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**PART 1 - GENERAL**

**1.1 Summary**

These specifications cover the excavation and backfill of trenches for the installation of storm sewer, sanitary sewer, water lines, service lines, pressure sewer lines, and other underground utilities.

**1.2 Definitions**

- A.** Foundation material or stabilization fabric will only be required when standard bedding requirements will not adequately support the pipe.
- B.** Backfill is the filling of the trench to the existing ground level or the finish grade line shown on the Drawings.
- C.** General trench excavation shall include whatever materials that are encountered (except solid rock) to the depths shown on the Drawings or as required to properly install the pipe.
- D.** Solid rock is defined as being rock formations other than cemented gravels that require hard ripping, jackhammering, blasting, or other extra work beyond the capability of heavy-duty trench excavating equipment such as a Caterpillar 235 or 345B Excavator.

**1.3 Safety**

- A.** See requirements for project safety in the General Requirements.
- B.** The determination of the safe trench width is the sole responsibility of the Contractor.

**1.4 Existing Utilities**

See the General Requirements for requirements for existing utilities and for preservation of survey monumentation.

**1.5 Dust and Mud Control**

The Contractor shall take appropriate action to control dust and mud caused by his operations. This shall include, but not be limited to, watering of exposed areas, cleaning of roadways, etc. This is considered a normal part of the construction project.

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**1.6 Repair of Unmarked Utilities**

Contractor shall, as requested by the City, either immediately arrange for the utility company to make the needed repairs or immediately make the repair to the damaged utility under the following conditions.

- A. When existing utilities are encountered during the performance of the Work that were not previously located by the utility as required by the Call Before You Dig notification system.
- B. Where existing utilities were farther than four feet away on either side of the marked location, and where damage to the utilities occurred due to no negligence of the Contractor.

**PART 2 - MATERIALS**

**2.1 Foundation Material**

Foundation material shall be well-graded 2-1/2"-0 or 1-1/2"-0 crushed rock.

**2.2 Bedding and Select Backfill**

Bedding and select backfill shall be well-graded 3/4"-0 or 1"-0 crushed rock or approved equal. The use of 1-1/2"-0 crushed rock will be allowed only when using ductile iron pipe. All bedding and select backfill materials shall be subject to the approval of the City and/or City Engineer.

**2.3 General Backfill**

- A. General backfill will consist of material excavated from the trench, or material imported by the Contractor. General backfill material shall be free of vegetative matter, boulders (10-inch plus), frozen material and any other unsuitable material, and shall have a moisture content that will allow for the required compaction of the general backfill material unless approved otherwise by the City and/or City Engineer. Use of backfill material containing consolidated masses 10-inch in diameter or greater is prohibited.
- B. When necessary, the Contractor shall selectively separate suitable general backfill material from unsuitable general backfill material.
- C. When the native material excavated from the trench is unsuitable or unacceptable for use as general backfill, the City and/or City Engineer may require the Contractor to remove the unsuitable material from the project site and import suitable general backfill material. Suitable material shall be similar in nature to native soils as approved by the City. When imported general backfill must be placed in or below the groundwater, the imported

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general backfill shall be free draining granular material with less than 20 percent passing a No. 4 sieve and less than 3 percent passing a No. 200 sieve.

**2.4 Controlled Density Fill**

- A. When called for on the Drawings, controlled density fill material shall be a flowable cement, sand or pea gravel, and Fly Ash Pozzolanic, or other approved materials, mixture that contains 75 to 120 pounds of Type II cement per cubic yard.
- B. The sand and other aggregates shall generally conform with the requirements of ASTM C 33.
- C. Air-entraining agent shall be added at the rate of 3 to 5 oz. per cubic yard.
- D. The material shall have a 28-day compressive strength of 100-200 psi and have a slump of 7 inches plus or minus 1 1/2 inches at the time of placement. The Contractor shall provide a mix design and data on the controlled density fill material he proposes to use along with typical compression test results.

**2.5 Anti-Flotation, Dewatering and Trench Stabilization Fabrics**

- A. Fabric for anti-flotation and dewatering shall be Mirafi 500X or approved equal.
- B. Fabric for trench stabilization shall be Mirafi 140N Fabric or approved equal.

**PART 3 - EXECUTION**

**3.1 Clearing and Grubbing**

- A. Contractor shall do all clearing and grubbing and removal of structures, etc. necessary to permit proper installation of the pipeline and to eliminate the possibility of stumps, logs, brush, or rubbish being mixed with the backfill material. A sufficient amount of all stumps and stump roots shall be removed so that any future removal of any remaining parts of the stumps and/or roots will not damage the pipeline. All stumps, roots, logs, brush and rubbish shall be removed and disposed of in conformance with the requirements of local authorities controlling air pollution, and solid waste disposal.
- B. Should the area in which construction takes place be served by rural mail carrier service, the Contractor shall cooperate with the mail service and re-install, in a convenient location, any rural mail boxes which will have to be removed or be blocked by construction operations. As soon as the work is completed, all mail boxes removed shall be replaced undamaged in their original location.

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- C. As soon as the work is completed, all signs, guardrails, utility poles, fences, etc., that were moved for the construction operation shall be replaced undamaged in their original location. Damaged items shall be replaced by the Contractor with new items of equal quality.

**3.2 Cutting of Asphalt Pavement and Concrete Sidewalks, Curbs and Driveways**

- A. Where the excavation is made in a paved street, the asphalt surface shall be cut on each side of the trench prior to excavation, to provide a vertical joint in the surface. Cutting of the asphalt will be made with a saw designed for the cutting of asphalt.
- B. The use of a jackhammer, wheel cutter, or other similar tool may be allowed by the City only where the Contractor can demonstrate that the alternate method provides a neat straight edge.
- C. Prior to excavating across a concrete structure such as a curb, sidewalk, or driveway, the Contractor shall cut and remove a section of the structure in order to provide for his excavation. The dimensions of the removed section shall be such that the Contractor's excavation will not result in undermining of the remaining structure.
- D. The Contractor shall cut the concrete structure with a diamond saw or other equipment designed for that purpose such that a neat, straight, vertical edge is left on the remaining concrete structure. The Contractor shall similarly cut and remove any such concrete structure undermined or damaged by his construction work.
- E. Following proper backfill and compaction of his excavation, as specified herein, the Contractor shall repair streets, replace the curbs, sidewalks, or driveways in conformance with the Drawings, or, if no Drawing is provided, equal to the condition prior to removal.

**3.3 Trench Excavation**

- A. When solid rock is encountered in trench excavation, the City shall be notified.
- B. Trench Width
  - 1. The maximum trench width in the pipe zone shall be 2 feet plus the O.D. of the pipe and the minimum trench width in the pipe zone shall be 1 foot plus the O.D. of the pipe. This width shall be maintained to the top of the pipe.
  - 2. The maximum clear width above the top of the pipe will not be limited except in cases where excess width of excavation would cause damage to adjacent structures or utilities.

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**C. Unsuitable Material**

1. When natural soil conditions exist in the bottom of the trench that are unsuitable for proper pipe installation, the Contractor shall immediately notify the City. The Contractor shall then over-excavate the trench below the design grade to a depth specified by the City Engineer. Such over- excavation shall be to provide for foundation material as specified herein.
2. Foundation material or stabilization fabric, as shown on the Drawings, shall be provided by the Contractor only when specifically called for on the Drawings or in these Specifications or when required by the City and/or City Engineer.
3. As an alternative to over-excavation and placement of foundation material, a geotextile fabric may be used if field use proves acceptable. The fabric material shall be placed on the bottom of the trench and the bedding material placed over the fabric to proper pipe grade. The fabric width shall be one foot wider than the trench bottom.

**D. Exploratory Work**

Contractor shall perform appropriate exploratory work to locate utilities when they are known to exist but the specific location is unknown or not marked accurately. Appropriate exploratory work shall be performed in these situations.

**3.4 Shoring, Sheeting, and Bracing of Trenches**

- A. The Contractor shall adequately sheet and brace the trench during excavation whenever necessary to satisfy trench safety standards, prevent cave-ins, or to protect adjacent structures or property. Where sheeting and bracing are used, the Contractor shall increase trench widths for the bracing material accordingly.
- B. The sheeting must be kept in place until the pipe has been placed, backfilled at the pipe zone, tested for defects, and repaired if necessary. All sheeting, shoring, and bracing of trenches shall conform to the requirements of the public agency having jurisdiction.

**3.5 Dewatering Excavated Areas**

- A. All groundwater, seepage, or stormwater that may occur or accumulate in the excavation during the progress of the work shall be removed. In areas where the nature of soil and hydrostatic pressures are of such a character as to develop a quick condition in the earth mass of the trench, the dewatering operation shall be conducted so that the hydrostatic pressure will be reduced to or near zero in the immediate vicinity of the trench.

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- B.** All excavations shall be kept free of water during the construction or until otherwise requested by the City.
- C.** Contractor shall dispose of all waste and water removed from the trench. Disposal shall be in accordance with all state and local regulations.

**3.6 Location of Excavated Materials**

- A.** During trench excavation, the excavated material shall be located within the construction easement or right-of-way so that the excavated material will not obstruct any private or public traveled roadways or streets, or cause undue damage to the streets.
- B.** Contractor shall provide means of containing overly saturated soils, i.e., muck, or remove the muck from the work area as it is excavated, if such soils are encountered in the excavation. The intent is to prevent excessive damage or disruption to street rights-of-way or easement beyond what would normally occur during such work. Pile and maintain material from trenches so that the toe of the slope of the material excavated is at least two feet from the edge of the trench. It shall be the Contractor's responsibility, however, to determine the safe loading of all trenches.

**3.7 Disposal of Excavated Materials**

Contractor shall dispose of all excavated material, which is not required for, or is unsuitable for, backfill. The Contractor's method of disposal shall comply with regulations of the governing body having jurisdiction.

**3.8 Trench Backfill**

- A.** All backfill material shall be placed into the trench so that free fall of the materials into the trench is prevented until at least two feet of cover is provided over the pipe. Under no circumstances shall sharp or heavy pieces of material be allowed to drop directly onto the pipe. Methods of backfilling, other than as specified herein, shall be used only upon the approval of the City.
- B.** Bedding and Select Backfill
  - 1.** A minimum 4-inch depth of bedding shall be placed on the trench bottom, compacted to 85 percent of the maximum density as determined by ASTM D 698 or WSDOT Test Method 606, as applicable, and smoothed to provide uniform bedding so the pipe is supported along its full length and not by the bells. Bell holes at each joint shall be provided to ensure support along the entire pipe length.

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2. It shall be understood that the 4-inch depth is a minimum depth only, not an average depth and does not preclude the Contractor at his option from placing additional depth of bedding to facilitate his work. Once the pipe is properly installed, the bedding material shall be brought up to the spring line of the pipe in 4-inch lifts and compacted to 85 percent density. Care shall be used to ensure that the bedding material is properly worked under the haunch of the pipe for its full length.
  3. Select backfill shall then be brought up from the spring line to the minimum distance above the top of the pipe shown on the Drawings, leveled and compacted to 85 percent of ASTM D 698 or WSDOT Test Method 606, as applicable, density. Compaction of the bedding and select backfill by hand tamping will be allowed if the 85 percent density is achieved; otherwise, mechanical tamping will be required.
- C. All general backfill material shall be pushed first onto the slope of the backfill previously placed and allowed to roll down into the trench. The Contractor shall not push the backfill material directly into the trench until at least two feet of cover is provided over the pipe.
- D. Compaction
1. In roadways, driveways, under curbs and sidewalks, or as shown on the Drawings, general backfill shall be placed in horizontal lifts not to exceed 12 inches in depth and compacted to 90 percent of the laboratory density as determined by ASTM D 1557 or WSDOT Test Method 606, as applicable. The method of compaction shall be selected by the Contractor.
  2. The Contractor shall exercise extreme care to avoid damage to the pipe during compaction of the trench. Where materials consist of cobbles and coarse gravels, compaction of each lift shall be accomplished by at least five passes of an appropriate vibrating type compactor. When materials are such that meaningful in place density test cannot be run, then the Contractor and the City and/or City Engineer will agree on a method of compaction which will provide adequate compaction.
  3. In sections where specific compaction requirements are not specified, general backfill shall be compacted, as a minimum, to a density equal to that of the natural ground adjacent to the trench. All trenches shall be maintained for a period of one year after final acceptance of the project. Any settlement of the trenches during the one-year guarantee period shall be remedied promptly at the request of the City and at no additional cost to the City.



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**E. Controlled Density Backfill Placement**

1. When called for on the Drawings, Contractor shall backfill trenches with controlled density fill (CDF).
2. CDF shall be placed in the trench in such a manner to ensure the trench is completely filled to the lines and grades called for on the Drawings. The controlled density fill
3. CDF shall be protected from traffic loads for a three-hour period after which required surface restoration work may be performed.

**F. Canal or Irrigation Ditch Crossing**

1. Where the trench crosses a canal, irrigation ditch or culvert, the backfill shall be compacted the entire trench depth with mechanical tampers to 90 percent of the laboratory density as determined by ASTM D 1557.
2. All backfill material in the canal or ditch liner and in the trench cut-off wall shall be imported clay or a soil/bentonite mixture as approved by the City Engineer. Unless required otherwise, the soil/bentonite mixture shall be 1 part bentonite to 10 parts soil by weight. A high grade bentonite material shall be used.
3. The ditch lining, conduit or pipe shall be restored to its original condition. The crossing shall be water tight and free of any leakage or seepage. The Contractor shall be fully responsible for repairing canal or ditch banks at no cost to the City should leakage occur at the crossing.

**3.9 Execution of Dust and Mud Control**

If the Contractor fails to properly control the dust and mud, the City may request him to do so in writing. If, after 24 hours from this request, the Contractor has not corrected the dust or mud problem, the City may elect to have the corrective work performed and withhold the cost from the Contractor's payments.

**3.10 Restoration, Finishing, and Cleanup**

- A.** The Contractor shall restore or replace all paved surfaces, graveled surfaces, curbing, sidewalks, trees and shrubbery, lawns, pastures and fences, or other existing facilities disturbed by his work unless otherwise specified. Restoration and cleanup shall be a continuing operation and shall be diligently pursued until completed.

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- B.** All surplus material and temporary structures as well as excess excavation shall be removed by the Contractor and the entire site of Contractor operations shall be left in a neat and clean condition.
  
- C.** Surface restoration shall be performed in accordance with Technical Specifications - "Surface Restoration." All other existing facilities shall be replaced or restored equal to their original condition.

END OF SECTION