

SECTION 02315**TRENCHING AND BACKFILLING FOR PIPING SYSTEMS****PART 1 - GENERAL****1.01 WORK INCLUDED**

- A. The work included under this Section consists of excavating, backfilling and compaction as required for the construction of the piping systems as specified herein. (See Section 02314 for excavation for structures.)
- B. All excavations shall be executed in accordance with the South Florida Building Codes, the State of Florida Trench Safety Act (TSA), OSHA requirements and all applicable requirements of Section 01016, including notification of Sunshine State One-Call Center (1-800-432-4770), 48 hours prior to any excavation.

PARTS 2 - PRODUCTS**2.01 BACKFILL MATERIAL**

- A. Except where a 1:10 cement/sand or flowable fill concrete mix is required (See Section 02745), granular soil backfill materials shall be utilized. Suitable backfill material shall be clean, shall not be expansive nor have high organic content, shall be free of clay, marl, unstable materials, debris, lumps and clods, and shall meet the following requirements:
 - 1. Maximum Liquid Limit shall not exceed 12 as determined by ASTM D 423.
 - 2. Maximum Plasticity Index shall not exceed 35 as determined by ASTM D 424.
 - 3. Not more than 10 percent of weight shall be finer than 74 micron (No. 200) U.S. Standard Sieve.
- B. Backfill material containing limerock shall have sufficient sand to fill the voids in the limerock. No stones or rocks larger than 6-inches in diameter will be permitted in any backfill. Backfill material placed to a point at least one foot (1 ft.) above pipe and appurtenances shall be select backfill material not exceeding 2-inches in diameter. For PVC gravity sewers backfill material placed at least two feet (2 ft.) above pipe shall be select backfill material not exceeding 2-inches in diameter. In any case, above this point, but up to the upper 6-inches of the trench, backfill shall be of material not exceeding 6-inches in diameter.
- C. Debris, broken paving or broken concrete shall not be used.
- D. Material for backfill may be material resulting from excavation, only if it meets the above mentioned requirements, or if suitable in the opinion of the Department. If sufficient suitable backfill material, including select backfill material, is not available from the site, additional material shall be furnished.

2.02 SELECT BACKFILL MATERIAL

Select backfill material specified in these specifications or required by the Plans shall meet all the general requirements for backfill material set forth above, and in addition, shall be free of any rocks or stones larger than 2 inches in diameter. Select backfill for copper tubing shall be limerock screenings or sand. Select backfill material may be material resulting from excavation, if suitable in the opinion of the Department, carefully selected to comply with these requirements.

2.03 BEDDING MATERIAL

Pipe bedding material shall consist of one of the following types of material, and accordance with the Department's Standard Details: (See Section UC-300 for Gravity Sewer Piping Foundations)

- A. Bedding may be select backfill material, as specified above, if approved by the Department.
- B. Crushed stone (or drainfield limerock) shall be used for bedding of piping (except for copper pipe) and/or manholes as shown on the Standard Details. Crushed stone shall consist of hard, durable, sub-angular particles of proper size and gradation, and shall be free from organic material, wood, trash, sand, loam, clay, excess fines and other deleterious materials. The stone shall conform to the requirements of ASTM C 33, Size No. 57 (3/4-inch rock) and be graded within the following limits:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
1 ½-inch	100
1-inch	95 to 100
½-inch	25 to 60
No. 4	0 to 10
No. 8	0 to 5

- C. Sand for bedding copper pipe shall be a dry screened sand. Sand shall be graded sand with 100 percent passing a 3/8-inch sieve and not more than 5 percent passing a No. 200 sieve.
- D. Limerock screenings, sand or other fine material shall not be used for bedding.
- E. All pipe bedding material shall be new, unless otherwise approve by the Department. Existing pipe bedding material may not be used.

2.04 BACKFILL UNDER MANHOLES AND METER VAULTS

Any excavation below the levels required for the proper construction of manholes or meter vaults shall be filled with Class C concrete. The use of earth, rock, sand or other materials for this purpose will not be permitted. (See Section 02314 for excavation for structures.)

PART 3 - EXECUTION

3.01 CLEARING

- A. The Contractor shall perform all clearing necessary for the proper installation of all piping and appurtenances in the locations shown in the Drawings, in accordance with Section 02230, "Clearing and Grubbing".
- B. Where required, all existing shrubbery, trees, grass, sprinklers, fences, signs, mail boxes, structures, sidewalks, curbs, utility poles or structures subject to damage resulting from the excavation should be transplanted, relocated, braced, shored, or otherwise protected and preserved.

3.02 EXCAVATION

- A. The Contractor shall perform all excavation of every description and of whatever substances encountered, to the dimensions and depth shown on the Drawings. All excavations shall be made by open cut.
- B. When the walls of the excavations are to be kept vertical and in order to protect the safety of workmen, the general public, this or other work or structures, or excavation walls, or pipe installation including materials encountered in the excavation which have a tendency to slough or flow into the excavation, undermine the banks, weaken the overlying strata, or are otherwise rendered unstable by the excavation operation shall be retained by steel sheeting, stabilization, grouting or approved methods. Said methods shall comply with the Trench Safety Act (TSA). Sheeting and shoring or other approved method shall be designed by a Professional Engineer licensed to practice in the State of Florida.
- C. In areas where trench widths are not limited by right-of-way or easement widths, property line restrictions, existing adjacent improvements including pavements, structures, and other utilities, and maintenance of traffic, the trench sides may be sloped to a suitable angle of repose of the excavated material, but only from a point one foot above the crown of the pipe.
- D. A substantially and safely constructed moveable shield or box, as approved by the Engineer of Record, may be used in place of sheeting, except where specifically called for on the Plans to install sheeting. Where a moveable shield or trench box, is used in place of sheeting and shoring, the trench shall be opened immediately ahead of the shield as pipe laying proceeds inside the shield.
- E. Ladders or steps shall be provided for and used by workmen to enter and leave trenches.
- F. Materials removed from the trenches shall be stored and disposed of in such a manner that they will not interfere unduly with traffic on public streets and sidewalks. In congested areas, such materials, cannot be stored adjacent to the trench nor used immediately as backfill, shall be removed to convenient places of storage. If any material is creating a public hazard or other unsafe condition, it shall be removed immediately to a storage area.
- G. Materials suitable for use as backfill be hauled to and used in areas where not enough suitable material is available from the excavation. Material unsuitable for use in backfill shall be removed promptly and disposed of by the Contractor
- H. Excavation for Pipes and Piping Appurtenances (See Section UC-300 for additional requirements for gravity sewer piping):

1. Clear, as stated above, all existing items or structures in the way of the proposed pipeline or structures and excavate as necessary to the lines and grades shown on the Plans.
2. Where pavements or sidewalks are cut they shall be cut by means of a mechanical pavement saw to form true and straight edges which shall in general be either parallel or at right angles with the centerline of the pipe.
3. In order to protect himself from being held liable for any existing damaged pavement, including detour routes, the Contractor is advised to notify in writing the authority having jurisdiction over the street where such defective pavement exists prior to proceeding with any work in the vicinity. A copy of all such notices shall be forwarded to the Department.
4. Excavate pipe trenches to a minimum of 6-inches below the outside bottom of the proposed pipe barrel to provide for the installation of the bedding material.
5. If, in the opinion of the Department, the soil at that depth is unsatisfactory as foundation material because it contains unsuitable marl, muck, organic matter, or other unsuitable material, the excavation shall be continued 2 feet deeper, except if a suitable foundation material is exposed at a lesser depth, further excavation will not be required.
6. If the soil is still unsuitable after the additional excavation as prescribed above, the trench bottom shall be excavated further in one foot increments in accordance with "Trench Overcut", below.
7. Sheet piling and shoring shall be installed where necessary to control trench width, protect the workmen and the general public, and prevent damage to this or adjacent work, or structures.
8. Where wood sheet piling or certain designs of steel sheet piling are used, the Department may require the sheet piling to be cut off at a level 2-feet above the top of the installed pipe and that portion below that level shall be left in place.
9. If interlocking steel sheet piling is used, the Department may permit its complete removal in lieu of cut-off, providing removal can be accomplished without disturbing the bedding, pipe or alignment of the pipe. Any damage to the pipe bedding, pipe or alignment of the constructed utility caused by removal of sheet piling shall be cause for rejection of the affected portion of the work. Not more than 100-feet of trench shall be opened ahead of pipe laying operations at one time unless a greater length of open trench is approved by the Department.
10. Trench widths, when measured at a point 12 inches above the top of the pipe, shall provide a 12-inch maximum clearance on each side, between the outside of the pipe barrel and the face of the excavation, or sheet piling if used. Minimum trench width shall provide at least 6-inches clearance on each side, between the outside of the pipe barrel and the face of the excavation, or sheet piling if used.
11. Excavation for appurtenances, such as manholes and valves, shall be sufficient to provide a clearance between their outer surfaces and the face of the excavation or sheet piling, if used, of not less than 12-inches. Manhole excavations shall be carried to sufficient depth to permit their construction on the undisturbed bottom of the excavation.

12. Excavation for thrust block shall be made in such a manner so that, when concrete is placed, it will bear against a firm, undisturbed, vertical trench wall with bearing are in accordance with the schedule shown in the Standard Details.
 13. Selected backfill shall then be placed and compacted in 6-inch layers up to the level of the pipe bedding material.
 14. When the pipe to be installed in a trench requires the pipe installers to work under and around the pipe, the Contractor may request the Department that he be allowed to exceed the 12" maximum clearance, specifying the clear distance desired. The decision of the Department in this regard shall be final.
 15. The ends of existing mains shall be temporarily capped or plugged to keep them clean and the ends of all mains shall be temporarily anchored to keep the joints from blowing apart from internal pressure until the new mains can be reconnected to them.
 16. In addition to specific construction methods specified, the general requirements in subsequent subsections, below, shall apply to the work of this project.
- I. Excavation for PVC Gravity Sewers and Service Laterals:
1. The Contractor shall make all excavations necessary for the construction of the gravity sewers and service laterals to the lines and grades shown on the Plans, and in accordance with the Standard Details.
 2. In stable soils, trench widths when measured to a point 12 inches above the top of the pipe shall provide a 12-inch maximum clearance on each side, between the outside of the pipe barrel and the face of the excavation, or sheeting if used. Minimum trench widths under the same conditions shall be 6-inches on each side for the pipe for 4-inch and 6-inch pipe, and 9-inches on each side of the pipe for 8-inch pipe and larger. Minimum trench widths are required to provide room for a man to place and compact the haunching and initial backfill material. Embedment material shall be Class I. (See Section UC-300)
 3. In unstable soils (defined as peat, much or other organic soils, elastic silts and clays below the water table, and fine sands below the water level), trench widths when measured at a point 12-inches above the top of the pipe shall be a minimum of five (5) nominal pipe diameter in width. Slightly greater width are at the Contractor's option in order to accommodate his trenching equipment, but the pipe bedding material shall extend to the face of the excavation, or sheeting if used. Embedment material shall be Class II. (See Section UC-300)

3.03 TRENCH STABILIZATION

Trench bottoms which are rendered soft or unstable as a result of construction methods, such as improper or inadequate sheeting, dewatering or other causes, shall be stabilized. In no event shall pipe be installed when such conditions exist. The Contractor shall correct such conditions so as to provide proper bedding or foundations for the proposed installation.

3.04 TRENCH OVERCUT

- A. If, after excavating the trench to a depth of 2 feet 6 inches below the outside bottom elevation of the proposed pipe barrel, and the soil at that depth is still unsatisfactory as foundation material because it contains marl, muck, organic matter, or other unsuitable material, the pipe trench shall be excavated further in one-foot depth increments until a suitable foundation material is found. As a point of reference, it has been the Department's experience that, typically, trench overcut does not extend to depths more than 6 feet. However, the Department reserves the right to require trench overcut to depths up to 6 feet, i.e., to a point 8.5 feet below the bottom of the pipe.
- B. Select backfill, as defined above, shall then be compacted in 6-inch layers up to the bottom of the proposed 6 inches of pipe bedding.

3.05 REMOVAL OF WATER

- A. It is a basic requirement of these Specifications that excavation shall be free from water before pipe or structures are installed. However, it is realized that in certain sections of the work this cannot be accomplished economically and the Contractor may request permission to use the "Alternate Method of Construction" defined below.
- B. The Contractor shall provide all necessary pumps, underdrains, well point systems, and other means for removing water from trenches and other parts of the work including structures. The Contractor shall continue dewatering operations until the backfill has progressed to a sufficient height over the pipe to prevent flotation or movement of the pipe in the trench, so that the backfill is above the natural water level.
- C. Where applicable, the Contractor shall be required to obtain all necessary permits approving the location and proposed method of disposal before discharging water from any excavation into any portion of the public right-of-away or into any existing drainage structure or facility.
- D. Water from the trenches and excavation shall be disposed of in such a manner as will not cause injury to public health, to public or private property, to the work completed or in progress, to the surface of the streets, or to cause interference with the use of the same by public. Submit the proposed method of handling and disposal of trench waster for approval before starting the excavation.
- E. The Contractor is cautioned that Dade County or other governing body having jurisdiction over the work location may have regulatory rules and ordinances prohibiting, or limiting, the discharge of water from any excavation into sanitary and storm sewer systems, or to canals and drainage ditches. Obtain all necessary permits approving the location and proposed method of disposal before discharging water from any excavation into any portion of the public right-of-way, or into any existing drainage structure or facility.
- F. Pumps and engines for dewatering systems shall be operated with mufflers and a minimum noise level suitable to a residential area. The Contractor shall be responsible for any nuisance created due to the disposal of the water from his discharge system.

3.06 INSTALLATION OF BACKFILL

- A. Backfilling of pipe trenches will not be allowed until the work has been approved by the Department, pressure tested if required, and the Department indicates that backfilling may proceed. Any work which is covered or concealed without the knowledge and consent of the Department shall be uncovered or exposed for inspection. Partial backfill may be made to help restrain the pipe during pressure testing, if previously authorized by the Department.
- B. The Contractor shall backfill all trenches and other excavations made in the process of installing the pipe. He shall maintain the surface of the backfill free from major irregularities and potholes.
- C. Select backfill material shall be placed under and around the pipe to one foot above the crown (or to two feet above crown for PVC gravity sewers) in 6-inch layers. Each layer shall be thoroughly compacted to at least 90 percent of maximum density as defined by AASHTO Standard No. T-180, "Moisture-Density Relations of Soils using a 10-lb. (4.54 kg.) Rammer and an 18-in. (457 mm) Drop". The material in the ditch may be compacted by either hand tamper or a mechanized power tamper, provided the results obtained meet the continued approval of the Department. Particular attention and care shall be exercised in obtaining thorough support for the branch of all service connection fittings. Care shall be taken to preserve the alignment and gradient of the installed pipe.
- D. Backfilling and compacting of material lying above a point one foot (or two feet for PVC pipe), above the crown of the pipe and below the pavement base or the surface of the ground, if out of pavement, shall be accomplished in layers not exceeding 9 inches in thickness. Each layer shall be thoroughly compacted with a powered hand tamper or a mechanized power tamper to at least 98 percent of maximum density as determined by AASHTO Specification T-180 or such greater density as may be required by the governing authority over the area in which the work is performed. A testing laboratory will make periodic field tests to determine the density being obtained in each lift, or layer, or the backfill. When compacted backfill fails to meet the specified percentage of maximum density as shown by test results, it shall be reworked and recompact, and then retested. The reworking, recompact and retesting of the backfill shall be repeated as many times as may be necessary to obtain compacted backfill with density meeting or exceeding the specified percentage as indicated by test results.
- E. The Contractor shall exercise proper care to insure that no pipe will be broken or displaced through the use of the type of mechanical compacting equipment he selects. Water shall be added as required to obtain optimum moisture to facilitate compaction, but ponding or inundation of backfill will not be permitted. These ponding limitations shall not prohibit backfill in a wet trench up to the level of the natural water table if the "Alternate Method of Construction" is utilized.
- F. Backfill shall in general be kept up with the rate of pipe laying. The backfill up to the springline of the pipe shall be placed as soon as practical after the laying of the pipe. On parts of the line where ground water level may be high enough to float the pipe, the placing of the backfill and the rate of pumping the trench shall be so controlled as to prevent the pipe from floating or moving from the line and grade shown on the Plans.
- G. In the event that sufficient suitable material is not available at any point to properly backfill the trench, the Contractor shall transport suitable material from points of the line where such material is available or shall otherwise furnish suitable material.

- H. Suitable material in excess of all backfill requirements and all unsuitable material shall be removed from the work and disposed of by the Contractor.
- I. Within paved areas of trench excavation, the base and surfacing shall be reconstructed as specified under Section 02745, "Pavement Removal and Replacement".
- J. Where cuts have been made through unpaved, stabilized rock roadways, driveways and parkways, surface restoration shall consist of 3 inches of compacted limerock overlaid by 3 inches of gravel or graded and washed rock with a maximum diameter of ½-inch, except as otherwise directed by the Department. The rock shall be installed over the entire width of the disturbed area and shall closely match the existing rock at each location. Several grades of rock may be required to attain this end, but it is not anticipated that more than one grade will have to be used at any one location.
- K. Backfill for Structures: See Section 02314.

3.07 INSTALLATION OF PIPE BEDDING - FORCE MAIN AND WATER MAIN

- A. As described above, all pipe trenches shall be excavated to a level 6-inches below the outside bottom of the proposed pipe barrel. The resulting excavation shall be backfilled with approved pipe bedding material, up to the level of the outside bottom of the proposed pipe barrel. This material shall be tamped and compacted to provide a proper bedding for the pipe and shall then be shaped to receive the pipe, including recesses for the pipe bells and couplings. Placing and compacting bedding up to the level of the lower one-third of the pipe barrel shall immediately follow the installation of the pipe. Bedding shall be provided under the branch of all fittings to furnish adequate support and bearing under the fitting.
- B. Select Backfill material may be utilized where the excavated trench bottom is above water.
- C. Any excavation below the levels required for installation of the pipe bedding shall be backfilled with approved bedding material, tamped, compacted and shaped to provide proper support for the proposed pipe.
- D. For installation of gravity sewers, see Section UC-300, "Gravity Sewer Pipe Foundation".

3.08 COMPACTION AND DENSITIES

- A. Methods of control and testing of backfill construction to be employed in this work are:
 - 1. Maximum density of the material in trenches shall be determined by AASHTO Designation T 180.
 - 2. Field density of the backfill material in place shall be determined by AASHTO Designation T 238.
- B. Laboratory and field density tests are necessary to establish compliance with the compaction requirements of these specifications. The Department will not accept projects for which successful laboratory and field density test results are submitted. Tests will be made at depths and locations to the satisfaction of the Department.

- C. Trench backfill which does not comply with the specified densities, as indicated by such tests, shall be reworked and recompacted until the required compaction is secured.

3.09 ALTERNATE METHOD OF CONSTRUCTION

A. General:

1. A combination of conditions in the substrata, water table, or method of disposal may be encountered during the course of the work which make dewatering impossible, or only possible through the use of unusual methods, the cost of which is excessive. When such conditions are encountered, but only after all reasonable means to dewater the excavation have been employed without success, the Contractor, with the concurrence of the Department may elect to employ the following alternate method of construction. The concurrence of the Department shall be obtained and the Contractor shall limit the use of the alternate method of construction to such specific portions of the work as determined applicable.
2. The requirements set forth in other sections of these Specifications shall establish the required standards of construction quality for this work. Use of the alternate method of construction described hereinafter shall in no way be construed as relieving the Contractor of his basic responsibility for satisfactory completion of the work.
3. Subject to all of the requirements stated hereinabove, including approval by the Department, construction will be permitted in accordance with the following specifications.

B. Removal of Water: The installation of pipe, manholes and appurtenances under water will be permitted and the dry-trench requirements of "Removal of Water" will be waived.

C. Excavation: Excavation shall be performed in accordance with normal applicable excavation specifications.

D. Pipe Bedding for Ductile Iron and Vitrified Clay Pipe:

1. Pipe bedding shall be placed from 6-inches below the outside bottom of the proposed pipe barrel up to the level of the springline of the pipe barrel of gravity sewers and to the level of the lower one-third of the pipe barrel for force mains or water mains. The bedding material shall be washrock, drainfield limerock or approved material. Limerock screenings, sand or other fine organic material shall not be used.
2. The bedding material used shall be tamped and graded to provide a proper bedding for the pipe and shall then be shaped to receive the pipe. Bedding shall be provided under the branch of all fittings to furnish adequate support and bearing under the fitting.

E. Bedding for PVC Pipe: The pipe bedding, haunching and initial backfill material shall conform to embedment material listed in Section UC-300 for either stable or unstable soil conditions as required, and shall be placed and compacted in as stated in "Installation of Pipe Bedding", above.

F. Backfill:

1. After the pipe is installed, backfilling shall proceed in accordance with the provisions of "Installation of Backfill", except that select backfill material or pipe bedding material shall be used to backfill around the pipe and to a level one foot above the outside top (crown) of the pipe. Under no circumstances shall material other than select backfill or specified pipe bedding material be considered satisfactory for this purpose.
2. If the Alternate Method of Construction is used, all backfill material, shall be carefully lifted into the trench and released to fall freely therein when the bucket or container is near or at a moderate height above water level. Height of release shall be to the satisfaction of the Department. Below the existing water level, and to a point not more than 18-inches above the water level, the backfill material shall be carefully placed into place in uniform layers, of equal depth on each side of the pipe. From a point not more than 18-inches above the water level, and below the pavement base or the surface of the ground if out of paving, backfill material shall be placed and compacted for normal backfilling as provided in "Installation of Backfill" and "Compaction and Densities".

G. Backfill for PVC Gravity Sewers:

1. After the pipe is installed, backfilling shall proceed in accordance with the provisions of "Installation of Backfill", except that select backfill material or pipe bedding material shall be used to backfill to a level two feet above the outside top (crown) of the pipe. Under no circumstances shall material other than select backfill or specified pipe bedding material be considered satisfactory for this purpose.
2. If the Alternate Method of Construction is used, all embedment and backfill material, shall be carefully lifted into the trench and released to fall freely therein until the bucket or container is at or just above water level. Below the existing water level, and to a point not more than 18-inches above the water level, the backfill material shall be carefully placed into place in uniform layers, of equal depth on each side of the pipe. From a point not more than 18-inches above the water level, and below the pavement base or the surface of the ground if out of paving, backfill material shall be placed and compacted for normal backfilling as provided in "Installation of Backfill" and "Compaction and Densities".

3.11 RESTORATION OF EXISTING SURFACES

Paved and grassed areas disturbed by the operations required under this Section shall be restored as indicated on the approved Plans and/or specified herein.

END OF SECTION