

## SECTION 3 - CONSTRUCTION

(Low Pressure Sewage Collection System)

### 1. PRELIMINARY WORK

#### 1.1 Location of Lines

The streets, roads and easements in which lines shall be placed have been indicated on the Plans. Any change from locations approved by the Engineering Department shall be approved by the Engineering Department before construction.

#### 1.2 Location and Protection of Underground Utilities

Prior to trenching the Contractor shall determine, insofar as possible, the actual location of all underground utilities in the vicinity of this operation and shall clearly mark their locations so that they may be avoided by equipment operators. Where such utility lines or services appear to lie in the path of construction they shall be uncovered in advance to determine the exact location and depth and to avoid damage due to trenching operations. Existing facilities shall be protected during construction or removed and replaced in equal condition, as necessary.

Should any existing utility line or service be damaged during, or as a result of the Contractor's operations, the Contractor shall take such emergency measures as may be necessary to minimize damage and shall immediately notify the utility involved. The Contractor shall then repair the damage to the satisfaction of the utility or shall pay the utility for making the repairs. In all cases, the restoration and/or repair shall be such that the damaged structure will be in as good or better condition as before the damage occurred.

#### 1.3 Removal of Obstructions

The Contractor shall be responsible for the removal, safeguarding and replacement of fences, walls, structures, culverts, street signs, billboards, shrubs, mailboxes, or other obstructions which must be moved to facilitate construction. Such obstructions must be restored to at least their original condition.

#### 1.4 Clearing and Grubbing

The Contractor shall be responsible for cutting, removing and disposing of all trees, brush, stumps, roots and weeds within the construction area. Disposal shall be by means of chippers, landfills, or other approved method and not in conflict with state or local ordinances.

Care shall be taken to avoid unnecessary cutting or damage to trees not in the construction area. The Contractor will be responsible for loss or damage to trees outside the permanent easement or rights-of-ways.

## 2. EXCAVATION

### 2.1 General

The Contractor shall perform all required excavation and backfilling incidental to the installation of the sewer lines, air release valve installations, and other appurtenances under this Contract. Excavation shall be carried to the depths indicated on the Drawings or as necessary to permit the installation of pipe, bedding, structures or appurtenances. Care shall be taken to provide a firm, undisturbed, uniform surface in the bottoms of trenches and excavations for structures. Where the excavation exceeds the required depth, the Contractor shall bring the excavation to proper grade through the use of an approved incompressible backfill material (generally crushed stone or fill concrete, depending upon the nature of the facility to be placed thereon). In the event unstable soil conditions are encountered at the bottom of the excavation, the Engineering Department may direct the Contractor to continue the excavation to firm soil or to provide pilings or other suitable special foundations.

The Contractor shall take such precautions as may be necessary to avoid endangering personnel, pavement, adjacent utilities or structures through cave-ins, slides, settlement or other soil disturbance resulting from his operations. Refer to Paragraph 2.10 for requirements - Subsurface Conditions.

The Contractor shall be responsible for storage of excavated material, disposal of surplus excavated material, trench dewatering and other operations incidental to excavation and backfilling operations.

### 2.2 Pavement Removal

Where existing paved streets, roads, parking lots, drives or sidewalks must be disturbed during construction of the project the Contractor shall take the necessary steps to minimize damage. Permanent type pavement shall be cut or sawed in a straight line before removal and care shall be taken during excavation to avoid damage to adjacent pavement. Where trucks or other heavy equipment must cross curbs or sidewalks, such areas shall be suitably protected.

### 2.3 Trench Excavation

Trenches shall be excavated in a neat and workmanlike manner, maintaining proper alignment except where necessary to make deviations to miss obstructions.

Trenching for installation of low pressure sewage collection piping shall be such that the pipe will have a minimum cover of thirty (30) inches. The bottom of trenches must be shaped by hand and bell holes must be dug so that full length of pipe is resting on trench bottom. Blocking shall not be used.

Trenches shall be opened up far enough ahead of pipe laying to reveal obstructions, but in general shall not include more than 300 feet of continuous open trench at any time. The Contractor will be required to follow up trenching operations promptly with pipe laying, backfill and clean-up, and in event of failure to do so, may be prohibited from opening additional trench until such work is completed.

The Contractor shall plan his operations so as to cause a minimum of inconvenience to property owners and to traffic. No road, street or alley may be closed unless absolutely necessary, and then only if the following conditions are met:

1. Permit is secured from appropriate, State, County or Municipal authorities having jurisdiction.
2. Fire and Police Departments are notified before road is closed.
3. Suitable detours are provided and are clearly marked.  
No driveways shall be cut or blocked without first notifying the occupants of the property. Every effort shall be made to schedule the blocking of drives to suit to occupants convenience, and except in case of emergency, drives shall not be blocked for a period of more than 8 hours.

The Contractor shall furnish and maintain barricades, signs, flashing lights, and other warning devices as necessary for the protection of public safety. Flagman shall be provided as required on heavily traveled streets to avoid traffic jams or accidents.

Trench width shall be held to a minimum consistent with proper working space for assembly of pipe. Maximum trench width up to a point one foot above top of pipe shall be limited to the outside pipe diameter plus 16". Boulders, large stone, shale and rock shall be removed to provide clearance of 6" below and on each side of the pipe.

Trench walls shall be kept as nearly vertical as possible with due consideration to soil conditions encountered and when necessary, sheeting or bracing shall be provided to protect life and property.

Where unstable soil conditions are encountered at the trench bottom, the Contractor shall remove such additional material as may be directed by the Engineering Department and replace the excavated material with approved backfill.

The Contractor shall excavate by hand wherever necessary to protect existing structures or utilities from damage or to prevent overdepth excavation in the trench subgrade.

Excavated material shall be stored safely away from the edge of trench and in such a way as to avoid encroachment of private property.

#### 2.4 Excavation for Structures

Excavation for air release valve installations, metering pits or other appurtenance shall be only as large as may be required for the structure or appurtenance and for working room around the same. In earth, excavation shall generally extend to the outer limits of the structure at the bottom, and shall slope outward at such angle as may be required for

stability of excavated face. In rock, excavation shall be carried to a point 6 inches outside the structure so that no rock is left within 6 inches of the finished structure or appurtenance.

Care shall be taken as the excavation approaches the desired grade to avoid overdepth excavation and provide a firm and undisturbed soil surface on which footings, slabs or foundations are to be placed. Should the Contractor excavate below the desired grade level, the excavation shall be brought to grade by the use of Class B concrete at the expense of the Contractor. The use of tamped earth backfill under foundations, footings or slabs will not be acceptable.

Where structures rest partially upon rock, the rock shall be excavated to a point 6" below bottom of structure and compacted crushed stone shall be used to bring the excavation back to grade. Where the structure will rest completely on sound solid rock, the rock shall be excavated to a point 4" below bottom of structure and compacted crushed stone shall be used to bring the excavation back to grade.

Should the material found at the desired subgrade appear to be unstable or otherwise unsuitable for support of the structure, such condition shall be immediately called to the attention of the Engineering Department. The Engineer may direct that such unsuitable material be removed and replaced with concrete, he may modify the foundation design to suit the condition, or he may determine that the bearing capacity of the material for the load to be supported; but in any case shall provide written instructions to the Contractor as to the procedure to be followed.

## 2.5 Rock Excavation

Where rock excavation is encountered in trenches the excavation shall be carried to a depth of 6" below the bottom of the pipe. The rock shall also be removed to a width of at least 6" beyond the outside of the pipe on each side so that no rock is left within 6" of the outside wall of the pipe. Where rock is excavated in the bottom of the trench, the trench shall be brought back to grade by the use of crushed stone which shall be compacted to form a stable base for the pipe laying operation.

The Contractor shall exercise all necessary precautions in blasting operations. Suitable blasting mats shall be provided and utilized as required. Blasting shall be done only by experienced men. Careless shooting, resulting in the ejection of stones or other debris during blasting, shall be corrected immediately by the Contractor's representative.

No blasting shall be done unless the Contractor shall have taken out the necessary insurance to fully protect the Department of Public Works from all possible damages resulting from the blasting operations. The blasting shall be done in accordance with all recognized safety precautions and in accordance with regulations of authorities having jurisdiction. In addition the Contractor shall exercise the necessary care to safeguard the stores of blasting materials on the property.

Where rock is encountered in the immediate vicinity of gas mains, telephone cables, building footings, gasoline tanks, or other hazardous areas the Contractor shall remove the rock in a manner that will insure protection of these structures. Care shall be taken in blasting operations to see that pipe or other structures previously installed are not

damaged by blasting. In general, blasting shall not be done within 25' of the completed

pipe line or any existing structure.

Excavation for wastewater pump station structures in rock and in high groundwater sites, especially where rock trenchers are utilized to excavate for pump station, shall include constructing an excavated trench and crushed stone French drain to a natural drainage course to promote drainage of pump station site.

## 2.6 Subsurface Obstructions

In excavating, backfilling, and laying pipe, care must be taken not to remove, disturb or injure other pipes, conduits, or structures, without the approval of the Engineering Department. If necessary, the Contractor, at his own expense, shall sling, shore up and maintain such structures in operations, and within a reasonable time shall repair any damage done thereto. Repairs to these facilities shall be made to the satisfaction of the Engineering Department.

The Contractor shall give sufficient notice to the interested utility of his intention to remove or disturb any other pipe, conduit, etc., and shall abide by their regulations governing such work. In the event subsurface structures are broken or damaged in the prosecution of the work, the Contractor shall immediately notify the proper authorities and shall be responsible for any damage to persons or property caused by such breaks.

When pipes or conduits providing service to adjoining buildings are broken during the progress of the work, the Contractor shall have them repaired at once. Delays such as would result in buildings being without service over night or for needlessly long periods during the day, will not be tolerated, and the Department of Public Works reserves the right to make repairs at the Contractor's expense without prior notification. Should it become necessary to move the position of a pipe, conduit, or structure, it shall be done by the Contractor in strict accordance with instructions given by the Engineer or the utility involved.

## 3. INSTALLATION OF PIPELINES AND APPURTENANCES

### 3.1 General

The Contractor shall use only experienced men in the final assembly of pipe in the trench, and all pipe shall be laid in accordance with these Specifications and the recommended practice of the pipe manufacturer. Trench bottoms shall be carefully prepared and shall be free of water.

Care shall be exercised to insure that pipe of the proper strength or classification meeting the specifications in every respect is provided at the site of pipe laying operations. Recommended tools, equipment, lubricant and other accessories needed for proper assembly or installation of the pipe shall be provided at the site of the work. Any damaged or defective pipe discovered during the pipe laying operations shall be discarded and removed from the site of the pipe laying operations.

The Contractor shall exercise care in the storage and handling of pipe, both on the storage yard and at the site of laying operations. Suitable clamps, slings, or other lifting devices shall be provided for handling pipe and fittings. Pipe and fittings shall be carefully

lowered into the trench piece by piece. Pipe and fittings shall be carefully inspected for defects and for dirt or other foreign material immediately before placing them in the trench. Suitable swabs shall be available at the site of laying operations, and any dirt or foreign material shall be removed from the pipe before it is lowered into the trench.

Bell holes for bell and spigot and mechanical joint pipe shall be dug in trench to allow entire length of pipe barrel to be bedded and to allow proper jointing of pipe.

Alignment of pipe shall be as true as possible in order to avoid air pockets. When work is suspended either for the night or for any other reason, open ends of the pipe shall be securely plugged to prevent the entrance of foreign materials. Dead ends of the pipe and unused branches of crosses, tees, valves, etc., shall be closed with plugs suitable to the type of pipe in use.

Cutting of pipe shall be done in a neat, workmanlike manner without damage to pipe, coatings and linings and so that a smooth end remains at right angles to axis of pipe.

### 3.2 Pipe Installation

PVC (Polyvinyl Chloride) Plastic Pipe - Provisions of AWWA Specification C-605, latest revision, "AWWA Standard for Installation of PVC Pressure Pipe for Water" shall apply. Laying condition shall be Type 2 (flat bottom trench without blocks) with tamped backfill. Backfill of select material compacted to top of pipe. Compaction to be approximately 80 percent Standard Proctor, AASHTO T-99). Remainder of backfill requirements are as described in Subsection 4 - Backfill.

Joints shall be an approved slip type joint for 1-1/2 inch and larger pipe and solvent weld for pipe less than 1-1/2 inch.

Pipeline shall be jointed together in trench according to recommendations of pipe manufacturer. For slip joint pipe, inside of bell and outside of spigot end shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter. Circular rubber gasket shall be flexed inward and inserted in gasket recess of bell socket. Thin film of gasket lubricant shall be applied to inside surface of gasket or spigot end of pipe or both. Gasket lubricant shall be as supplied by pipe manufacturer and approved by Engineer. Spigot end of pipe shall be inserted into socket with care used to keep joint end to bottom of socket with forked tool, jack-type tool, or other device approved by Engineer. Pipe not furnished with depth mark shall be marked before assembly to assure that spigot end is inserted to full depth of joint. Field cut pipe lengths shall be filled or ground to resemble spigot end as manufactured.

Whenever it is desirable to deflect slip-on joint pipe in order to form long-radius curve, amount of deflection shall not exceed maximum limits as specified by the pipe manufacturer. Deflections exceeding these maximum limits shall be accomplished by using approved cast or ductile iron fittings; PVC fittings shall not be used.

For solvent weld pipe and fittings use primer and cement furnished by pipe manufacturer. Pipe ends are to be cut square and smooth, removing burrs and ragged edges with file or abrasive paper. Remove all foreign material including water from the mating surfaces with a clean, dry cloth. To apply primer and cement and to complete the joint, follow recommendations of the pipe supplier as supplemented by these specifications. Pipe

supplier shall submit written instructions for making joint to Engineer for approval. Instructions shall be kept on the job site at all times. All workmen involved in making joints shall be thoroughly familiar with the proper installation techniques and the approved instructions shall be adhered to at all times. Only qualified workmen shall be used to make solvent weld joints.

Detection tape as per specified in Division 2 shall be installed over PVC pipe as backfill proceeds. The tape shall be installed in accordance with the tape manufacturer's recommendation and shall be located 12" to 18" above the top of the pipe.

### 3.3 Installation of Fittings

Fittings in pipe lines shall be firmly secured to prevent the fitting from being blown off the line when under pressure. When connections are made between the new work and existing mains, the connections shall be made using specials and fittings to suit the actual conditions.

All tees, caps, plugs, bends or other fittings subjected to unbalanced forces tending to pull the joints apart shall be protected with concrete thrust blocks. Thrust blocks shall be provided in accordance with details shown on Drawings, and must bear against an undisturbed trench face. Thrust blocks must be used unless written permission is obtained from the Engineering Department to use special locked-joint fittings, anchoring fittings, or pipe clamps with tie rods.

Fittings shall be placed in locations indicated on Drawings or designated by the Engineering Department and shall be installed in accordance with provisions of these Specifications dealing with laying of pipe. Joints shall be compatible with pipe material and shall be as described in Division 2 of these Specifications.

Before being placed in trench, all fittings shall be subjected to inspection by the Engineering Department, and any defective, unsound or damaged fittings shall be rejected and Contractor shall remove at once from work area.

### 3.4 Installation of Valves, Valve Boxes

Valves shall be placed in the locations indicated on the Plans or at locations designated by the Engineering Department. All valves shall be set vertically. Before being placed in the trench, all valves shall be carefully examined by the Contractor and Engineering Department to see that they are in good working order.

Over each valve shall be placed a valve box. All valves which, when properly set, have operating nuts, handwheels or levers, deeper than 24 inches below the top of the valve box shall have extension stems with operating devices located within 24 inches of the valve box top.

The valve box shall not come in contact with valve at any point. Backfill around boxes shall be tamped to maintain centered and plumbed alignment of box.

Box shall be installed with top set flush with finished surface in paved areas and one to two inches above natural ground level in unpaved areas.

### 3.5 Air Release And Air/Vacuum Valve Installation

Where shown on the Drawings or where directed by the Engineering Department, the Contractor shall install an air release or air and vacuum valve to allow for the escape of entrained air.

The air control valve installation shall be constructed in accordance with the Standard Detail Drawing.

The Contractor is cautioned to allow for an increase of bury on the pipeline at the location of the air control valve to provide for the proper valve box installation at designed finish grade.

### 3.6 Utility Marker Installation

Where indicated on the Drawings, Contractor shall install utility markers to identify the location of lines, valves or other installed facilities. Markers shall be installed in accordance with manufacturer's recommendations and located in such a way that potential for damage from vehicular traffic and vandalism as well as theft is minimized.

### 3.7 Service Installation

Services shall be installed in the best workmanlike manner. Service lines shall run at a 90 degree angle to the main and shall terminate at or near the property line of the served property. Cover shall be as much as practical but in no case less than 18 inches.

Installation shall be in accordance with Standard Detail Drawings.

## 4. BACKFILL

### 4.1 General

Backfilling shall be carried out as expeditiously as possible, but shall not be undertaken until the Engineer has been given the opportunity to inspect the work. The Contractor must carry out all backfilling operations with due regard to: the protection of pipes, structures and appurtenances; the use of prescribed backfill materials; and procedures to obtain the desired degree of compaction. No equipment may be used which will result in damage to or misalignment of the pipe.

### 4.2 ~~Acceptable Backfill Material~~ Backfill Material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, or other material that in the opinion of the Engineering Department is unsuitable. From one foot above top of pipe to within twelve inches of finished grade in unpaved areas, backfill may contain stones up to six inches in their greatest dimension, unless otherwise specified. Backfill containing rock must contain enough dirt to fill voids between rocks.

When backfill material is not specified on Project Drawings or elsewhere in these

Specifications, Contractor may backfill with the excavated material provided material

consists of loam, clay, sand, gravel, or other materials that, in opinion of the Engineering Department, are suitable for backfilling.

Backfilling shall not be done in freezing weather and it shall not be made with frozen material. No fill shall be made where material already in trench is frozen. Backfill shall not be made with material which, in the Engineering Department opinion, is too wet.

Where crushed stone backfill is required the crushed stone shall be clean No. 6 size 3/4" to 3/8" as designated in AASHTO M-43, Sizes of Coarse Aggregate, standard for crushed stone.

#### 4.3 Backfilling Under Pipe

All trenches shall be backfilled by hand from bottom of trench to centerline of pipe. 3/4" crushed stone shall be placed in 6" layers and thoroughly compacted by hand tamping. Backfill material shall be deposited in trench for its full width on each side of pipe, fittings and appurtenances simultaneously. Care must be taken to compact fill along sides of pipe and appurtenances adjacent to pipe wall.

#### 4.4 Backfilling Under Pipe in Rock

Where trench is excavated in rock or shale, 6" space below pipe shall be backfilled with 3/4" crushed stone firmly compacted to form a cushion for pipe and appurtenances.

#### 4.5 Backfilling Over Pipe

From centerline of pipe, fittings and appurtenances to a depth of 1 foot above top of pipe, trench shall be backfilled with 3/4" crushed stone by hand or by approved mechanical methods of 6" layers and thoroughly compacted by hand tamping or by approved mechanical methods. Contractor shall use special care in placing this portion of backfill in order to avoid injuring or moving pipe.

After the backfill has been placed to a depth of at least 12" above top of pipe, additional backfill may be placed by means of suitable mechanical equipment subject to a 9" limitation of maximum thickness of layers placed before compaction.

No placement method or equipment used shall be such as to result in damage to the pipe or misalignment of the pipe. Rolling equipment shall not be used until at least 18 inches of backfill has been placed over the top of the pipe.

#### 4.6 In Areas Subject to Vehicular Traffic

Where excavation is made through pavement, curbs, driveways, sidewalks, road shoulders, or other areas subject to vehicular traffic or supporting permanent structures, or where such areas, items or structures are undercut by excavation, entire backfill shall be crushed stone which shall be placed in layers or lifts not exceeding 9" in thickness. After placing in layers, crushed stone shall be carefully compacted to maximum density or minimum volume. Such backfill, placed where called for on the Drawings or as directed by the Department of Public Works, shall be designated as Crushed Stone Backfill.

Where excavation is made through permanent pavements, backfill shall be placed as described above to subgrade elevation only. Remainder of backfill shall be crushed stone placed as directed to finished pavement grade to serve as temporary pavement.

From time that backfilling is complete until time permanent pavement surface is replaced or, in absence of pavement replacement, until job is accepted, Contractor shall, at direction of the Engineering Department, water streets, roads, etc., to settle dust where excessive dust has, in opinion of the Engineering Department, been caused by Contractor's operations. If Contractor refuses or delays unnecessarily to obey direction of the Engineering Department, the Owner shall, after 24 hours written notice through the Engineering Department, be permitted to proceed with such work with cost to be billed to Contractor.

#### 4.7 In Areas Not Subject to Vehicular Traffic

Where excavation is made in areas not subject to vehicular traffic or supporting permanent structures and where settlement is unimportant, Contractor may backfill trench from 1 foot above top of pipe to top of trench with approved excavated material using hand or approved methods. Backfill material shall be brought up to the original ground level and shall then be mounded over to provide for additional settlement. Compaction of this backfill material will not be required, however, the Contractor shall exercise care to confine the mound to the area immediately over the trench and shall be responsible for bringing in such additional fill material as may be required from time to time during the one year warranty period to fill in areas where excessive settlement has occurred.

### 5. COMPLETING INSTALLATION OF LINES, STRUCTURES, ETC.

#### 5.1 General

The Contractor shall not, without the permission of the Engineering Department, remove from the line of work any earth excavated there from which may be suitable for backfilling or surfacing until the excavation has been refilled and surfaced.

As soon as the backfilling of any excavation is completed and when in areas of existing development, the Contractor must at once begin the removal of all surplus dirt except that actually necessary to provide for the settlement of the fill. He shall also remove all the pipe and other material placed or left on the street by him except material needed for the replacement of paving, and the street shall be opened up and made passable for traffic. Following the above work, the repairing and complete restoration of the street surfaces, bridges, crossings, and all places affected by the work shall be done as promptly as possible.

All excavated material shall be cleared from adjacent street surfaces, gutters, sidewalks, parkways, railroads, grass plots, yards, etc., and the whole work shall be left in tidy and acceptable condition. Contractor will be required to re-grass lawns or neutral grounds where trenches are excavated in these locations or where Contractor has damaged lawns or neutral grounds by his operations.

The Engineering Department shall be sole authority in determining time in which rough and final clean-up shall be prosecuted. Rough clean-up shall consist of removal of large rocks, grading of excess backfill material over pipe line or removal of said material, opening of any drainage device, restoration of any street or roadway to condition so that traffic may safely and conveniently use street or roadway, restoration of pedestrian ways to condition where pedestrians may safely and conveniently use same. Rough clean-up shall, in general, be prosecuted no later than 1 day after pipe laying and backfilling or no farther behind pipe laying operations than 1000 feet; whichever time limit is shortest shall govern. Final clean-up consisting of pavement replacement, sidewalk replacement, removal of rocks, hand raking with seeding, strawing, etc., of lawns and neutral grounds, adjusting grade of ground over pipeline, property repairs, and other items shall be prosecuted as soon as is practical after pipe has been laid and backfilled. In general, this would be no later than 2 to 3 weeks after completion of backfilling.

## 5.2 Pavement Replacement

Before trenching in paved areas the Contractor shall cut through the pavement in a straight line along the sides of the proposed trench so that the pavement may be removed and the trench may be dug without damage to the adjacent pavement. During construction suitable precautions shall be taken to protect the pavement edges and surfaces and minimize damage.

As soon as the pipe has been installed, the trench shall be backfilled as specified and, where directed by the Department of Public Works, a temporary pavement patch shall be provided in areas which have permanent paving. "Permanent paving" shall mean asphaltic concrete ("hot mix") or Portland cement concrete. Cold mix, surface treatments, and crushed stone are excluded from the "permanent pavement" classification. The temporary pavement patch shall consist of at least 6" of compacted stone base brought to within 2" of the surface of the existing permanent pavement. A 2" layer of cold mix asphaltic concrete shall then be applied to protect the base, prevent "pot holes" or "chuck holes", and provide a reasonably smooth pavement surface until the permanent patch is made. The temporary pavement patch shall be placed within 48 hours of receipt of written instruction of the Department of Public Works.

## 6. PREFABRICATED GRINDER SEWAGE PUMP STATIONS

The Contractor shall refer to material specifications concerning work on this item and standard Contract Drawings.

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