SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This WORK shall consist of all labor, equipment, and materials necessary for excavation, trenching, and backfilling for utility lines and other related WORK.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 01 57 19, Temporary Environmental Controls

2. Section 31 23 00, Excavation and Fill.

3. Section 31 23 19, Dewatering.

4. Section 31 25 00, Erosion and Sedimentation Control.

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):

a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3)).

b. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

2. Colorado Department of Transportation (CDOT).

3. Occupational Safety and Health Administration (OSHA).

1.04 SUBMITTALS

A. Submit certification that bedding and pipe zone material meets SPECIFICATION.

PART 2 PRODUCTS

2.01 MATERIALS

A. Muck Excavation:

1. Muck excavation shall also include the replacement of excavated muck with uniformly graded rock ranging from three-quarter (3/4) inch to one and one-half (1-1/2) inches or as required by ENGINEER.

2. ENGINEER shall determine which type of aggregate or other material shall be used after observing the specific site conditions.

B. Bedding and Pipe Zone Materials:

1. Well-Graded Sand:

Sieve Size	Total Percent Passing by Weight
⅜ - inch	100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 30	25 - 60
No. 50	10 - 30
No. 100	2 - 10

2. Squeegee Sand:

Sieve Size	Total Percent Passing by Weight
⅜ - inch	100
No. 200	0 - 5

3. CDOT #67:

Sieve Size	Total Percent Passing by Weight
1 inch	100
¾ - inch	90 - 100
⅜ - inch	20 - 55
No. 4	0 - 10
No. 8	0 - 5

a. It shall be the responsibility of CONTRACTOR to locate material meeting the SPECIFICATIONS, to test its ability to consolidate to at least seventy-five percent (75%) relative density, and to secure approval of ENGINEER before such material is delivered to the PROJECT.

b. Relative density shall be determined as stipulated in ASTM D4253.

C. Backfill:

1. Use only backfill for trenches which is free from rocks, large roots, other vegetation or organic matter, and frozen material.

2. No rocks greater than three (3) inches in diameter shall be allowed.

D. Cut-Off Walls:

1. Clay Cut-Off Walls: More than fifty percent (50%) shall pass a No. 200 Sieve. The plasticity index shall be greater than twelve (12).

2. Controlled Low Strength Material Backfill: (Flo-Fill, See Section 31 23 23, Flowable Fill).

PART 3 EXECUTION

3.01 GENERAL

A. The following procedures shall be followed by CONTRACTOR in sequencing the WORK:

1. No more than one hundred fifty (150) feet of trench shall be left open at any time.

2. The entire trench shall be backfilled to within fifty (50) feet of the open trench upon conclusion of each day's WORK.

3. The trench shall not be backfilled until the pipe installation is found acceptable by ENGINEER.

4. Trench shall be backfilled within one hundred (100) feet of the pipe installation at all times.

5. Clean-up shall be maintained within four hundred (400) feet of the trench excavation.

B. Prior to placement in the trench, all pipes, fittings, and appurtenances shall be cleaned and examined for defects by CONTRACTOR.

1. If found defective, CONTRACTOR shall reject the defective pipe, fitting, or appurtenance.

2. CONTRACTOR shall advise ENGINEER of all defective materials.

C. Surplus Excavation:

1. All surplus excavation shall be placed, in an orderly manner.

2. If material is stockpiled on private property, written permission shall be obtained from the property owner and provided to ENGINEER.

3.02 OBSTRUCTIONS AND DISPOSAL OF WASTE MATERIAL

A. CONTRACTOR shall remove obstructions that do not require replacement from within the trench or adjacent areas such as tree roots, stumps, abandoned piling, buildings and concrete structures, frozen material, logs, and debris of all types without additional compensation.

B. ENGINEER may, if requested, make changes in the trench alignment to avoid major obstructions, if such alignment changes can be made within the WORK limits without adversely affecting the intended function of the facility.

C. Excavated materials unsuitable for backfill or not required for backfill shall be disposed of in accordance with local regulations.

3.03 TRENCH EXCAVATION

A. All existing asphalt or concrete surfacing shall be saw cut vertically in a straight line, and removed from the job site prior to starting the trench excavation. This material shall not be used in any fill or backfill.

B. Clearance:

1. The trench shall be excavated so that a minimum clearance of six (6) inches is maintained on each side of the pipe for proper placement and densification of the bedding or backfill material.

2. The maximum clearance measured at the spring line of the pipe shall be eighteen (18) inches regardless of the type of pipe, type of soil, depth of excavation, or the method of densifying the bedding and backfill.

C. Except as otherwise dictated by construction conditions, the excavation shall be of such dimensions as to allow for the proper pipe installation and to permit the construction of the necessary pipe connections.

D. Care shall be taken to ensure that the excavation does not extend below established grades.

1. If the excavation is made below such grades, the excess excavation shall be filled in with sand or graded gravel deposited in horizontal layers not more than six (6) inches in thickness after being compacted and shall be moistened as required to within two percent (2%) of the optimum moisture content required for compaction of that soil.

2. After being conditioned to have the required moisture content, the layers shall be compacted to the required density.

E. CONTRACTOR shall stockpile excavated materials in a safe manner. Stockpiles shall be graded for proper drainage.

F. CONTRACTOR shall place and grade the trench base to the proper grade ahead of pipe laying. The invert of the trench shall be compacted to provide a firm unyielding support along entire pipe length.

G. Surplus excavation shall be disposed of by CONTRACTOR at CONTRACTOR’s expense.

3.04 PROTECTION

A. Sheeting and Shoring:

1. CONTRACTOR shall protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent any excessive widening or sloughing of the trench which may be detrimental to human safety, to the pipe or appurtenances being installed, or to existing facilities or structures.

2. The latest requirements of OSHA shall be complied with at all times including trenching and confined space entry requirements.

3. CONTRACTOR shall be responsible for underpinning adjacent structures which may be damaged by excavation WORK, including service utilities and pipe chases.

B. Weather and Frost:

1. CONTRACTOR shall protect bottom of excavations and soil adjacent to and beneath foundations from frost.

2. Do not place backfill, fill, or embankment on frozen surfaces.

3. Do not place frozen materials, snow, or ice in backfill, fill, or embankments.

4. Do not deposit, tamp, roll, or otherwise mechanically compact backfill in water.

C. Drainage and Groundwater:

1. The excavation shall be graded to prevent surface water runoff into trench or excavation.

2. Maintain excavations and trenches free from water during construction.

3. Remove water encountered in trenches to the extent necessary to provide a firm subgrade, to permit joints to be made in the dry, and to prevent the entrance of water into the pipeline.

4. Divert surface runoff and use sumps, gravel blankets, well points, drain lines, or other means necessary to accomplish the above.

5. Maintain the excavation or trench free from water until the structure, or pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

6. Prevent water from entering into previously constructed pipe.

7. Do not use the pipe under construction for dewatering.

3.05 FOUNDATIONS ON UNSTABLE SOILS

A. If the bottom of the excavation is soft or unstable, and in the opinion of ENGINEER, cannot satisfactorily support the pipe or structure, a further depth and width shall be excavated and refilled to six (6) inches below grade with rock or other approved material, uniformly graded between three-quarter (3/4) inch and one and one-half (1-1/2) inches to provide a firm foundation for the pipe or structure. From six

(6) inches below grade to grade, the appropriate bedding material shall be placed to provide support for the pipe or structure.

3.06 PIPE BEDDING

A. After completion of the trench excavation and proper preparation of the foundation, six (6) inches of bedding material shall be placed on the trench bottom for support under the pipe.

B. Bell holes shall be dug deep enough to provide a minimum of two (2) inches of clearance between the bell and the bedding material.

C. All pipes shall be installed in such a manner as to ensure full support of the pipe barrel over its entire length.

D. After the pipe is adjusted for line and grade and the joint is made, the bedding material shall be carefully placed and tamped under the haunches of the pipe.

E. For all types of pipe, the limits of bedding shall be as shown on the trench section details on the DRAWINGS.

F. Bedding shall be compacted to seventy five percent (75%) relative density in accordance with ASTM D4253. Care shall be exercised to ensure sufficient tamping under the pipe to achieve uniform support.

3.07 BACKFILL AND COMPACTION

A. All muck excavation, bedding, and pipe zone material shall be imported unless otherwise designated by OWNER’s geotechnical engineer.

B. Pipe:

1. The pipe trench shall be backfilled to the limits as shown on the DRAWINGS.

2. The backfill in all areas shall be compacted by vibrating, tamping, or a combination thereof to seventy five percent (75%) relative density for sand material as determined by the relative density of cohesionless soils test, ASTM D4253, or to ninety five percent (95%) of the Maximum Standard Proctor Density for cohesive soils as determined by ASTM D698.

3. All backfill shall be brought up to equal height along each side of the pipe in such a manner as to avoid displacement.

4. Bedding shall be distributed in 6-inch (6") maximum lifts over the full width of the trench.

5. Wet, soft or frozen material, asphalt chunks, or other deleterious substances shall not be used for backfill.

6. If the excavated material is not suitable for backfill, as determined by ENGINEER, suitable material shall be hauled in and utilized and the rejected material hauled away and disposed of.

7. Backfilling shall be conducted at all times in a manner to prevent damage to the pipe or its coating and shall be kept as close to the pipe laying operation as practical.

8. Backfilling procedures shall conform to the additional requirements, if any, of appropriate agencies or private right-of-way agreements.

C. Unsurfaced Areas: All surface cuts shall be, as a minimum, restored to a condition equal to that prior to construction.

D. Surfaced Areas:

1. All surface cuts shall be, as a minimum, restored to a condition equal to that prior to construction.

2. All gravel or paved streets shall be restored in accordance with the regulations and requirements of the agency having control or jurisdiction over the street, roadway, or right-of-way.

E. Grassed or Landscaped Areas:

1. In landscaped or agricultural areas, topsoil, to a depth of twelve (12) inches, shall be removed from the area of general disturbance and stockpiled.

2. After installation of all pipelines, appurtenances and structures and completion of all backfill and compaction, the stockpiled topsoil shall be redistributed evenly over all disturbed areas.

3. Care should be taken to conform to the original ground contour or final grading plans.

3.08 FIELD QUALITY CONTROL

A. In-place moisture density tests will be performed to ensure trench backfill complies with specified requirements. The following minimum tests will be performed.

1. Trench Bedding: One per two hundred (1 per 200) feet.

2. Backfill: One per two hundred (1 per 200) feet.

B. Backfill Compaction Tests:

1. Backfill compaction tests will be performed until compaction meets or exceeds requirements.

2. The cost of “passing” tests will be paid by OWNER.

3. Costs associated with “failing” tests shall be paid by CONTRACTOR.

C. Pipe bedding will be tested prior to placement of backfill.

D. Testing of all bedding and backfill material will be done in compliance with Occupational Safety & Health Administration (OSHA) - Excavations.

3.09 RESTORATION

A. Scarify surface, reshape, and compact to required density completed or partially completed areas of WORK disturbed by subsequent construction operations or by adverse weather.

B. Maintain and correct backfill, fill, and embankment settlement and make necessary repairs to pavement structures, seeding, and sodding which may be damaged as a result of settlement for the guarantee period.

C. Such maintenance and correction may be performed by subcontract.

D. Upon completion of the WORK, all plants, rubbish, unused materials, concrete forms, and other like material shall be removed from the job site.

E. The site shall be left in a state of order and cleanliness.

END OF SECTION