOT LESS THAN 2 PIECES FOR EACH SIZE	SEALED CAN
COPPER PIPE	ADVANCE, AND AS REQUIRED BY ENGINEER, WITH TEST SPECIMENS LIMITED TO A MAX OF 0.5% OF SIZE AND STRENGTH	NOT LESS THAN 2 PIECES FOR EACH SIZE	SEALED CAN

Section 333 Shop Tests

All materials shall be tested at the shop or plant of, and by, the producer. Each manufacturer of such materials shall be fully equipped to carry out the tests required. Upon demand of the Town the manufacturer shall perform such additional number of tests as the Town may deem necessary to establish the quality of the material offered for use. The Town shall be furnished with certified records or reports of the results of all tests that have been made as specified. The Town may require additional tests by an independent testing laboratory.

Meters must be tested for accuracy of registration in accordance with AWWA C-705 recommended procedure for testing cold water meters.

Certification of tests in accordance with AWWA C-705 and the 300 P.S.I.G. static pressure test in accordance with a.3.2. of appendix to C700 must be furnished upon shipment of meters.

Section 334 Field Test

All water lines and appurtenances shall be tested in the field in the presence of a Town representative, together with a representative of the contractor, in the manner prescribed herein.

It is intended that the herein described testing procedures are to be systematically carried out as an integral part of the pipe-laying procedures. Failure to accomplish successful testing results may be considered as non-completion of construction.

The contractor shall furnish without charge, all labor and equipment necessary to complete specified testing.

Any section of water line showing leakage in excess of the amounts specified herein shall be repaired or replaced by the contractor at no cost to the Town or developer.

Where any section of main is provided with concrete thrust blocking or buttressing (with exception to the buttresses on fire hydrant installations,) the pressure test shall not be made until at least five (5) days have elapsed after the concrete thrust blocking was installed.

Sufficient backfill shall be placed prior to filling with water and field testing to prevent lifting of the pipe. When local conditions require that the trenches have to be backfilled immediately after the pipe has been laid, the testing may be carried out after backfilling has been completed, but before placement of permanent surface. Should the contractor elect to backfill the entire trench, or any portion thereof, prior to testing, it shall be the contractor's responsibility to locate and repair any leaks which occur during this test.

Section 335 Leakage Test - Procedure for Testing Water Mains

A. General

The test section of main pipe shall not exceed 1,000 feet in length where practical.

A hydrostatic pressure and leakage test shall be conducted. The contractor will furnish the pump, gauge and measuring device for the pressure and leakage testing. Leakage is defined as the quantity of water to be supplied to the pipe section under test necessary to maintain the specified leakage test pressure. The duration of formal leakage tests shall be maintained for a period of not less than three (3) hours. The contractor will furnish the pump, pipe, connections, gauge, meter and all other necessary apparatus, as shown on std. Detail W-45.

Warning: the testing methods described herein are specific for water pressure testing only. These procedures should not be applied for air-pressure testing because of serious safety hazards involved with compressed air. Also, main pipelines intended for buried surface should generally be tested with the backfill in place.

B. Test Pressure Required

The pressure required for testing the section (or segment) of main under test is that pressure at the test pump that will cause the test pressure in the main to be 50 PSI above the normal working pressure.

Normal working pressure at a point in the main is calculated by taking the elevation of the point and subtracting it from 592 feet and multiplying the result times 0.43. For example, at a tap in the main at 410 feet elevation, the normal working pressure is 592 feet minus 410 feet equals 182 feet. Then, 182 feet times 0.43 equals 78 PSI.

Test pressure at pump is calculated in two steps as follows:

Required test pressure at the tap for the pump is calculated by taking the elevation of the tap and subtracting it from 708 feet and multiplying the result times 0.43. For example, at a tap in the main at 410 feet elevation, 708 feet minus 410 feet equals 298 feet. Then 298 feet times 0.43 equals 128 PSI test pressure required.

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Filling Main with Water

Before filling the main with water, the Town's representative should operate all the valves on the section to be tested to verify the valves are correctly open or closed. Before applying the specified test pressure, all air shall be expelled from the section of pipe undergoing the test. If permanent air vents are not available at the high points in the piping, the contractor shall install corporation cocks to permit the expulsion of air as the pipe line is filling with water. Following removal of the air, the corporation cocks are closed off. When filling the pipe line, it is important to fill it slowly to permit the air to escape over top of the incoming water. After the pipeline appears to be filled, the pressure should be applied and any remaining air bled off at valve points. The pipeline pressure shall be allowed to stabilize at the test pressure before starting any formal tests. After completing the leakage tests, the temporary corporation cocks should be removed and the tapped holes plugged off with an approved brass plug.

C. Leakage Test

All of the air shall be expelled from the test section to the satisfaction of the Town's representative. The pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Town.

Once the leakage test period is started, the water pressure should not be allowed to vary by more than five (5) PSI. If or when the water pressure drops by 3 or 4 PSI, the operator must add makeup water to boost the pressure back to test pressure. The amount of makeup water supplied during the test must be measured by an appropriate meter or an approved calibrated cylindrical-wall bucket can be used.

If "D" is equal to the interior diameter of a bucket, then the volume of water in 1 inch of vertical depth is equal to:

$$\text{VOLUME OF 1-INCH DEPTH} = 0.0034 (D \times D) = \text{GALLONS}$$

For example, for a 12-inch diameter bucket, each inch of water is equal to $0.0034 \times 12 \times 12 = 0.49$ gallons. And if during the 2-hour test period, the water level in the bucket dropped by 5 inches, then the corresponding water used was $5 \times 0.49 = 2.45$ gallons or 1.22 gallons per hour.

D. Leakage Test Acceptance Criteria

No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = (S) (D) (\text{SQUARE ROOT OF } P) / 133,200$$

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In which L equals the allowable leakage in gallons per hour, S is the length in feet of the pipe section tested, D is the nominal diameter of the pipe in inches, and p is the test pressure applied during the leakage test, in pounds per square inch.

For example, for 1300 feet of 8-inch pipe at 95 PSI, the allowable leakage rate would calculate to: $1300 \times 8 \times \text{square root } 95$ divided by 133,200 and equals 0.761 gallons per hour.

All visible leaks must be corrected.

All underground leaks detected, using electronic and sonic instrumentation, must be corrected.

ALLOWABLE LEAKAGE FOR PRESSURE PIPE SYSTEMS IN U.S. GALLONS PER HOUR					
NOMINAL PIPE SIZE, INCHES	Test Pressure psi				
	50	100	150	200	250
ALLOWABLE LEAKAGE PER 1000 FEET					
4"	.19	.27	.33	.38	.43
6"	.29	.41	.50	.57	.64
8"	.38	.54	.66	.76	.85
10"	.48	.68	.83	.96	1.07
12"	.57	.81	.99	1.15	1.28

Section 336 Testing Equipment

A pressure test pump shall be provided. The pump shall be capable of providing a minimum flow of six (6) GPM and pressure of 300 PSI or greater. The pump shall be a Hydro-Test II, or model no. 36452 manufactured by Wheeler-Pilor International or equal. A meter to measure make-up water shall also be installed. The pump, pipe connections, taps into the pipe, all necessary apparatus labor and water, shall be furnished by the contractor. See standard detail W-45.

Section 337 Disinfection

When the mains are completed, each section of main shall be chlorinated and tested.

All labor, tools, materials, and test equipment necessary for making the tests and chlorinating the mains shall be furnished by the contractor. The contractor shall perform all chlorination tests, using equipment and procedures approved by the Town. The water required for testing and chlorinating the water lines will be supplied by the Town. The contractor shall notify the Town, in writing; at least two (2) days in advance of the dates planned for testing and chlorinating the water line sections.

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Disinfection of water mains shall be performed by the contractor, as specified and directed, and shall conform to AWWA C-651-05. The contractor shall provide all labor, materials, and equipment for and shall perform the sterilizing operations complete under the direction of the Town representative.

Procedure: The following methods may be used to apply the chlorine subject to the approval of the engineer: liquid chlorine gas - chlorine mixture/water. A chlorine mixture shall be applied by means of a chlorinating feed device, or, if approved by the Town, chlorine gas may be fed directly from a cylinder through proper regulating devices. Any such arrangements must be provided with means for preventing the backflow of water into the chlorine feed system.

The following chlorine compounds may be used: calcium hypochlorite (HTH, perchloron, pittchlor, hoodchlor, which contain approximately 70 percent available chlorine).

A calcium hypochlorite solution containing 5 percent available chlorine shall be used, which can be prepared by adding 12 pounds of 70 percent HTH, perchloron, pittchlor, or hoodchlor to 20 gallons of water. This is first made into a paste and then thinned to a slurry water and then added to the unit or piping.

The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the main or structure to be disinfected that the dose of available chlorine applied shall be 50 PPM or enough to produce residual chlorine of 10 PPM after 24 hours contact.

Water for filling the mains or works should be introduced slowly and the quantity of chemical applied proportionately to the rate of water introduced. The proportion should be equivalent to one pound of available chlorine to each 2400 gallons of water if chlorine gas is used, or one pound of 70 percent hypochlorite to each 1680 gallons of water. This is equivalent to a dosage of 50 PPM chlorine.

After the chlorine has been in contact with piping and works for 24 hours or longer, samples collected should indicate a residual chlorine concentration of 10 PPM or more.

During the 24 hour period, all valves and hydrants in the section being tested shall be operated in order to disinfect all working parts of the system.

Following the chlorination, the main should be flushed as soon as possible, preferably within 24 hours, because prolonged exposure to high concentrations of chlorine might damage the asphaltic seal coating on the main interior surface. Water shall be flushed from the new pipeline until the residual chlorine content is no greater than 2.0 mg/l. The contractor shall be responsible for proper disposal of all water used in the disinfection process, including that flushed from the pipe. The method of disposal shall be approved by the Town. If required by the Town, the contractor shall be responsible for neutralization of chlorinated water to a residual chlorine concentration of no greater than 2.0 mg/l. Such neutralization shall be performed at no additional cost to the Town.

Section 338 Bacteriological Test

The superintendent for the Town of Boonsboro shall conduct bacteriological sampling of water lines so as to meet the department of the environment (MDE) standards for coliforms. The contractor shall be responsible for providing a completed piping system which meets all testing requirements. The Washington County Department of Water Quality shall provide the laboratory test equipment and perform the testing of the bacteriological samples collected by the superintendent.

Section 339 Testing Water Service Lines

Leakage testing of the water service lines may proceed after the water main has been leakage tested and accepted.

After tapping the main, running the service piping, and installation of the service line piping and fittings in the meter vault, the corporation cock should be verified that it is in the full open position. Then air should be bled from the meter end of the line and the line flushed until water is clear. Then the line is valved off, at the meter, while under full system water pressure.

Acceptance testing consists leaving the line pressurized for at least thirty (30) minutes. Any visible seepage of water is cause for rejection of the installation. Backfilling can begin after a successful pressure test result.

Section 340 Concrete

Sets of four (4) cylinders will be made for each class of concrete used on any one day's operation, but not less than one set for every fifty (50) cubic yards of concrete poured. Samples from which test specimens are to be molded will be secured in accordance with "fresh concrete, sampling" ASTM C 172-54. Specimens will be made and cured in accordance with "making and curing concrete compression and flexure test specimens in the field" ASTM C 31-66. One specimen will be tested at the age of seven (7) days and two (2) at the age of twenty- eight (28) days, all in accordance with "compressive strength of molded concrete cylinders test" for ASTM C 39-66.

A. Preliminary Tests

1. The contractor shall obtain the services of a testing laboratory which shall, in advance of the beginning of operations, make preliminary determination of controlled mixes, using the materials proposed and consistencies suitable for the work, in order to determine the mix proportions necessary to produce concrete conforming to the type and strength requirements called for herein. Aggregates shall be tested in accordance with the following ASTM specifications: C 29-69, C 40-66, C 127-68, C 128-68 and C 136-67. Compressive tests shall conform to ASTM specifications C 39-66 and C 192-69.

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2. Prior to the beginning of concrete operations, the Town shall receive a statement from the testing laboratory of the proportions proposed for the different concrete mixtures required for the work. This statement shall be accompanied by a report in detail showing at least four (4) different water-cement ratios for each brand of cement to be used, and 7-day and 28-day concrete strength obtained. The strength determinations shall be based on not less than four (4) concrete test specimens for each age and each water-cement ratio.

3. The tests shall establish a curve representing the relation between the average strength of the concrete at 28 days, or an earlier period, and the water cement ratio which shall be established for a range of all strengths and ages called for on the drawings. The water-cement ratio to be used in the structure shall be that corresponding to a point on the curve established by these tests, representing strength of concrete 15% higher than the minimum ultimate strengths called for.

4. The results of all preliminary tests shall be submitted in duplicate as soon as available, for approval by the Town.

5. The Town shall have the right to make adjustments in concrete proportions if necessary, to meet the requirements of the specifications.

6. In the event that the contractor furnishes reliable test records of concrete made with materials from the same sources and of the same quality in connection with current work, then all or part of the strength tests specified hereinbefore may be waived by the Town, subject, however, to any provisions to the contrary as required by building codes or ordinances of the governing authority.

B. Field Tests

1. During concrete operations, the Town will arrange to have slump tests and test cylinders made to determine whether the concrete as being produced complies with the standards of quality specified. Tests shall be in accordance with section 205 "tests". The contractor shall provide, at no cost to the district, the required test cylinders.

2. Whenever it appears that tests of the laboratory cured cylinders fail to meet the requirements set forth in section 4.3 of ACI 318-71, the Town shall have the right, at the contractor's expense, to:

A. Order changes to the proportions of the mix to increase the strength.

B. Require additional tests of specimens cured entirely under field conditions.

C. Order changes to improve procedures for protecting and curing the concrete.

D. Require additional tests in accordance with "standard method of obtaining and testing cores and sawed beams of concrete", ASTM C42-68.

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3. If the above tests fail to prove that the questionable concrete is of specified quality, the contractor shall replace such portions of the concrete work as the Town directs, all at no expense to the Town.

4. In the event that the concrete is placed during freezing weather or that a freeze is expected during the curing period, an additional cylinder will be made for each set, and it will be cured under the same conditions as the part of the structure which it represents.

5. In addition to the above, slump tests will be made at random with a standard slump cone with one test made on each ten (10) cubic yards of concrete place; also, slump tests will be made on the test cylinder concrete.

6. The Town reserves the right, if it elects, to retain the services of a testing laboratory for inspection at the mixing plant. The contractor shall make no changes from the approved mix in the source of brand materials used in the concrete without the prior approval of the Town. The Town reserves the right to have periodic checks made to ensure against such changes.

Section 341 Soil Compaction Testing

At the Town's option, the Town may employ an independent soils testing firm to monitor the structural backfill soils compaction to verify that the compaction meets contract requirements.

Section 342 Electronic-Sonic Testing for Leaks

At any time after leakage testing of the water mains has been completed, the Town reserves the option to employ a leak-detection technician who employs electronic-sonic equipment to search for water leaks. If the technician determines that a leak is present in a water main or service piping that is still under warranty, then the contractor shall excavate and make necessary repairs to stop the leak at no cost to the Town. If the contractor excavates and no leak is apparent, then the Town will reimburse the contractor for the costs of excavation and restoration.

Section 343 Restoration of Surfaces

The contractor shall furnish all plant, labor, materials and equipment to perform all operations required for removal of temporary surfaces, replacement of permanent surfaces and disposal of any excess or unsuitable material.

Section 344 Restoration Within Existing Developments

A. Driveways, Private Roadways and Parking Areas

1. Bituminous Asphalt Surfaces

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A. The existing pavement shall be cut back a minimum distance of twelve inches (12"), twenty four inches (24") when within SHA right-of-way on both sides of the trench and all material removed to the depth as outlined in the standard details. All cutting shall be by sawing. If the contractor has disturbed or damaged, by his operations, the pavement outside of the trench area, the cut back shall extend to the most distant point of the damage or disturbed area.

B. If the distance from the cut back to the edge of the existing pavement is less than two feet (2'), the pavement shall be removed the full width and depth to the edge of existing pavement at the expense of the contractor. After the removal of all pavement and backfill material to the sub base of the new pavement, the surface shall be graded to a uniform plane and compacted with heavy duty rollers or tampers that will produce a minimum of 5000 lbs. Per square inch.

C. The asphalt material and placement of same shall be in full accordance with the latest edition of the Maryland State Highway Administrations "specifications for materials, highways, bridges and incidental structures".

2. Stabilized Granular Surfaces

The surface shall be graded to a uniform plane with granular material to the kind and elevation existing before construction. The surface shall be compacted with heavy duty rollers that will produce a minimum of 5000 lbs. per square inch.

B. Town and County Roads

The contractor shall restore county roads or streets in accordance with the permit requirements and/or as shown on standard detail W-40.

C. Lawn and Grassy Areas

Whenever the surface of the ground has been disturbed in the course of operation under the contract, the final graded surface shall be stabilized by seeding, sodding, planting or other methods approved by the district to prevent erosion. Seeding shall be performed only in non-cultivated field areas. Other disturbed areas, such as residential lawns and other property, shall be sodded or seeded as directed by the Town.

Furnish and spread a minimum of four inches (4") of topsoil over areas to be sodded or seeded. Topsoil shall be free of stones, sticks, waste material and similar debris. Topsoil shall be spread only when prepared to follow up with fertilizing and seeding. Fine grade to finished lines, grades and contours, fertilize and seed, all at such times as will meet with the approval of the Town.

The topsoil having been spread and raked spread the following:

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Hydrated lime - 60 lbs. Per 1000 sq. Ft. (or) agricultural ground limestone - 100 lbs. Per 1000 sq. Ft
10-20-10 fertilizer - 25 lbs. Per 1000 sq. Ft.

Delay seeding and/or sodding until after a heavy rain or watering and not sooner than a week after applying fertilizer.

Sod shall contain viable grass of a similar type to the surrounding area. Sod shall be carefully placed on the prepared soil surface in such a manner as to blend in with the adjacent undisturbed area.

All seed used shall be labeled in accordance with the U.S. Department of Agriculture rules and regulations under the Federal Seed Act in effect at the time of purchase, which shall be later than the contract date hereof. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable. Seed shall not be more than one (1) year old.

Seeding and planting shall be as follows unless otherwise directed by the project representative.

Level to 30 degree sloped areas

Percentage

Seed Parts Purity

Kentucky 31 Fescue 50 to 95% Annual Rye Grass 15 to 98% Kentucky Blue Grass 25 to 85%

Red Top 20 to 90%

Spreading Rate - 2.5 lbs. Per 1000 sq. ft.

1. Mulching

A. On all slopes not sodded mulch shall be furnished and placed after the slopes are seeded.

B. Mulch shall consist of hay, wheat, rye or oat straw, salt hay or peat moss. Mulch shall be free of sticks larger than one fourth (1/4) inch diameter, stones clay or other foreign material. All material proposed for use as mulch shall be subject to the approval of the Town.

C. Mulch shall be applied at an average rate of one hundred fifteen (115) pounds per one thousand (1,000) square feet so as to provide a loose depth of from one and one half (1-1/2) inches to three (3) inches. Mulch may be applied by any method commonly used for applying mulch subject to the approval of the Town.

D. Mulch adjacent to structures shall be secured by the "peg and string" method using stakes or pins driven into the ground on five (5) foot centers or less. Binder twine shall be strung between adjacent in straight lines and crisscrossed diagonally over the mulch, after which the stakes shall be driven in to draw the binder twine down tight onto the mulch.

E. On the other areas away from structures either the "peg or string" or the, "asphalt spray" or, a light weight fibrous material mulch netting stapled to the ground may be used. The asphalt binder shall be emulsified asphalt and shall conform to the Maryland State Highway Administration designation SS-1, Grade AE.

2. All mulched areas shall be sprayed with asphalt binder so the surface has a uniform appearance. The binder shall be uniformly applied to the mulch at the rate of approximately one and seven

Tenths (1.7) gallons to forty five (45) pounds of mulch. All equipment and methods of application shall be subject to the approval of the Town. The contractor shall be responsible for any and all disfigurement or damage to structure and property adjacent to the mulch areas.

3. Maintenance of planted areas

A. Maintenance of planted areas shall include irrigation when directed by the Town to establish the turf when seeding is done late in the planting season, in abnormally dry or hot seasons, or on adverse sites; and repairs, replacements, and reseedings within a planting season. Over seeding and fertilizing at one-half the original rates stipulated shall be done if the stand of vegetation is inadequate.

B. All new fill areas with slopes steeper than four to one (4:1) shall be protected from livestock until the permanent seeding stand has become established.

4. Reseeding

A. The contractor shall maintain the seeded area until acceptance of the work. Prior to acceptance of the work the contractor shall inspect all seeded areas for failures and make necessary repairs, replacements, and reseedings within the planting season, if possible.

B. If the stand is found to be inadequate, overseed and fertilize using half of the rate originally applied.

C. If the stand is over 50% damaged, re-establish following original lime, fertilizer, seedbed preparation and seeding recommendations.

5. Stabilization prior to delayed seeding

Areas which will not be seeded for a period of 30 days or more shall be stabilized with mulch. Mulch for critical area stabilization shall conform with the mulch requirements of the contract documents.

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D. Concrete sidewalks and curbs

The contractor shall furnish all plant, labor, equipment and material to restore sidewalks and curbs damaged or disturbed during construction to the grades and dimensions existing before construction.

E. Storm water drainage

The contractor shall not change or alter the storm water drainage ways. The contractor shall restore all surfaces disturbed during construction to the same contour as before construction.

F. Replacement of special surfaces and miscellaneous items lawns damaged during construction shall be brought to grade with topsoil: all weeds and debris shall be removed, transplanted or damaged shrubbery replaced and the entire area sodded or seeded as required to remove traces of damage to the lawns or other areas. In general, except in the case of cultivated fields, wherever the surface of the ground has been disturbed in the course of the operation under the contract, the final graded surface shall be stabilized by sodding or seeding as directed by the Town.

Mailboxes, street lighting poles and fixtures, ornamental works, fencing, culverts, drains (both natural and manmade) catch basins, manholes, walks, driveways, walls, etc. Shall be restored to the condition equal to, or better than existed prior to the start of the work.

Section 345 Restoration Within New Developments

All restoration and placement of surfaces shall be in accordance with the approved drawings; each item in respect to the governmental agency having jurisdiction.

Section 346 Standard Repair Procedure for Water Mains

A. Repair operations to existing water main piping shall follow requirements for disinfection in AWWA C651-05.

B. Repairs to existing cast-iron or ductile-iron pipe main shall be as shown on standard detail sheet W-30. The section of pipe to be repaired shall be cut out at a point as close as possible to the damaged area. The existing pipe shall be saw cut at a right angle to the pipe and shall not have any shoulder or unevenness. The existing pipe ends shall be cleaned and squared up. A ductile iron mechanical joint repair coupling or dresser coupling shall be installed on each end of the existing pipe and made ready for the replacement of pipe. A piece of ductile iron shall then be cut at right angles and a length of it installed. The repair couplings shall then be centered up over the cuts and the couplings tightened up. The excavation for the repair shall then be backfilled for the length of the repair and for a height of 12" over the pipe, using granular material.

C. Repairs to an existing PVC pipe shall be as shown on standard detail sheet W-30. A section of the pipe to be repaired shall be cut out at a point, as close as possible to the damaged area. The existing pipe shall be saw cut at right angle to the pipe and shall not have any shoulder or unevenness. The existing pipe ends shall be cleaned and squared up. Ductile iron mechanical joint repair coupling or a dresser coupling shall be installed on each end of the existing pipe and made ready for the replacement of pipe. A piece of PVC pipe, of strength equal to or greater than the broken pipe, shall then be cut at right angles and a length of it installed as long as possible to permit installation. The repair couplings shall then be centered up over the cuts and the couplings tightened up. The excavation for the repair shall then be backfilled for the length of the repair and for a height of 12" over the pipe, using granular material.

D. Where practical, repair should be backfilled except leaving a hole over the repair fittings. Water pressure should be restored to the normal pressure and all air removed from the main. The main pipe shall be dried off with paper towels and inspected for leaks during a minimum period of thirty (30) minutes.

Section 347 Standard Repair Procedures for Service Connections

1. Repairs to type "k" copper service connections shall be by cutting out the damaged piece of copper piping using a copper pipe cutting tool. Sawing of copper pipe is prohibited. The ends of the pipe shall be thoroughly cleaned and burrs removed. Pipe ends shall then be flared with a flaring tool. Pipe ends shall then be joined by a flared copper to copper coupling. Where connecting copper tubing to a dissimilar metal, the methods and materials of the connection shall be such as to prevent galvanic corrosion. The excavation for the repair shall then be backfilled for the length of the repair and for a height of 12" over the pipe with silica sand.

2. Repairs to PE C.T.S. service piping shall be by cutting out the damaged section of piping. The ends of the pipe shall be thoroughly cleaned and burrs removed. A quality stainless steel insert stiffener shall be inserted into the pipe ends. Pipe ends shall then be joined by a pack joint compression type coupling. The compression nut shall be sealed by a beveled Buna-N gasket locked in place by a stainless steel set screw. The compression nut shall have machined grooves in a split clamping device for gripping tubing and a tap for the set screw. The excavation for the repair shall then be backfilled for the length of the repair and for a height of 12" over the pipe with silica sand.

3. Disinfection of the repaired service connection shall be in accordance with approval by the certified water operator of the system, i.e., Mr. Bobby Mose.

Section 348 Use of Mechanical Restraints in lieu of Concrete Thrust Blocking

Except for the fire hydrant installations, the contractor has the option of installing mechanical thrust restraints in lieu of required concrete blocking, provided however that the contractor installs the restraints in strict accordance with the directions provided herein. With the use of mechanical restraints, the main can be backfilled and pressurized for leakage testing without having to wait for the blocking concrete to cure.

Fire hydrant installations require both mechanical restraints and concrete thrust blocks in accordance with W-17.

All fittings for changing pipe direction or changing pipe diameter or valves shall be mechanical joint and restrained with megalugs or uni-flanges. If concrete thrust blocks are not installed at the subject fitting, all joints closer to the fitting than the minimum restrained length specified in W-6, must also be restrained with appropriate mechanical restraints. If the pipe joints are the push-on type, install an appropriate megalug restraint.

The contractor must acknowledge that the directions given herein are valid only for water mains installed in the Town of Keedysville. The contractor should not employ the directions herein on job sites not associated with Keedysville. In theory, each joint must be individually calculated for mechanical restraining using engineering formulas. The directions herein for installing mechanical restraints are simplifications based on conditions in Keedysville projects. Non-Keedysville projects may have different soil, backfill, trench configuration, water pressure, etc., so the directions given in these standards may not apply.

Restraints shall be installed in strict accordance with the manufacturer's instructions and standard details W-6a and W-6b. When megalugs are used on tee fittings, no joints are permitted within five (5') feet of the tee, as measured on centers. Provide enough straight pipe to maintain a horizontal distance of five feet (5') from center of tee to center of valve.

If the water mains to be restrained are to be pressurized from the Keedysville water tank, i.e. gradient 592 feet, the detail W-6a shall be used. If the water mains to be restrained are to be pressurized from the Boonsboro reservoir, i.e., gradient 735 feet, the details W-6b shall be used.

Mechanically restrained joints can not be deflected more than five (5) degrees or more than the restraint manufacturer's recommended limit, whichever is less.

Joint restraints of the type that push in to the bell and lock, such as the "Field LOK" system, are prohibited.

Trenching, bedding, and backfilling must be in strict accordance with W-1 and the directions in this Division III.