

PART 1 GENERAL

1.1 Related Sections

- .1 Section 31 05 16 – Aggregates.
- .2 Section 32 11 23 – Roadway Grading.

1.2 Reference Standards

- .1 ASTM International (ASTM)
 - .1 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .2 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - .3 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - .4 ASTM D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 Work Included

- .1 The Work covered by this Section shall include excavation, trenching, backfilling, and disposal of excess materials, as required to complete the Work covered elsewhere in the Contract Documents.
- .2 The Contractor shall provide all labour, equipment, and materials to complete the Work covered by this Section.

1.4 Classification of Material

- .1 Earth Excavation
 - .1 Includes the excavation of all materials except rock excavation classified hereinafter.
- .2 Rock Excavation
 - .1 Includes the excavation of all boulders greater than 1 m³ in volume, or solid ledge rock of concrete foundations which, in the opinion of the Owner's Representative, requires its removal, drilling, wedging, sledging, or barring. No soft or disintegrated rock which can be removed with a pick, or loose, shaken, or previously blasted rock will be measured or allowed. Frozen materials shall not be classified as rock, nor will extra payment be allowed for excavating same.
- .3 Backfill
 - .1 Material excavated from the trench from which all boulders, roots, stumps, and other debris which would prevent consolidation of the material have been removed.
- .4 Surplus Material
 - .1 Excavated material which is not required for the completion of the Work.

- .5 Suitable Backfill Material
 - .1 Material from excavation which, in the opinion of the Owner's Representative, is suitable for use as backfill or for other processes.
- .6 Unsuitable Material
 - .1 Material from excavation which, in the opinion of the Owner's Representative, is not suitable for use as backfill or other processes.

1.5 Occupational Health and Safety Act

- .1 All excavations shall conform strictly to the requirements of the latest Occupational Health and Safety Act adopted by Nunavut.

1.6 Safety Measures

- .1 Suitable warning signs, lights, and barricades shall be erected for the protection of vehicles and pedestrians during construction. Watchpersons or flagpersons, when required, shall be supplied by the Contractor at their own expense.
- .2 Temporary traffic control devices, including signage and barricades, shall be implemented in accordance with Section 01 55 26 – Traffic Control.
- .3 All open trenches shall be protected through the use of barricades, such as jersey barriers at a minimum, when the Contractor is not on Site.
- .4 The Contractor shall comply with the instructions of a safety inspector appointed or recognized by Nunavut whose duty is to enforce Territorial acts governing the excavation of trenches and the protection of same.
- .5 The Contractor shall inform the Municipality's safety inspector of their intention to excavate at least 24 hours before commencing Work.
- .6 Trench safety, including bracing and shoring, is the sole responsibility of the Contractor. Open-cut trenches shall be sheeted and braced as required by the Workers' Safety and Compensation Commission and Municipal ordinances, and as may be necessary to protect life, property, and Work.
- .7 Trenches shall not be left open while unattended.
- .8 If the trench is adjacent to motorized traffic, precast concrete barriers shall be used to separate traffic from the trench. The provision of temporary concrete barriers shall be in accordance with the latest edition of the Manual of Uniform Traffic Control Devices for Canada (MUTCDC), by the Transportation Association of Canada (TAC).

1.7 Caution in Excavation

- .1 The Contractor shall exercise proper caution in excavating and shall repair and make good at their own expense any and all damage done to buried infrastructure. Where necessary, the Contractor shall make necessary explorations to discover location of existing pipes, conduits, services, etc.

1.8 Inconvenience to Adjacent Property Owners

- .1 Construction of the Work shall be carried out in such a manner that a minimum of inconvenience is caused to the owners and occupants of property adjacent to the Work.

1.9 Working Restrictions

- .1 The Contractor shall be responsible for maintaining adequate surface drainage during construction. The Contractor shall provide all necessary measures to ensure that natural drainage is not impeded to the detriment of the local municipal authority, private landowners, or the public. Water pumped out or removed from a trench shall not be discharged into the existing sewers unless permission in writing has been obtained from the authority having jurisdiction.
- .2 Steel-tracked equipment will not be allowed on the pavement at any time, unless the pavement is protected by planks, pads, or other devices.

PART 2 PRODUCTS

2.1 Materials

- .1 Granular Material
 - .1 Granulars A, B, C, and sand shall meet the requirements set out in Section 31 05 16 – Aggregates.
- .2 Granular Backfill
 - .1 Backfill material shall be selected from materials taken from the excavation if, in the opinion of the Owner's Representative, they are suitable.

PART 3 EXECUTION

3.1 Preparation of the Work

- .1 The Contractor, at their own expense, shall clear the surface or road as may be necessary for the full width and length of the proposed trenches or structures and shall dispose of all refuse in a manner satisfactory to the Owner's Representative. The unit prices for the Work shall include all costs incurred in removing material of whatever nature from the surface of the ground or road.

3.2 Alignment and Grade

- .1 Trenches shall be dug to the alignment and grade required from vault location to vault location unless the Contractor has a dedicated crew actively working on additional segments.
- .2 The bottom of the pipe trench shall be excavated to a flat surface for the bedding material. Earth, boulders, and rock shall be removed or excavated to provide a clearance of at least 200 mm below the insulation of pipe and the excavation for bedding of the pipe shall be refilled with thoroughly compacted material as specified herein.

3.3 Drainage

- .1 The Contractor shall keep all portions of the Work properly and efficiently drained during construction and until completion. They shall be held responsible for all damage that may be caused as the result of water backing up or flowing over, through, from, or along any part of the Work or surrounding properties due to their operation.

- .2 All costs associated with providing drainage for the Work as required, shall be included in the unit prices for the installation of mains and access vaults.

3.4 Excavation and Preparation of Trench

- .1 Excavation shall be taken to mean the removal from the trench of all materials of whatever kind encountered, for the subsequent installation of all pressure mains, sewer mains, pre-fabricated access vaults, and appurtenances. All excavation shall be made exactly to line and grade, as shown on the Drawings, or as established by the Owner's Representative. The length of the trench which has not been backfilled shall not extend beyond one access vault to the rear of the working area. Excavation, pipe laying, and backfilling shall proceed at such a pace as to prevent permafrost degradation. It shall be braced and drained in a manner to ensure that Work may proceed safely and efficiently therein.
- .2 The trench shall be excavated to the depth shown on the Drawings so as to provide a firm foundation for the pipe on solid and undisturbed ground. Any part of the bottom of the trench excavated below the specified grade shall be corrected with approved backfill, thoroughly compacted as directed by the Owner's Representative, with no extra cost to the Owner.
- .3 Large rocks and boulders shall be removed to provide a clearance of at least 150 mm below and on each side of all insulation, pipe, access vaults, and appurtenances. This is the minimum clear distance which shall be permitted between any part of the pipe and appurtenances being laid and any part, projection, or point of such rocks, boulders, or stones. The subgrade shall be made by backfilling with an approved sand or gravel in 150 mm layers.
- .4 These layers shall be thoroughly tamped as directed by the Owner's Representative so as to provide a uniform and continuous bearing and support for the pipe bedding.
- .5 Prior to trenching, the Contractor shall excavate test pits at 15 m intervals along the trench alignment, to a depth of 450 mm below the new pipe grade. The Contractor shall check for the presence of silty material in the test pits. If silty material is present below the pipe grade, the Contractor shall excavate and dispose of the silty material to 450 mm below the pipe grade and shall backfill up to the pipe bedding zone using Granular B material, compacted to 95% standard proctor density.
- .6 Where the bottom of the trench at subgrade is found to be unstable due to material which, in the judgement of the Owner's Representative, should be removed, the Contractor shall excavate and remove such unsuitable material to the depth determined by the Owner's Representative.
- .7 Ice rich soils shall be removed completely or to a maximum depth of 450 mm measured below the insulation of pipes.
- .8 The cost of such additional excavation of unstable subgrade due to the presence of unsuitable materials, and backfill, ordered by the Owner's Representative shall be paid for at the tendered unit price.
- .9 No extra payment shall be made for additional excavation and backfill that has become necessary due to subgrade that has become unstable due to water from melting snow and ice that has entered the trench. The trench shall be kept dry.

- .10 The Contractor shall prepare and submit a Trenching, Bracing, and Shoring Plan that complies with all applicable safety legislation.

3.5 Rock Excavation

- .1 Any boulders greater than 0.75 m³ in volume will be paid for as rock. Volume of individual boulders will be determined by measuring three mutually perpendicular dimensions. When rock is encountered, the Owner's Representative shall be notified at once, so that measurements can be made.
- .2 Measurements for rock volume shall be taken from the top of the rock strata to the bottom of the strata. If the rock strata extends below the elevation of the invert of the pipe, then an allowance of 200 mm below the bottom of the pipe insulation will be used in calculating the volume of rock.
- .3 Soft shale, soft sandstone, or other rock that can, in the opinion of the Owner's Representative, be successfully excavated with a 0.5 m³ backhoe or equivalent without blasting and without unusual wear and tear to the machine will not be classified as "rock excavation". Hardpan will not be classified as "rock excavation". Frozen subgrade material or permafrost will not be classified as "rock excavation".

3.6 Bracing and Shoring

- .1 When close sheeting is required, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting. The Owner's Representative reserves the right to order the sheeting driven to the full depth of the trench or to such additional depths as may be required for the protection of the Work.
- .1 Where the soil in the lower limits of the trench has the necessary stability, the Owner's Representative, at their discretion, may permit the Contractor to stop the driving of sheeting at some designated elevation above the trench bottom. The granting of permission by the Owner's Representative; however, shall not relieve the Contractor in any degree from the Contractor's full responsibility under the Contract.
- .2 Sheeting and bracing, which have been ordered left in place, shall be cut off and removed for a depth of 1 m below the established road grade or the existing surface of the road, whichever is lower. Trench bracing, except that which must be left in place, may be removed as the backfilling proceeds. Backfilling and withdrawal of sheeting shall proceed together; no voids shall be left in the trench by the withdrawal of sheeting. Sheeting shall not be driven any further below the bottom of the trench than is necessary to ensure proper support for the sheeting.
- .3 The cost of furnishing, placing, and removing the sheeting and bracing shall be included in the price bid for the Work. When sheeting and bracing have been ordered left in place by the Owner's Representative, the payment for such material shall be as an extra at cost of the material, plus 20%, and shall include the upper 1 m of "cut-off" section of the sheeting.
- .4 The Contractor shall identify areas where bracing or relocation of power poles is required and shall plan and coordinate associated Work with the power corporation accordingly.

3.7 Blasting

- .1 Blasting is not permitted within the Work area unless written approval is provided from the Municipality. The Contractor must submit a blasting permit application and engineered blasting plan in order to obtain approval for blasting.

3.8 Trenching by Hand

- .1 In any location where the use of trench digging machinery might cause property or utility damage, the Contractor shall carry out the trenching by hand at no extra cost to the Owner.

3.9 Tunnelling

- .1 Tunnelling may be done with the approval of the Owner's Representative and all shoring or grading necessary for the tunnel shall be left in place at the Contractor's expense. Before approval will be granted, the Owner's Representative may require the Contractor to submit a statement and drawings indicating exactly the method of tunnelling which will be used. Backfilling shall be carried out with approved materials and tamped with great care so as to leave the tunnel free of voids.

3.10 Excavated Material

- .1 All excavated material shall be piled into three piles:
 - .1 Suitable material that can be used for backfill,
 - .2 Unsuitable material that cannot be used for backfilling or other processes, and
 - .3 Frozen material. If upon inspection by the Owner's Representative, the thawed material is deemed suitable for use as backfill, this material can be classified as suitable, otherwise the material will be classified as unsuitable.
- .2 Unsuitable material shall be considered surplus material.
- .3 Remove soil contaminated with calcium chloride, toxic materials, or petroleum products and legally dispose of at a location accepted by the Owner's Representative.
- .4 All excavated material shall be piled in a manner that will not endanger the Work and that will avoid obstructing roadways and driveways. Hydrants under pressure, access vaults, and other utility controls shall be left unobstructed and accessible. Gutters and swales shall be kept clear or other satisfactory provisions made for roadway drainage, and natural watercourses shall not be obstructed.
- .5 The earth taken from the trench shall be neatly deposited at the sides in such a manner as to obstruct the road and driveways as little as possible. When it is impractical, in the opinion of the Owner's Representative, to place the earth at the side of the trench, it shall be removed and deposited as designated by the Owner's Representative. In either case, a clear space shall be left on one side of the trench to accommodate survey stakes.
- .6 Permafrost excavated from the trench shall not be stockpiled on top of material to be used as backfill. Material which is unsatisfactory after permafrost has been stockpiled on top of it shall be considered contaminated and removed from the Site by the Contractor.

- .7 Extra backfill material required because of the disposal of material contaminated by permafrost shall be supplied, placed, and compacted by the Contractor at their expense and shall be in accordance with the requirements of this Section.

3.11 Ownership of Excavated Material

- .1 Surplus earth and other excavated materials will remain the property of the Owner.
- .2 All surplus or other material of any kind arising from, or during, the construction of the Work, or any portion thereof, which belongs to the Owner shall not be sold, thrown away, dumped, wasted, or otherwise disposed of, except as directed by the Owner's Representative. If so, disposed of by the Contractor, the Owner's Representative shall ascertain, as nearly as they can, the quantity and value thereof, and shall direct the Contractor or their sureties to pay unto the Owner the amount thus found, or the Owner may deduct it from any subsequent progress claim.

3.12 Cleaning Up and Disposal of Surplus Excavated Material

- .1 All surplus and excess materials that arise out of the construction of the Work shall be removed and neatly piled, evenly spread, or deposited as directed by the Owner's Representative. The entire expense of loading, hauling, unloading, piling, spreading, or otherwise dealing with said waste material shall be borne by the Contractor. If any material is dropped or spilled it shall be promptly removed to the satisfaction of the Owner's Representative.

3.13 Water in Excavation

- .1 All water pumped or drained from the Work shall be disposed of in a suitable manner satisfactory to the Owner's Representative, without damage to the Work, or other property, structures, or persons.
- .2 The expense of removing the water, regardless of origin, is the responsibility of the Contractor. The Contractor shall be wholly responsible for any damage that may occur due to groundwater or stormwater entering the trench during the period of construction.
- .3 No extra payment shall be made for additional excavation and backfill that is required due to subgrade that has become unstable due to water from any source.

3.14 Backfilling

- .1 Trench excavations shall be backfilled with materials taken from the excavations if, in the opinion of the Owner's Representative, they are suitable for use as compacted backfill. Otherwise Granular B or backfill approved by the Owner's Representative shall be supplied by the Contractor as backfill.
- .2 All backfill shall be mechanically compacted in even layers not exceeding 150 mm in thickness so that there is no subsequent subsidence in the trench. The backfill shall be compacted to a density of 95% of the maximum density at optimum moisture content as determined by the Standard Proctor Test as per ASTM D698 and as field measured using the ASTM D6938 (nuclear methods) standard. The Contractor shall provide daily compaction test results to the Owner's Representative.
- .3 Edges of existing pavement shall be cut square with an asphalt saw or compressor and all irregularities removed. Prior to placing asphalt, the edges of the existing pavement shall

be swept clean. Pavement shall be replaced for the full damaged or removed width. Paved areas shall be replaced with asphalt unless asphalt is unavailable. If asphalt is unavailable, the paving shall be postponed to the subsequent year.

- .4 In open field areas, upon completion of all trenching and backfill, the entire disturbed area shall be bladed level.

3.15 Pipe Bedding

- .1 Bedding materials shall be supplied, placed, spread, and compacted as specified in Section 33 14 16.13 – Water Distribution Pipe.

PART 4 BASIS FOR PAYMENT

4.1 Trenching & Backfill

- .1 Unit of Measurement: Lineal Metres
- .2 Method of Measurement:
 - .1 Single Pipe Trench (Water or Sewer Main): Lineal metres of pipe installed, as measured along the pipe centreline, from centre of access vault to centre of access vault or from centre of access vault to tie-in to existing main as applicable.
 - .2 Double Pipe Trench (Water and Sewer Main): Lineal metres of pipe installed, as measured along the centreline at the midpoint between the two pipes installed, from centre of access vault to centre of access vault or from centre of access vault to tie-in to existing main as applicable. For the purpose of measurement, a double pipe trench is defined as any run of double pipe in a common trench where the distance between pipes is equal to or less than 1.60 m on centre.
 - .3 Triple Pipe Trench (Water Supply/Return and Sewer Main): Lineal metres of pipe installed, as measured along the pipe centreline, from centre of access vault to centre of access vault or from centre of access vault to tie-in to existing main as applicable. For the purpose of measurement, a triple pipe trench is defined as any run of three pipes in a common trench where the distance between pipes is equal to or less than 1.60 m on centre.
- .3 Item Includes: Excavation, stockpiling or windrowing, supply, placement, and compaction of bedding and backfill materials, compaction testing, drainage ditch restoration, off Site disposal of excess material including any tipping fees, as-built survey every 10 lineal metres and at bends, road and driveway restoration with Granular A and Granular B (unless included as a separate pay item), surface restoration, and all material, equipment, tools, labour, and incidentals necessary to complete the Work.
- .4 Additional payment shall not be made for adjustments to the depth of installation of watermains, sanitary sewer mains, or access vaults unless the Contractor can provide evidence, satisfactory to the Owner's Representative, that the increase in trench depth exceeds 0.5 m.

4.2 Lateral Services Excavation & Backfill

- .1 Unit of Measurement: Lineal metres

- .2 Method of Measurement:
 - .1 Separate Trench (Water or Sewer): Lineal metres of service pipe installed, as measured along the pipe centreline, from centre of main to end.
 - .2 Common Trench (Water and Sewer): Lineal metres of service pipe installed, as measured along the centreline at the midpoint between the two pipes installed, from centre of main to end.
- .3 Item Includes: Excavation, stockpiling or windrowing, supply, placement, and compaction of bedding and backfill materials, compaction testing, driveway reinstatement with Granular A, off Site disposal of excess material including any tipping fees, as-built survey every 10 lineal metres and at bends, surface restoration, and all material, equipment, tools, labour, and incidentals necessary to complete the Work.

4.3 Sub Excavation of Unsuitable Trench c/w Granular A Backfill

- .1 Unit of Measurement: Cubic metres
- .2 Method of Measurement: The number of cubic metres of unsuitable material removed from the trench area to facilitate water and sewer piping and vault installation. The quantity shall be agreed upon by the Contractor and the Owner's Representative in the field by measuring the approximate length, width, and depth of the void left by the excavation. The Contractor shall measure the excavation area prior to and after removal for record keeping and quantity verification.
- .3 Items Included: Excavation of unsuitable material, the supply, placement, and compaction of Granular A material, disposal of unsuitable material as directed including any tipping fees, and all material, equipment, tools, labour, and incidentals necessary to complete the Work.

4.4 Rock Excavation

- .1 Unit of Measurement: Cubic metres
- .2 Method of Measurement: Cubic metres of rock material removed as confirmed by survey. Acceptable survey methods are via total station equipment or survey grade GNSS equipment only. Drone surveys will not be acceptable. Survey data shall be provided to the Owner's Representative for quantity verification.

Measurements for rock volume shall be taken from the top of the rock strata to the bottom of the strata.
- .3 Item Includes: Mechanical hammering, mucking, excavating, stockpiling, loading, hauling, and disposal as directed including any tipping fees (if disposal is off Site).

4.5 Power Pole Bracing and Relocation

- .1 Unit of Measurement: Lump Sum.
- .2 Method of Measurement: No measurement will be made for this item. Payment shall be made based on the following:
 - .1 75% of lump sum price shall be made after confirmation that all bracing has been completed.
 - .2 25% of lump sum price shall be made at Substantial Completion.

- .3 Items Included: Power company coordination and approvals, temporary pole bracing as required by the power company (may include drilling or excavating adjacent to the pole to facilitate installation of pole support), pole relocation, and all material, labour, tools, equipment, and incidentals necessary to complete the Work.

END OF SECTION