

1.0 GENERAL

1.1 Description

- .1 This Section specifies requirement for excavating trenches and backfilling for installation of pipelines and appurtenances.

1.2 Related Work Specified Elsewhere

- .1 Water Distribution Section 02510
- .2 Manholes Section 02536
- .3 Sanitary Sewers Section 02537
- .4 Building Services Section 02539
- .5 Catch Basins, Grates and Frames Section 02631
- .6 Storm Drainage, Pipes and Fittings Section 02635

1.3 Definitions

- .1 Common excavation is defined as the excavation of all materials including rock, and shall include over-burden, hard pan, quicksand, frozen earth and boulders.
- .2 Boulder excavation is defined as boulders, pieces of concrete or masonry, in excess of 0.2 cubic metres and having an average diameter less than 600 mm, which can be removed with a power operated excavator.

1.4 Safety Requirements

- .1 Adhere to municipal and provincial requirements relating to safety of trenching work.

1.5 Protection

- .1 Existing Buried Utilities:
 - .1 Prior to commencing any excavation work, notify applicable utility authorities, establish location and state of use of buried services. Clearly mark such locations to prevent disturbance during work.
 - .2 Maintain and protect from damage, water, sewer, electric and other utilities encountered.
 - .3 Obtain direction of owner of utility and Engineer before moving or otherwise disturbing utility.

- .2 Existing Surface Features:
 - .1 Protect existing buildings, culverts, trees and other plants, lawns, fencing, service poles, wires located within right-of-way or adjoining properties from damage while work is in progress and repair damage.

- .3 Shoring and Bracing:
 - .1 Whenever shoring, sheeting, timbering and bracing of excavations is required engage services of a professional engineer to design and assume responsibility for adequacy of shoring and bracing. Professional engineer to be registered in province or territory in which work is to be carried out.
 - .2 When requested by Engineer, submit for review, drawings and calculations signed and stamped by professional engineer responsible for their preparation.
 - .3 Close sheeting, when required, to be designed and constructed to prevent adjacent soil or water from entering excavation.
 - .4 Maintain unobstructed access to fire and police appurtenances, telephone, electric, water, sewer, gas or other public utilities and private properties.
 - .5 Protect open excavation against flooding and damage from surface water run-off.

1.6 Site Conditions

- .1 The Bidder must examine the site of the Work before submitting his Bid, either personally or through a representative and satisfy himself as to the nature and location of the Work, local conditions, soils structure and topography at the site of the Work, the nature and quality of the materials to be used, the equipment and facilities needed preliminary to, and during, the prosecution of the Work, the means of access to the site, on-site accommodation, all necessary information as to risks, contingencies and circumstances as may affect his Bid, and all other matters which can, in any way, affect the Work under the Contract. The Tenderer is fully responsible for obtaining all information required for the preparation of his Bid and for the execution of the Work.

- .2 The Bidder is not entitled to rely on any data or information included in the Bid Documents as to site or sub-surface conditions or test results indicating the suitability or quantity or otherwise off-site or subsurface materials for backfilling or other uses in carrying out the construction of the Work. If the Bidder requires additional time to conduct his own investigations or is of the opinion either that the site or subsurface conditions or that site or subsurface materials differ materially from that indicated by data or information included in the Bid Documents, he shall promptly request such additional time or notify the Engineer in writing of this opinion before the time of Bid submission. The Engineer will either request the Owner to extend the time for submission of Bids or enable Bidders to carry out further investigation or issue an addendum modifying the Bid Documents or both as the circumstances may permit.

1.7 Protection of Existing Curb and Gutter and Sidewalks

- .1 The Contractor shall protect the existing curb and gutter from damage caused by his operations. Any curb and gutter damaged by the Contractor's operations shall be replaced at his own expense. This applies when the curb is not proposed to be replaced.

1.8 Measurement and Payment

- .1 Work performed to this section will be in conjunction with work involved in other sections with the exception of the following:

.1 Common Excavation:

Payment for common excavation will be included in the unit price tendered per metre of pipe(s) being installed. The cost shall include excavation, hauling, dewatering, backfilling, placing and compaction of bedding material, disposal of excess excavation material, restoration of roadways and ditches to previous cross-sections, grade and condition that existing prior to construction, regravelling of roadways and driveways disturbed by construction, disposal of all rocks not allowed as backfill and replacement with suitable backfill, and all other work required for which separate payment is not indicated in the tender form.

.2 Boulder Excavation: Shall be measured in cubic metres.

Boulder to be measured for payment shall be set at the side of the trench for measurement by Engineer. The boulders shall be individually measured in 3-point dimensions. Upon completion of measurement, the Engineer shall mark the boulders so they can be disposed of at a site approved by the Engineer and secured by the Contractor. The cost of this disposal and replacement with approved backfill shall be included in the unit price for boulder excavation.

.3 Unstable Subgrade:

Where the subgrade of the trench is unstable or will not properly support the pipe, or where it contains material harmful to the pipe such as ashes, cinders, refuse, vegetable or organic material, the Contractor shall excavate such material to the width, depth and length, authorized in writing by the Engineer, and dispose of the material at a suitable disposal location. The subgrade shall then be made by backfilling with granular backfill or bedding stone and compacting in 150 mm layers. The finished subgrade surface shall be shaped to provide a uniform and continuous support for the pipe. Unstable or otherwise unsuitable ground excavated from the bottom of the trench, will be measured in cubic metres calculated from the length, width and depth authorized for removal. Payment will be at the Unit Price tendered including excavation and hauling, backfilling with bedding stone, and compaction of all bedding material used.

.4 Bedding Stone: Shall be measured in cubic metres.

Bedding stone where required by the Engineer shall be used for bedding below the pipe.

The bedding stone quantity shall be calculated using a trench width of 1.1 m, times the length of trench and depth of bedding stone as requested by the Engineer. Any cost of bedding stone beyond the above widths or depths shall be borne by the Contractor.

The cost of any bedding stone required to correct any unauthorized over-excavation and disposal of over-excavation shall be borne by the Contractor.

.5 Imported Granular Backfill:

Where designated by the Engineer, imported granular backfill required for replacement of unsuitable material in the subgrade shall be paid for at the unit price bid per cubic metre in place based on the actual length, width and depth of the area filled, and shall include supplying, hauling, placing and compacting the material.

.6 Pavement Saw Cutting:

Saw cutting roadway asphalt materials will be measured and paid for at the contract unit price as listed in the Bid Form regardless of depth of asphalt.

.7 Removal and Disposal of Asphalt:

Removal of existing asphalt will be paid for at the unit price bid per square metre. The unit price shall include loading and hauling to an approved disposal area.

2.0 PRODUCTS

2.1 Materials

.1 Imported Granular Backfill:

- .1 Clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material, meeting following gradation limits:

<u>ASTM Sieve Designation</u>		<u>Per Cent Passing</u>		
50.0	mm			100
31.5	mm	60	-	100
16.0	mm	40	-	90
4.75	mm	25	-	60
2.00	mm	20	-	50
0.425	mm	10	-	25
0.075	mm	0	-	10

.2 Common Backfill:

- .1 Approved material selected from trench excavation or other source to be used in the Final Backfill zone, unfrozen and free from cinders, ashes, sods, refuse or other deleterious materials.
- .2 The maximum size of boulders permitted in backfill will be 0.02 m³ or 300 mm average diameter.

.3 Pipe Embedment Materials:

- .1 The pipe embedment zone shall be broken down into foundation, bedding, haunching, and initial backfill as identified in Figure 1 of ASTM Standard Practice D2321.
- .2 Materials for use as foundation, embedment, and backfill for all pipe material types are as classified in Table 1 of ASTM Standard Practice D2321. They include natural, manufactured, and processed aggregates and the soil types classified according to ASTM Test Method D 2487.
- .3 Class I, Class II, and Class III pipe embedment materials are suitable for use as foundation material and in the embedment zone subject to the limitations noted herein and in Table 2 of ASTM Standard Practice D2321.
- .4 Class IV-A materials should only be used in the embedment zone in special design cases, as they would not normally be construed as a desirable embedment material for flexible pipe.

- .5 Class IV-B, Class V Soils, and Frozen Materials are not recommended for embedment, and should be excluded from the final backfill except where specifically allowed by project specifications.
- .6 For ease of compactability and to facilitate proper placement of material in the haunch area of the pipe, a suggested gradation for sand within the pipe embedment zone are the following limits:

<u>ASTM Sieve Size</u>	<u>Per Cent Passing</u>
9.50 mm	100
4.75 mm	50 - 100
2.00 mm	30 - 90
0.425 mm	10 - 50
0.075 mm	0 - 12

The above material is classified as an ASTM D2321 Class II embedment material.

- .7 Fillcrete: Non-shrinking fill made up of a mixture of portland cement, sand, water and admixtures conforming to the following:
 - .1 Minimum 28 day compressive strength 0.60 to 2.00 MPa
 - .2 Slump 100 mm ±25 mm
 - .3 Portland Cement Type 10
 - .4 Air Entrainment 5% ±1%

.4 Bedding Stone (for use in the Foundation Zone):

A suggested material for bedding stone to be used as foundation material includes screened gravel, crushed stone or crushed gravel to following gradation requirements:

<u>ASTM Sieve Size</u>	<u>Per Cent Passing</u>
63.0 mm	100
37.5 mm	85 - 100
25.0 mm	75 - 95
19.0 mm	50 - 75
16.0 mm	25 - 50
9.50 mm	0 - 10

.5 Concrete:

Concrete required for cradles, Class A bedding, encasement, supports, reaction blocking to CAN A23.1-M90 and shall be 25 MPa CSA A3001 Type HS cement.

.6 Pit Locations:

The Contractor shall be responsible for locating, organizing approvals for haul roads, screening or crushing to meet specified gradations, loading, hauling and all other associated work for the specific trenching, backfilling and compaction material requirements.

3.0 EXECUTION

3.1 Site Preparation

- .1 Remove trees, shrubs, vegetation, fences and other obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Strip topsoil and other surface materials from within limits of excavation and stockpile or dispose as specified.
- .3 The Contractor is responsible for maintaining sewage flows by pumping when replacing sewer mains. This will be considered a subsidiary obligation of the Contract and no extra payment will be made for this item. By-passed sewage shall only be discharged to a legal disposal location.

3.2 Dewatering

- .1 Trenches must be maintained in a dry condition for pipe laying. Method and execution of dewatering are the responsibility of the Contractor and should be designed such there is no detrimental impact on adjacent utilities and/or structures.
- .2 Dispose of water in a manner not detrimental to public health, environment, public and private property, or any portion of work completed or under construction.

3.3 Excavation

- .1 Excavations shall be in accordance with the Saskatchewan Occupational Health Safety Act and Occupational Health and Safety Regulations.
- .2 Minimum trench width shall conform to the drawing details. Where trench walls are stable, trench widths shall be of sufficient width, but no greater than necessary, to ensure working room to properly and safely place and compact haunching and other pipe embedment zone materials. The space between the pipe and the trench wall must be wider than the compaction equipment used to construct the pipe embedment zone.
- .3 In addition to safety considerations, the trench width in unsupported, unstable soils may compromise the structural design parameters of the pipe. Notify the Engineer when unsupported, unstable soils are encountered so that actual structural support conditions are considered.

- .4 Excavate to lines, grades, elevations and dimensions indicated on drawings.
- .5 Remove and salvage or dispose replaced piping and manholes to an approved location as directed by the Engineer.
- .6 The foundation soil shall be moderately firm to hard in-situ soil, stabilized soil, or compacted fill material. Ledge rock, boulders and large stones should be removed, where present, to provide a minimum clearance of 150 mm below pipe invert.
- .7 Notify Engineer when soil at proposed elevation of trench bottom appears unsuitable for foundation of installation.
- .8 Remove unsuitable material from trench bottom to extent and depth necessary to stabilize foundation and replace with approved material. The cost of any granular backfill or bedding stone required to correct any unauthorized over-excavation shall be borne by the Contractor.
- .9 Where groundwater and soil characteristics may contribute to the migration of soil fines into or out of the foundation, embedment soils, sidefill, and/or backfill materials, methods to prevent migration of fines shall be provided by the Contractor.
- .10 The finished subgrade surface shall be shaped to provide a uniform and continuous support for the pipe bedding.
- .11 Unless otherwise authorized by Engineer in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 10 m of trench at end of day's operation.
- .12 Stockpile suitable excavated materials required for trench backfill in approved location. Where excavated material cannot be piled along the trench, stockpile at locations approved by the Owner.
- .13 Dispose of surplus and unsuitable excavated material in an approved disposal site location.
- .14 Do not obstruct flow of surface drainage or natural water courses.
- .15 Sufficient clear space must be left on one side of the trench to accommodate the construction survey stakes.

3.4 Pipe Embedment Zone Construction

- .1 Construction in the pipe embedment zone (i.e. bedding, haunching and initial backfill) shall conform to the requirements of Section 02510, 02537 and 02635.

3.5 Final Backfilling

- .1 Do not proceed with final trench backfilling operations until Engineer has inspected installations.
- .2 The Contractor shall not push final backfill directly onto the pipe until there is at least 300 mm of carefully placed initial backfill over the pipe to avoid damage to the pipe.
- .3 After the initial backfill is completed and meets specific requirements; the common backfill material shall be pushed down a ramp or slope of existing backfill and not directly onto the new bedded pipe. A crawler tractor or front-end loader working in the trench and parallel with it shall compact the trench to the required Class II or Class III backfill as outlined herein.
- .4 Notwithstanding the above, under no circumstances shall equipment that exceeds the structural capacity of the pipe be allowed direct access over the pipe until sufficient cover has been obtained. The Contractor shall be solely responsible for ensuring the equipment used during final backfilling operations is carefully selected and staged such that the pipe is not damaged during final backfilling operations.
- .5 Class II Backfill:

Class II Backfill shall be used under all street and road right of ways or as indicated on the drawings. Approved excavated material shall be placed in 300 mm lifts over the whole width of the trench. Each lift shall be compacted to at least 98% of standard proctor maximum dry density as determined by the ASTM D698 test procedures, using mechanical compaction equipment.
- .6 Class III Final Backfill:

Class III Backfill shall be used where trenches are located in parks, green space or as indicated on the drawings. Approved excavated material shall be placed in 600 mm lifts over the whole width of the trench. Each lift shall be compacted to at least 95% of standard proctor maximum dry density as determined by the ASTM D698 test procedures, using mechanical compaction equipment.
- .7 Use common or granular backfill material as indicated or as required by the Engineer.
- .8 Backfilling around installations:
 - .1 Do not backfill around or over cast-in-place concrete within 24 hours after placing.
 - .2 Place layers simultaneously on sides of installed work to equalize loading.

- .3 Place material by hand under, around and over installations until 300 mm of pipe embedment above pipe crown is provided. Dumping material directly on installations will not be permitted.
- .4 Boulders in excess of 0.02 m³ or 300 mm average diameter will not be allowed in any of the backfill.
- .9 Do not place frozen material in the embedment zone. During freezing weather conditions, heat the embedment material as necessary to provide enough free moisture to facilitate compaction as specified.

Placing frozen material during final backfilling operations will result in considerable consolidation of the final backfill material. Obtain the necessary approvals prior to utilizing frozen material as final backfill material and repair as subsequent damage due to excessive consolidation of the material.

- .10 Shoring, sheeting and bracing:
 - .1 Unless otherwise shown on drawings remove sheeting and shoring from trench during backfilling operations in a manner that does not disrupt the pipe embedment zone.
 - .2 Do not remove bracing until backfilling has reached level of bracing.

3.6 Trench Subsidence

- .1 The Contractor shall be responsible to ensure that trench settlement is maintained at a maximum of 50 mm for a period of one year from time of substantial completion.
- .2 Contractor shall bear the costs for repairs of subsidence beyond 50 mm by filling with asphalt, and levelling to meet the technical requirements of the approving authority.

3.7 Access to Properties and Street Maintenance

- .1 Until the date of substantial completion, the Contractor, at his costs, shall be responsible for street maintenance and access to properties.
- .2 Such maintenance and access to properties shall include providing proper drainage, temporary gravel streets, street levelling with use of motor patrol, and providing towing services when required.

3.8 Construction Easements and Repair

- .1 The Contractor shall be responsible for obtaining any construction easements beyond the easement limits as set out on the drawings.

- .2 All costs for restoration within the construction easements indicated on the drawings and beyond to a condition equal to or better than their condition prior to construction, shall be borne by the Contractor.

3.9 Cleanup

- .1 The Contractor shall be required to restore all roadways and areas affected by his operation to conditions prior to construction start or to design elevations and cross-sections within this contract.
- .2 The Contractor shall restore drainage after construction of the storm sewer mains are complete. The Contractor shall replace all existing sidewalks, curbs and other appurtenances damaged from construction activities at his cost.

END OF SECTION