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SECTION 200

UNDERGROUND PIPE CONSTRUCTION

200 EXCAVATION

- A. Unless otherwise shown on the drawings, all underground pipe construction shall be done in open trenches.
- B. CONTRACTOR shall remove all vegetation and topsoil along the trench line to the width of the proposed trench before beginning excavation. Vegetation and topsoil removed shall not be used as backfill in the trench. Sufficient topsoil shall be salvaged for restoration. CONTRACTOR shall remove concrete and asphalt pavements to the minimum width practical for excavation of a safe trench. Maximum width of pavement removal for payment purposes shall be 9 feet unless otherwise authorized by ENGINEER. Pulverized pavements may be used as trench backfill so long as they conform to backfill gradation requirements. Pavement removals shall be paid for according to the unit price bid. Cost for vegetation and topsoil removal and stockpiling shall be considered incidental.
- C. Trenches:
 - 1. Trenches shall be excavated in conformity with the required alignment and grades as shown on the drawings and as laid out in the field by ENGINEER. ENGINEER reserves the right to adjust the profile grades from those shown on the drawings.
 - 2. Excavation shall be done in such a way as to remove loose materials and provide a uniform, stable trench bottom.
- D. Rock Excavation:
 - 1. Rock excavation shall include all hard, solid rock ledges, bedded deposits and unstratified masses and all conglomerate deposits or any other material so firmly cemented that in the opinion of ENGINEER it is not practical to excavate and remove same with a 225-net flywheel horsepower trench backhoe, or equal, except after continuous drilling and blasting. Rock excavation shall also include rock boulders having a volume of 2 cubic yards or more. Soft or disintegrated rock which can be removed with a pick, loose, shaken or previously broken rock or rock which may fall into the excavation from outside the limits of excavation will not be classified as rock excavation.
 - 2. When rock is encountered, it shall be stripped of earth and ENGINEER and OWNER's representative notified and given proper time to observe the rock before removal. Any rock removed which has not been measured by ENGINEER or OWNER's representative will not be classified as rock excavation.
 - 3. The depth of rock excavation in a trench shall be 6 inches minimum below the pipe.
 - 4. Rock excavation shall be paid at the unit price bid per linear foot of trench regardless of depth.
 - 5. All rock excavated from the trench shall be classified as undesirable backfill material and shall be disposed of off the site.
- E. Surplus Material: Surplus material from trench excavation shall be considered to include vegetation, excess salvaged topsoil, excavated rock, boulders larger than 6 inches in diameter, and all other material from excavation not needed nor suitable for backfilling trenches.

- F. Sheeting: CONTRACTOR shall provide all sheeting and/or bracing needed to protect the work, adjacent lands, utilities, pavement, etc., and to provide safe working conditions in the trench. Trench box apparatus shall be considered bracing. Sheeting and bracing shall be according to CONTRACTOR's design and shall comply with the Wisconsin Administrative Code and OSHA requirements. Removal of any sheeting or bracing from the trench shall be accomplished in such a manner as to fulfill the above requirements. Sheeting and bracing shall be removed from the site following construction unless specific written permission is given by ENGINEER to leave it in place. This work shall be done at CONTRACTOR's expense.
- G. Dewatering:
1. CONTRACTOR shall, at CONTRACTOR's own expense, remove any water which may accumulate or be found in the trenches associated with underground pipe construction and shall form all dams, flumes, or other works necessary to keep the excavation entirely clear of water while pipe bedding, piping, or other associated work is being constructed.
 2. In the event that CONTRACTOR's dewatering operation adversely affects private water supply systems, CONTRACTOR shall provide property owners with alternative potable and non-potable supplies until dewatering operations are ceased and groundwater levels return to normal.
 3. ENGINEER reserves the right to limit the extent of excavation in advance of pipe laying and backfilling depending on the nature of the soil and other conditions affecting the work.
- H. Additional Excavation: ENGINEER reserves the right to order additional excavation where unsuitable trench bottom conditions exist. When this condition arises, the excavation shall be carried to such depths as directed by ENGINEER. The maximum width of the additional trench excavation shall be consistent with standard pipe installation details. Bedding stone wrapped in geotextile fabric shall be installed to replace additional materials excavated as directed. Additional excavation, including backfill with geotextile fabric and bedding stone, shall be paid for according to the unit price bid, except for those cases where the instability is related to inadequate dewatering or CONTRACTOR's failure to adequately protect the trench. In such cases, additional excavation shall be done at CONTRACTOR's expense.
- I. Exploratory Excavation: When requested by ENGINEER, CONTRACTOR shall perform exploratory excavations to uncover utility lines or otherwise investigate existing conditions within the proposed construction limits. Where utility lines are uncovered, the elevation of the utility lines shall be determined by ENGINEER, and the utility companies advised by ENGINEER for any adjustments required. CONTRACTOR shall be responsible for any required backfilling with excavated materials and restoration. Cost for exploratory excavations shall be paid for in accordance with the unit price bid.

201 PIPE BEDDING

- A. Pipe shall be installed on granular bedding in accordance with the standard detail drawings. CONTRACTOR shall provide bedding to assure uniform and continuous bearing support for the pipe or structure.
- B. Immediately prior to placing the pipe, CONTRACTOR shall shape bedding by hand to fit the entire bottom quadrant of the pipe. If pipe is of the bell and spigot type, bell holes shall be provided to prevent the bell from supporting the backfill load. Bell holes shall be large enough to permit proper making of the joint but not larger than necessary to make the joint. All adjustments to line and grade must be done by scraping away or filling in bedding material under the body of the pipe.

- C. Bedding material shall consist of crushed limestone, dolomite ledge rock, or gravel aggregate. The material shall be hard and durable and shall meet the following gradation specifications.

BEDDING MATERIAL GRADATION

Sieve Size	Percentage by Weight Passing		
	Gradation No. 1	Gradation No. 2	Gradation No. 3
1-inch	100	--	--
3/4-inch	90 to 100	--	--
1/2-inch	--	100	100
3/8-inch	20 to 55	90 to 100	--
No. 4	0 to 10	--	75 to 100
No. 8	0 to 5	0 to 15	--
No. 30	--	0 to 3	--
No. 100	--	--	10 to 25

- D. No material native to the trench shall be used for bedding material.
- E. CONTRACTOR shall provide ENGINEER with a sieve analysis of bedding material for review prior to starting construction.

202 LAYING OF PIPE

- A. Wherever the word pipe appears in this article, it shall be understood to include pipe fittings and accessories.
- B. Pipe shall be of the size, type, class, and design and shall be laid at the locations, to the required lines and grades as shown on the drawings, required by the Contract Documents, or requested by ENGINEER. All material found to have cracks, flaws, or other defects will be marked as rejected by ENGINEER, and CONTRACTOR shall promptly remove such defective material from the site. Proper installation of structures and fittings, whose locations are shown on the drawings and laid out by ENGINEER, shall be accomplished by the use of random lengths of pipe furnished by CONTRACTOR. The cost of random lengths of pipe shall be included in the Contract unit prices for the respective sizes and types of pipe.
- C. Unless otherwise approved by ENGINEER, pipe laying shall commence at the lowest point and proceed toward the upper end.
- D. Pressure pipes shall be installed to ± 0.1 ft of required grade. Gravity pipes shall be installed to within 0.03 feet of required grade and shall be free of any standing water within the pipe throughout the completed installation. The joints shall be properly adjusted and set firmly to line and grade to provide a smooth and uniform invert.
- E. Pipes shall be handled so as to avoid damage. CONTRACTOR shall furnish suitable lifting and handling devices designed to distribute the weight of the pipe over the length of the pipe and prevent high stresses over small areas. The method of placing the pipes together shall be in accordance with manufacturer's guidelines and such that there will be no damage to the pipes.

- F. Pipe shall not be laid within 40 feet of, and shall be protected from, the effects of blasting. Pipe shall not be laid in water, on frozen ground within the trench or at a time when weather is unsuitable for the proper performance of the work.
- G. No length of pipe shall be laid until the previously laid length of pipe has been sufficiently covered to hold it securely in place during the jointing operation. If, in making a joint, any previously laid pipe is disturbed, such pipe shall be removed and relaid. Adequate backfill or supplemental ballast shall be placed on the pipe to prevent floating. Any pipe which has been floated or has settled in excess of the tolerances noted shall be removed and relaid at the expense of CONTRACTOR.
- H. Whenever a portable trench box or shield is used, special precautions shall be taken so as not to pull already jointed pipe apart or leave voids around the pipe wall. Whenever possible, the bottom edge of the box shall be kept at a level approximately even with the top of pipe. Cover material shall be placed to at least the top of pipe prior to moving the box.
- I. All water must be kept out of the pipe until the joint is completed and water shall not be allowed in or about the pipe until the trench has been filled at least 1 foot above the top of the pipe.
- J. Any earth or other materials that may enter the pipe shall be removed by and at the expense of CONTRACTOR. CONTRACTOR shall securely plug pipe ends at the suspension of pipe laying activities.
- K. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be joined and of the joint materials shall be clean and dry. Lubricants, primers, adhesives, and other joint material shall be used and installed as recommended by the pipe or joint manufacturer's specifications. The joint materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a workmanlike manner as to obtain the degree of watertightness specified. Pipe shall be brought "home" by using methods approved by the pipe manufacturer. CONTRACTOR shall not push pipe "home" with motor-powered excavation equipment.

203 COVER MATERIAL

- A. Material placed from the bedding material to 1 foot above the top of the pipe shall be termed cover material. Cover material shall be deposited in the trench for its full width on each side of the pipe, fittings, and appurtenances simultaneously in 6-inch layers and shall be compacted using hand tamping bars and/or mechanical tampers. CONTRACTOR shall use special care in placing cover material so as to avoid injury to the pipe.
- B. Cover material shall consist of durable granular particles that conform to the following gradation specifications:

COVER MATERIAL GRADATION

<u>Sieve Size</u>	<u>Percentage by Weight Passing</u>
1-inch	100
3/4-inch	85 to 100
3/8-inch	50 to 80
No. 4	35 to 65
No. 40	15 to 30
No. 200	5 to 15

- C. Unwashed bank run sand and crushed bank run gravel will be considered generally acceptable cover material. Native trench materials may be used for cover material if they substantially conform to the above gradation specifications and a suitable credit is extended to OWNER.
- D. Bedding material may be substituted for cover material.

204 INSULATION

- A. Insulation shall be provided over utilities including sanitary sewer, water mains, water services and sanitary laterals at storm sewer crossings or where the depth of cover is allowed to be less than 6.5 feet. Insulation shall be Dow Chemical Company, "Styrofoam Hi-40" insulation board, or approved equal. The insulation shall be installed to provide a minimum R-value of 20. Full width insulation boards shall be centered over the utility line for a minimum length of 8 feet at storm sewer crossings, and a minimum length of 4 feet beyond areas where cover is less than 6.5 feet. Insulation will be considered incidental to the utility bid items provided.

205 BACKFILLING

- A. Backfill shall be that material placed from the top of cover material to the subgrade as shown on the detail drawings.
- B. Unless otherwise provided, all trenches and excavations shall be backfilled immediately after the utility lines and appurtenances have been constructed therein. In covering utility lines and filling around structures, the backfill material shall be brought up evenly on all sides so that no unbalanced pressure is brought to bear on the installation.
- C. Backfill shall not be placed when the ambient air temperature is below 35°F.
- D. Backfill for storm inlets and fire hydrants shall be bedding material.
- E. When the type of backfill material is not otherwise specified, CONTRACTOR may backfill with the excavated material, provided such material consists of loam clay, sand, gravel or other materials which, in the opinion of ENGINEER, are suitable for backfilling. All excavated material used as backfill shall be well-graded material allowed to contain stones up to 6 inches in their greatest dimension, and shall be free from frost, cinders, ashes, refuse, organic matter, boulders, rocks, frozen lumps or other material which in the opinion of ENGINEER is unsuitable.

- F. When required by the Contract Documents or when excavated material is determined to be unsuitable for backfilling, backfill shall be granular material consisting of durable particles ranging in size from fine to coarse in a substantially uniform combination. Sufficient fine material shall be present to fill all the voids in the coarse material. Unless otherwise allowed by ENGINEER, granular backfill shall conform to the following gradation specification:

GRANULAR BACKFILL

Sieve Size	Percentage by Weight Passing
2-inch	95 to 100
No. 4	35 to 60
No. 200	5 to 10

- G. The cost for using salvaged excavated material as backfill shall be considered incidental to the related work, and the cost shall be included in the prices bid for the related items.
- H. The cost for hauled in granular backfill material as required by the Contract Documents shall be included in the price bid for associated work.
- I. Where hauled-in granular backfill is required because the excavated material has been determined to be unsuitable for backfilling, granular backfill shall be considered incidental to the related work, and the cost shall be included in the prices bid for the related items.

206 INSTALLATION

- A. CONTRACTOR shall provide equipment and labor necessary for performing the Work. Equipment shall be satisfactory as to design, capacity and mechanical condition for the purposes intended. Any equipment which is not maintained in full working order, or which, as used by CONTRACTOR is inadequate to obtain the results prescribed, shall be repaired, improved, replaced or supplemented in order to complete the work in accordance with Contract requirements.

207 COMPACTION

- A. Unless approved by ENGINEER, all backfill material shall be placed in uniform layers not exceeding 12 inches and compacted after each layer with suitable mechanical equipment ramming or tamping tools approved by ENGINEER. In general, granular backfill materials shall be compacted using vibratory mechanical equipment, and non-granular backfill materials shall be compacted using weighted sheeps-foot type equipment.
- B. Each layer of material shall be uniformly spread and then uniformly compacted to the required percentage of maximum density as shown on the standard detail drawings. Maximum density of the material shall be determined by a laboratory compaction test performed by OWNER's soils consultant in accordance with ASTM Test Designation D1557-64T, Method D.
- C. The field density tests for determining the compaction of the fill in place shall be performed under the direction of ENGINEER by a qualified soils engineer selected by ENGINEER.

- D. The cost of compaction testing will be paid by OWNER. In the event testing indicates compaction below specified minimum limits, CONTRACTOR shall recompact as directed by ENGINEER. Costs of additional testing following failure to meet contract standards for compaction shall be paid by CONTRACTOR.

END OF SECTION