

PART 1 - GENERAL

1.1 SUMMARY

- .1 This Section specifies the definition for the correction to maximum dry density to take into account aggregate particles larger than 4.75mm.

1.2 RELATED SECTIONS

- .1 Excavating, Trenching and Backfilling: Section 31 23 10  
.2 Granular Base and Sub-Base Materials: Section 32 11 16

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)  
.1 ASTM C127-2012, Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.  
.2 ASTM D1557-2012, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).  
.3 ASTM D4253-00(2006), Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.4 DEFINITIONS

- .1 Corrected maximum dry density is defined as:  
.1  $D = (D1 \times D2) / ((F1 \times D2) + (F2 \times D1))$   
.2 Where: D = corrected maximum dry density kg/m<sup>3</sup>.  
.1 F1 = fraction (decimal) of total field sample passing 4.75mm sieve  
.2 F2 = fraction (decimal) of total field sample retained on 4.75mm sieve (equal to 1.00 - F1)  
.3 D1 = maximum dry density, kg/m<sup>3</sup> of material passing 4.75mm sieve determined in accordance with Method A of ASTM D1557.  
.4 D2 = bulk density, kg/m<sup>3</sup>, of material retained on 4.75mm sieve, equal to 1000G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.  
.3 For free draining aggregates, determine D1 (maximum dry density) to ASTM D4253 wet method when directed by Departmental Representative.

PART 2 – PRODUCTS Not applicable.

PART 3 – EXECUTION Not applicable.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 RELATED SECTIONS**

- .1 Section 32 01 90.33 - Tree and Shrub Preservation
- .2 Section 01 35 43 - Environmental Procedures.

**1.2 REFERENCES**

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3 DEFINITIONS**

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .5 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments greater than 200 mm diameter to not less than specified depth below existing ground surface.

**1.4 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

**1.5 QUALITY ASSURANCE**

- .1 Perform Work in accordance with the projects Erosion and Sedimentation Control Plan as specified at Section 01 57 14.
- .2 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.
- .3 Safety Requirements: worker protection.
  - .1 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

**1.6 STORAGE AND PROTECTION**

- .1 Prevent damage to trees, landscaping, natural features, bench marks, utility lines, water courses, root systems of trees which are to remain.
  - .1 Repair damaged items to approval of Departmental Representative
  - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

**1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction Waste Management and Disposal.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- .1 Soil Material for Fill:
  - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
  - .2 Remove and store soil material for reuse.

**PART 3 - EXECUTION**

**3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.2 PREPARATION**

- .1 Inspect site and verify with Departmental Representative items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
  - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
  - .2 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.
- .3 Notify utility authorities before starting clearing and grubbing.
- .4 Keep roads and walks free of dirt and debris.

**3.3 APPLICATION**

- .1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

**3.4 CLEARING**

- .1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.
- .2 Clear as indicated by Departmental Representative, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.
- .3 Cut off branches and cut down trees overhanging area cleared as directed by Departmental Representative.
- .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

**3.5 CLOSE CUT CLEARING**

- .1 Close cut clearing to ground level of ground surface.
- .2 Cut off branches on trees overhanging area cleared as directed by Departmental Representative.
- .3 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

**3.6 ISOLATED TREES**

- .1 Cut off isolated trees as directed by Departmental Representative at height of not more than 300 mm above ground surface.
- .2 Grub out isolated tree stumps.
- .3 Prune individual trees as indicated.
- .4 Trim trees designated to be left standing within cleared areas of dead branches 40 mm or more in diameter; and trim branches to heights as directed.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.

**3.7 UNDERBRUSH CLEARING**

- .1 Clear underbrush from areas as indicated at ground level of ground surface.

**3.8 GRUBBING**

- .1 Remove and dispose of roots larger than 75 mm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 200 mm in greatest dimension, but less than 0.25 m<sup>3</sup>.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

**3.9 REMOVAL AND DISPOSAL**

- .1 Remove cleared and grubbed materials off site as indicated designated by Departmental Representative.
- .2 Cut timber greater than 125 mm diameter to 2400 mm lengths and stockpile as indicated. Stockpiled timber becomes property of Contractor.
- .3 Dispose of cleared and grubbed materials by removal off site to approved location.
- .4 Chip and stockpile cleared and grubbed vegetative material on site as directed by Departmental Representative.
- .5 Remove diseased trees identified by Departmental Representative and dispose of this material to approval of Departmental Representative.

**3.10 FINISHED SURFACE**

- .1 Leave ground surface in condition suitable for stripping of topsoil to approval of Departmental Representative.

**3.11 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 RELATED SECTIONS**

- .1 Section 31 23 33 - Excavation, Trenching and Backfilling.
- .2 Section 32 91 19.13 – Topsoil Placement and Finish Grading

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM D1557 (Modified Proctor) Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m).

**1.3 EXISTING CONDITIONS**

- .1 Establish precise field location of underground services before commencing work.
- .2 Known underground and surface utility lines and buried objects are as indicated on site plan for guidance only.
- .3 Refer to dewatering in Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .4 Refer to drainage requirements.

**1.4 PROTECTION**

- .1 Protect existing fencing, trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- .1 Fill material: in accordance with of Section 31 23 33 - Excavating, Trenching and Backfilling.
- .2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Departmental Representative.

**PART 3 - EXECUTION**

**3.1 GRADING**

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Rough grade to follow depths indicated on details.
- .3 Prior to placing fill over existing ground, scarify surface to depth of 150mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .4 Compact filled and disturbed areas to as follows:
  - .1 85% under landscaped areas.
  - .2 98% under pond surface and swales as directed by Departmental Representatives.
  - .3 95% under concrete walk, curb and gutters.
  - .4 As specified or detailed for other areas of site.
- .5 Do not disturb soil within branch spread of trees or shrubs to remain.

**3.2 TESTING**

- .1 Inspection and testing of soil compaction will be carried out by testing laboratory. Costs of tests will be paid by Departmental Representative.

**3.3 SURPLUS MATERIAL**

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping as directed by Departmental Representative.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 WORK INCLUDED

- .1 This Section specifies requirements for furnishing all materials, labour, tools and equipment and performing all operations necessary to excavate all types of material encountered, placing of excavated material as backfill, disposal of unsuitable and surplus material and furnishing backfill material as specified below, all as shown on the Drawings and as specified in this Section.
- .2 The Work generally includes, but is not necessarily limited to the following items:
  - .1 Trench excavation and backfilling for pipelines, concrete encased ductbanks, direct bury ductbanks and conduits and appurtenances.
  - .2 Structure excavation and backfilling.
  - .3 Supplying and placing pipe foundation material where required.
  - .4 Control of water by dewatering.
  - .5 Excavating and placing common material.
  - .6 Providing borrow material.
  - .7 Stockpiling or disposal of surplus material.
  - .8 Removal and disposal of unsuitable material.
  - .9 Sheet piling, shoring and bracing to support trench walls, sides of excavations and existing structures or utilities and embankments.

### 1.2 RELATED WORK

- .1 Conduits, Conduit Fastenings and Conduit Fittings: Section 26 05 34
- .2 Rock Removal: Section 31 23 16
- .3 Granular Base and Sub-Base Materials: Section 32 11 16
- .4 Water Mains: Section 33 11 00
- .5 Sanitary Sewer: Section 33 31 00
- .6 Sewage Lift Station: Section 33 32 14
- .7 Manholes, Catch Basins and Structures: Section 33 39 00
- .8 Storm Sewer: Section 33 41 00
- .9 Concrete Encased Duct Banks: Section 33 65 76

### 1.3 REFERENCES

- .1 CAN/CGSB 148.1-2003 COMPLETE SET, Methods of Testing Geotextiles and Geomembranes
- .2 CAN/ULC-S701-2011, Thermal Insulation, Poly-styrene, Boards and Pipe Covering.
- .3 ASTM D1557-2012, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).

- .4 ASTM D4254-00(2006), Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

#### 1.4 SUBMITTALS

- .1 Submit samples, indicating source, material characteristics and sieve analysis in accordance with Section 01 33 00 for items listed:
  - .1 Structural fill.
  - .2 Type C3 (surge).
  - .3 Granular materials for pavements:
    - .1 Type 1 granular base.
    - .2 Type 2 granular subbase.
  - .4 Pipe bedding materials.
  - .5 Rip-Rap.

#### 1.5 PROTECTION OF EXISTING FEATURES

- .1 Existing buried utilities and structures:
  - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .2 Prior to commencing excavation work, notify Departmental Representative and the authorities having jurisdiction, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during Work.
  - .3 Confirm locations of buried utilities by careful test excavations.
  - .4 Maintain and protect from damage, water, sewer, electric, telephone and other utilities and structures encountered.
  - .5 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Advise Departmental Representative of existing lines in area of excavation that require removal or relocation and cost for such work.
  - .6 Record location of maintained, re-routed and abandoned underground lines.
- .2 Existing surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected by work.
  - .2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Departmental Representative.

#### 1.6 SHORING, BRACING AND UNDERPINNING

- .1 Protect existing features in accordance with applicable federal and local regulations and with authorities having jurisdiction.
- .2 Engage services of qualified professional engineer who is registered or licensed in province of Nova Scotia, in which Work is to be carried out to design and inspect sheeting, shoring, bracing and underpinning required for Work.
- .3 Submit design and supporting data for bracing of Nova Scotia Power (NSP) infrastructure to NSP for approval and to Departmental Representative for record.
- .4 Submit design and supporting data at least three (3) weeks prior to commencing Work to Departmental Representative or record.

- .5 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in province of Nova Scotia.

1.7 SUPPORT OF EXCAVATION

- .1 Suitably slope or properly shore sides of excavations according to site conditions, all in accordance with the Nova Scotia Occupational Health and Safety Act.
- .2 The choice of any method of support will be the responsibility of the Contractor. However, drawings and calculations for the method of support selected, designed by a qualified professional engineer in accordance with the Provincial safety requirements, are to be submitted to Departmental Representative for review before its use.
- .3 If it is desirable that any support, other than that which may be shown on the Drawings, be left in the excavations, then Departmental Representative will issue instructions accordingly.
- .4 Take every precaution against slips or falls, but if any should occur, at once make good the same. If any such slip or fall affects or may affect the stability of the permanent Work, execute such remedial work as necessary, including filling up of any space left by the slip or fall with approved granular material. Submit proposed remedial Work to Departmental Representative for review.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Select Backfill material: common fill material approved from site excavation or borrow pits. Such material to be free from stumps, trees, roots, sod, muck, organics or other deleterious material. Material to be well graded having a maximum particle size not exceeding 200 mm with 40% to 60% of the material retained on 75 mm sieve. Material must not be frost susceptible. The material must be free from frost, and not be placed on frozen ground or in water. It must have a moisture content that will allow compaction to the specified densities. Use Select Backfill material where indicated.
- .2 Granular materials under slab: type 1 gravel as specified in Section 32 11 16.
- .3 Building foundation backfill: type 2 gravel as specified in Section 32 11 16.
- .4 Clear stone: crushed and screened, hard, durable stone, free from clay and organic matter, and graded as follows:
- .1 Clear Stone, 28 mm:

Sieve Size (mm)	Cum. % Passing
28	100
20	90-100
10	0-40
5	0-10

- .5 Pipe bedding materials:
- .1 For pipe: well graded, granular material conforming to Type 1 granular base aggregate gradation specification as indicated in Section 32 11 16.
- .2 For electrical conduit: hard, durable, crushed stone particles, free from clay lumps, cementation, organic material, frozen material and other deleterious material and graded as follows

<u>Sieve Size (mm)</u>	<u>Cum. % Passing</u>
9.5	100
4.75	50-100
2.00	30-65
0.425	10-30
0.075	5-10

- .6 300mm Rip-Rap: hard, durable, dense cuboid igneous quarry stone, cuboid in shape, with least dimension not less than one-half the largest dimension, free from cracks, seams or other structural defects. Resistant to water and ice attack. Rock featuring thin foliations not acceptable. Free from stumps, roots, sod, mulch or other deleterious material. Sieve gradation in percent passing:

<u>Sieve Size (mm)</u>	<u>Cum. % Passing</u>
350	100
300	70
200	20

- .7 Removal rock: hard, durable stone retrieved from site rock removal operations. Random sizing.
- .8 Drip strip: cobble, clean, washed river stone, rounded, granitic in nature. Size to vary between 38mm and 75mm.
- .9 Crusher dust for mowing strip: clean, non-plastic, free of deleterious materials, natural or manufactured crusher Dust obtained from crushing bedrock and in accordance with the following sieve requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
9.5 mm	100
4.75 mm	95 to 100
2.36 mm	80 to 100
1.18 mm	50 to 90
600 µm	25 to 65
300 µm	10 to 35
150 µm	2 to 10

- .10 Granular materials for pavements: to Section 32 11 16.
- .11 Rigid insulation: to Section 07 20 00.
- .12 Geotextile: non-woven, needle-punched synthetic filter fabric composed of minimum 85% by mass of polyester with inhibitors to resist deterioration. Mullen Burst 1.40 MPa to CAN/CGSB-148.1 No. 6.1, Grab Tensile 450 N to CAN/CGSB-148.1 No. 7.3.
- .13 Underground warning tape:
- .1 Detectable metallic tape, 50 mm wide clearly marked as follows:
    - .1 "CAUTION - BURIED SEWER LINE", colour green with black text.
    - .2 "CAUTION - BURIED WATER LINE", colour blue with black text.
  - .2 Polyethylene, 3.5 mils thick, 75mm wide, clearly marked as follows:
    - .1 "CAUTION - BURIED ELECTRICAL CONDUIT", colour red with black text.

### PART 3 - EXECUTION

#### 3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement, curb or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

#### 3.2 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative. Stockpile granular materials in manner to prevent segregation.

#### 3.3 BLASTING

- .1 Refer to Section 31 23 16

#### 3.4 EXCAVATION - GENERAL

- .1 Excavate in all kinds of materials including rock encountered on Site and make own computations of amounts and nature of excavation required.
- .2 Select method of excavation, support and dewatering suitable for the works. Submit proposed method to Departmental Representative for record.
- .3 Prior to excavating trenches, measures shall be in place to handle and monitor pumped water from trench excavations, as per the Contractor's Sediment and Erosion Control Plan. Water shall be monitored for pH and suspended solids, and discharged in an approved manner.
- .4 Protect property or structures above or below ground in accordance with the Contract.
- .5 Bear foundations or underside of all structures including pipe surrounds on the material as shown on the Drawings and neatly finish all bearing surfaces to the required levels and grades.
- .6 Earth bottoms of excavations to be undisturbed soil, free from loose, soft, or organic matter. Remove any soil softened due to frost or standing water prior to placing structures.
- .7 Excavations of structure bearing surfaces are to be proof rolled in the presence of an experienced geotechnical inspector and approved by Departmental Representative. Any soft spots are to be over-excavated and backfilled with approved fill.
- .8 If the excavated surface is unsuitable the Departmental Representative will determine what work is required to secure a proper foundation. If such Work is due solely to the nature of the ground, then Departmental Representative will measure the Work, but if such work is due to any act or default of the Contractor in carrying out of the Works, resulting in disturbance of natural ground conditions, then the Execute such Work at no additional cost to the Contract.

- .9 Excavation to greater depth than is shown on the Drawings will be at no additional cost to the Contract, unless ordered by Departmental Representative. Make good trench bottom with approved granular material adequately compacted as approved by Departmental Representative or with concrete as may be necessary for the safety or stability of the Works.
- .10 Pile excavated material a safe distance away from sides of trench so it will not endanger personnel and the work, reduce sight distances, or obstruct roadways.
- .11 Leave existing utility controls unobstructed and accessible at all times.
- .12 Do not obstruct drainage ditches and natural watercourses.
- .13 Departmental Representative reserves the right to require surplus material to be placed for embanking, general grading or other improvement or use on site, for the general benefit of Corrections Canada.
- .14 Control grading so that the surface of the ground will be properly sloped to prevent water from running into excavated areas. Promptly remove any water which accumulates in excavations.
- .15 Place excavated soil to be re-used as backfill in stockpiles properly graded and sealed against rain.

### 3.5 DEWATERING AND HEAVE PROTECTION

- .1 Keep excavations and trenches free of water. Control excavations to prevent surface water running into excavated areas.
- .2 Do Work in connection with dewatering and supply and maintain on the Work, pumps, in number and capacity sufficient to keep bottom of excavations dry and free from water so placing of pipe, manholes, and concrete will be done in the dry. Operate equipment for as long as necessary.
- .3 Confirm sub-drains, sump holes, wells or the like required for dewatering shall not endanger the stability of the Works. On completion of the Work completely backfill and consolidate excavations.
- .4 Dispose of water removed from excavations in a manner that will prevent injuries to public health or private property or to any operation of the work completed or under construction. Do not pump water containing silt or other material in suspension into natural water courses.
- .5 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

### 3.6 STRUCTURE EXCAVATION

- .1 Excavate to lines, grades, dimensions and elevations shown on Drawings.
- .2 Extend excavations sufficient distance from footings and walls to allow placing and removal of forms and for placing backfill materials indicated.
- .3 Prior to excavation around any manhole (existing or newly constructed as part of the tender), supply and install catchment or diversion devices in all manholes prior to Work commencing on the manhole. Install such devices in a manner so as not to impede the flow through the manhole and remove after all Work is completed.

### 3.7 TRENCH EXCAVATION

- .1 Trenches for piping, conduit, and related excavations to be of sufficient width and depth at all points to allow pipes to be laid, joints to be formed, and appurtenant structures to be built in a workmanlike manner, and when needed, to allow for sheeting and shoring, pumping, draining, and for removing and replacing all materials unsuitable for foundations.
- .2 Excavate trenches so pipe can be laid to the alignment and depth required. Excavation length to be not more than the pipe length that can be laid and backfilled in one (1) day. Brace and drain trench so workers may work safely and efficiently.
- .3 Remove organic material and soft deposits to a depth where medium dense to dense materials are encountered as designated by Departmental Representative.
- .4 Do not stockpile excavated materials alongside trench if the bearing soil will cause trench side failure or bottom uplift and affect pipe alignment.

### 3.8 UNSUITABLE MATERIAL EXCAVATION

- .1 Notify Departmental Representative when materials unsuitable for use in the work are encountered and remove to depth and extent as directed by Departmental Representative.
- .2 Backfill excavations with structural fill material or selected backfill material as directed by Departmental Representative.
- .3 Dispose of unsuitable material off site.

### 3.9 GRANULAR BEDDING & SURROUND

- .1 Place bedding to suit pipe or conduits as indicated.
- .2 Do not dump bedding materials directly onto pipe.
- .3 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .4 Shape bed true to grade to provide continuous uniform bearing surface for pipe. Do not use blocks when bedding pipe.
- .5 Shape transverse depressions in bedding as required to suit joints.
- .6 Carry bedding material across actual trench width. Mounding of bedding is not permitted.
- .7 Compact each layer full width of bed to at least 90% to ASTM D1557.
- .8 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material or foundation material as directed by Departmental Representative.
- .9 After pipe installation, place and compact bedding to haunch line of pipe. Place and compact bedding material from haunch line of pipe to top of pipe in maximum 150 mm layers. Place remaining bedding material to 300 mm above top of pipe before further compaction. Compact 95% to ASTM D1557.

- .10 In areas of excessive groundwater, the Departmental Representative may approve the substitution of the specified bedding with 28mm clear stone completely surrounded with geotextile separator to prevent the migration of fines into the clear stone.

### 3.10 BACKFILLING- GENERAL

- .1 At the start of pipe laying operations, the Contractor's geotechnical engineer is to be on-site to establish rolling and compaction patterns in the presence of the Departmental Representative.
- .2 Every second day during pipe laying operations, or as otherwise directed by the Departmental Representative, the Contractor's geotechnical engineer is to be on-site to confirm compaction of bedding and backfill materials.
- .3 Submit compaction results to the Departmental Representative for approval.
- .4 Do not proceed with backfilling operation until Departmental Representative has inspected and approved installations.
- .5 After pipelines and structures have been built, backfill trenches and other excavated areas with materials shown on Drawings or as specified. Remove timber and debris from excavation before backfilling is commenced. Do not cover up or put out of view any Work until it has been examined, measured and approved by Departmental Representative. If any work is covered without approval of Departmental Representative, Departmental Representative may order backfilled excavation to be uncovered for examination.
- .6 Place backfill in unfrozen condition.
- .7 Do not backfill around or over cast-in-place concrete within 24 hours after placing.
- .8 Where temporary unbalanced earth pressures are liable to develop on walls or other structures, permit concrete to cure minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure.
- .9 Place foundation material to provide suitable surface for construction as directed by the Departmental Representative.
- .10 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

### 3.11 BACKFILLING STRUCTURES

- .1 After installation of foundations, clean excavations of trash and debris. Backfill consists of Structural Fill material or material shown on Drawings. Place material to meet following requirements and approval of the Departmental Representative.
- .2 Place backfill in horizontal layers not more than 300 mm deep.
- .3 Compact each layer by rollers, mechanical tampers, or other suitable equipment to obtain a density of not less than 95% to ASTM D1557.
- .4 Compact the Structural Fill placed below the footings and slabs to not less than 100% to ASTM D1557.

### 3.12 BACKFILLING TRENCHES

- .1 Backfill trench from top of bedding to top of subgrade using materials shown on Drawings.
- .2 Place backfill in 300 mm layers and compact 98% to ASTM D1557. Thoroughly compact each layer before placing next layer. Carry out compaction tests to demonstrate the effectiveness of backfill thickness per lift versus the number of passes with the selected equipment to achieve the specified compaction.
- .3 During backfilling, keep trenches free of water at all times and controlled so as to prevent surface water running into excavated areas. Remove silty materials, which become wetted and subsequently liquid or extremely plastic.
- .4 Leave surface of backfill initially high and repair settlement of trench backfilling.

### 3.13 BACKFILLING- TESTING

- .1 Provide material testing to minimum limits as follows:
  - .1 Testing of all areas except trenching:

<u>Material</u>	<u>Compaction Test Frequency</u>	<u>Moisture Content Test Frequency</u>
Select Backfill	1 per 15m <sup>3</sup> placed	1 per 45m <sup>3</sup> placed
Structural Fill	1 per 10m <sup>3</sup> placed	1 per 30m <sup>3</sup> placed
Type C3	1 per 10m <sup>3</sup> placed	1 per 30m <sup>3</sup> placed
Removal Rock	1 per 15m <sup>3</sup> placed	1 per 45m <sup>3</sup> placed

- .2 Testing of trenching:

<u>Material</u>	<u>Compaction Test Frequency</u>	<u>Moisture Content Test Frequency</u>
Pipe bedding	1 per 10m along trench	1 per 30m <sup>3</sup> placed
Sand bedding	1 per 10m along trench	1 per 30m <sup>3</sup> placed
Select backfill	1 per 15m along trench	1 per 45m <sup>3</sup> placed

### 3.14 MARKER TAPE

- .1 Place marker tape and plank in trenches above rical conduits and pipes, where indicated.

### 3.15 INSULATION

- .1 Place rigid insulation in trench where indicated or as required in areas where pipe cover is less than 1600 mm. Do not disturb or break boards during backfilling.

**3.16 REINSTATEMENT**

- .1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Reinststate disturbed areas to condition, elevation and thickness equal to or better than that, which existed before excavation.
- .3 Clean and reinststate areas affected by work as directed by Departmental Representative.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SUMMARY

- .1 This Section specifies requirements for rock removal by rock hammering and/or controlled blasting.

### 1.2 RELATED SECTIONS

- .1 Submittal Procedures: Section 01 33 00  
.2 Environmental Procedures: Section 01 35 43  
.3 Quality Control: Section 01 45 00  
.4 Rough Grading: Section 31 22 13  
.5 Excavating, Trenching and Backfilling: Section 31 23 10

### 1.3 REFERENCES

- .1 Canada Labour Code.  
.2 Blasting Safety Regulations made under Section 82 of the Occupational Health and Safety Act S.N.S. 1996, c. 7 O.I.C. 2008-65 (February 26, 2008, effective April 1, 2008), N.S. Reg. 89/2008.  
.3 Halifax Regional Municipality By-Law Number B-600 Respecting Blasting.

### 1.4 GENERAL

- .1 Assess rock conditions and determine most effective rock removal methodology.  
.2 Remove rock using means to suit existing native rock conditions including breaking by hammering, blasting and/or a combination of both.  
.3 Responsibility for Blasting Quality Control, and Safety and Protection of surrounding infrastructure from damage rests solely with the Contractor.

### 1.5 DEFINITIONS

- .1 Rock: any solid material in excess of 1.00m<sup>3</sup> that while in an unfrozen state cannot be removed by means of heavy duty mechanical excavating equipment equipped with a 1.15m<sup>3</sup> bucket.  
.2 Controlled Blasting: the controlled use of explosives and blasting accessories in carefully spaced and aligned drill holes, to produce a free surface, or shear plane, in the rock along the specified backslope. Controlled blasting techniques include line drilling, cushion (or trim), pre-shearing and smooth-wall blasting techniques.  
.3 Rock hammering: the controlled demolition of rock through use of heavy duty mechanical excavating equipment equipped with hydraulic rock breakers sized to suit rock conditions encountered.

## 1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00.
- .2 Submittals: Contractor is solely responsible for all damage related to rock removal and is therefore required to submit a Rock Removal Plan that clearly details the methodology and operations for removal of rock. Submit this plan to the Departmental Representative for record purposes only (i.e. the Departmental Representative will not issue approval of the plan). Contractor is solely responsible for the preparation and execution of the Rock Removal Plan. This plan is to be written and executed to prevent any damage whatsoever to nearby structures. Rock Removal Plan is to include a response plan should any damage inadvertently occur to nearby structures.
  - .1 Indicate proposed method of carrying out work. Include details on protective measures, time of blasting and other pertinent details.
  - .2 Include proofing methodology to allow for determination of maximum safe charge size to be used in blasting activities.
  - .3 Submit blasting records to Departmental Representative at end of each shift for each individual shot. Maintain complete and accurate record of drilling and blasting operations.
  - .4 Submit Rock Removal Plan two (2) weeks prior to any removal activity.
  - .5 Have Rock Removal Plan stamped by a Professional engineer licenced to practice in the Province of Nova Scotia.
  - .6 Rock Removal Plan to detail both the author's qualifications and the qualifications of the persons that will ensure the removal is carried out in accordance with the plan.

## 1.7 CONTROL OF EXPLOSIVES

- .1 Transportation, handling, storage, and use of explosives will be subject to the Occupational Health and Safety Act and related Provincial and Federal Regulations. Provide such reasonable and adequate protective facilities as are necessary to prevent loss or theft of explosives. Overnight storage of explosives and detonators on site is not permitted.

## 1.8 BLAST WARNING PROCEDURES

- .1 General:
  - .1 Erect proper, durable signs of adequate size stating that blasting operations are being carried out in the area. Post signs at points clearly visible to all traffic approaching the area. Establish a system of reliable, audible warnings by the Contractor, subject to the Departmental Representative's approval, to ensure proper warning to all personnel in the area of an impending detonation.
- .2 Special:
  - .1 Be cognizant of the possible need to schedule blasting during periods when delicate operations are not being performed (i.e., medical activity). In the event that the Departmental Representative states that blasting cannot be performed at certain times because of negative effects, reschedule blasting at no additional charge to the Contract. Propose rescheduled times for approval by the Departmental Representative and update the Rock Removal Plan accordingly.
- .3 Radio transmitters:
  - .1 Radio transmitters will not be permitted in the immediate area of blasting operations, unless properly locked and sealed. Be responsible for the effect due to any stray currents and the radio communication system within the area of the site. Furnish with the necessary data pertaining to radio systems and any other available data upon receipt of a written request. Mutually agreeable administrative procedures will be developed between the Contractor and the Departmental Representative for the supervision of activities to control the use of any equipment (including mobile transmitters and radios), that emits electromagnetic radiation, within the construction area during blasting operations.

### 1.9 SAFETY SENTRIES

- .1 Post safety sentries during blasting operations at the following minimum locations:
  - .1 Adjacent properties on Morris Drive.
  - .2 Adjacent properties on Windmill Road.

### 1.10 NOISE CONTROL

- .1 Include noise as a factor in planning blasting operations. In the event the predicted noise emission is to be excessive for a particular period, discuss this problem with the Departmental Representative and authorities having jurisdiction to determine mitigation efforts to be implemented before the commencement of the Work.

### 1.11 AIR BLAST CONTROLS

- .1 Design blast rounds in order to minimize air blast overpressures. If detonating cord is used, cover with sand to minimize air blasts. Consider postponement of blasting operations when a heavy low-level cloud cover exists. Blasting operations to take into account wind direction and possibility of focusing.

### 1.12 BLAST POWER

- .1 Design blast rounds to minimize ground acceleration low frequency shock waves and peak particle velocity (PPV).
- .2 Blasting and Vibration Control:
  - .1 Control ground vibration frequencies to prevent damage to properties, structures, infrastructure or remaining rock mass.
  - .2 Ground acceleration of any blast is not to exceed those specified in HRM By-Law B-600.
  - .3 Notwithstanding HRM By-Law B-600, PPV is not to exceed 1mm/sec at a distance of 450m from the explosive charge location.
  - .4 PPV is not to exceed 4mm/sec at the nearest building.

PART 2 – PRODUCTS                      Not applicable.

## PART 3 - EXECUTION

### 3.1 ENVIRONMENTAL PROTECTION

- .1 Perform Work in accordance with Section 01 35 43 and approved Environmental Protection Plan.

### 3.2 GENERAL

- .1 Perform rock hammering to extents indicated in submitted Rock Removal Plan.
- .2 Perform blasting operations in accordance with:
  - .1 Section 82 of the Nova Scotia Occupational Health and Safety Act - Blasting Safety Regulations.
  - .2 HRM By-Law B-600 Respecting Blasting.
  - .3 Departmental Representative's requirements.
  - .4 Submitted Rock Removal Plan.

### 3.3 QUALITY CONTROL – GENERAL

- .1 Quality Control Preconstruction Condition Survey:
  - .1 Provide a Preconstruction Condition Survey on properties, structures and infrastructure within a radius as recommended by the Contractor's insurers, but not less than the greater of: area indicated on drawings; or to the distance as specified in HRM By-Law B-600. Submit report to Departmental Representative two (2) weeks before blasting is scheduled to commence. Have the report prepared by a recognized firm specializing in such work.
  - .2 Obtain all necessary permits required prior to conducting blasting activities. Bear all costs for obtaining such permits.
- .2 Quality Control Postconstruction Condition Survey:
  - .1 Provide a Postconstruction Condition Survey on properties, structures and infrastructure within a radius as recommended by the Contractor's insurers, but not less than the greater of: area indicated on drawings; or to the distance as specified in HRM By-Law B-600. Submit report to Departmental Representative within one (1) week of conclusion of blasting operations. Have the report prepared by a recognized firm specializing in such work.

### 3.4 NOTICE TO BLAST

- .1 Provide 24 hours notice of planned blasting activities to Departmental Representative. Do not proceed with blasting schedule without approval of Departmental Representative.

### 3.5 PREPARATION

- .1 Unless otherwise permitted by the Departmental Representative, completely remove all overburden soil, loose or decomposed rock and foreign objects along the top of the excavation, to a distance as indicated in the Rock Removal Plan, of the production hole drilling limits, or to the end of the cut, before drilling the controlled blasting holes. Remove potentially dangerous material located beyond the excavation limits.

### 3.6 FLYROCK SAFETY

- .1 Before the firing of any blast, encase the rock to be blasted with blasting mats. Place mats for every blast over the entire loaded area. Mats will restrict all flyrock from leaving the site. If blasted rock escapes the blasting mats, all blast-related activities, including drilling operations, will cease. Prepare a report describing why rock was allowed to be ejected, and how such events will be prevented in the future. Submit report to the Departmental Representative. In order to proceed with any further blast-related activity, obtain written permission from the Departmental Representative. These provisions do not relieve the Contractor from all responsibility for the safety of his own personnel, the safety of the general public, damage to structures, or responsibility under the Occupational Health and Safety Act.

### 3.7 TRIAL BLASTING

- .1 Perform trial blast consisting of a maximum of one-half of the maximum safe charge strength.
- .2 Review performance of trial blast and accelerometer data measurements.
- .3 Provide assessment of trial blast performance and adjust Rock Removal Plan as necessary to allow for efficient and safe removal operations. Provide assessment to Departmental Representative for record.
- .4 Conduct as many trial blasts as necessary, increasing in charge strength incrementally to ensure QMP and safety issues are addressed during rock removal operations.

### 3.8 ROCK REMOVAL

- .1 Perform excavation in accordance with Erosion and Sedimentation Control Plan and Section 31 23 10.
- .2 Remove rock to alignments, profiles, and cross sections as indicated.
- .3 Explosive controlled blasting is only permitted within construction boundary.
  - .1 The best modern practice of controlled blasting methods shall be employed. Acceptable controlled perimeter techniques include the so-called smooth wall, cushion, pre-splitting or line drilling blasting. Control use of explosives and blasting accessories, in carefully spaced and aligned drill holes, to produce uniform free surfaces or shear planes in the rock along the required backslope.
  - .2 Do blasting operations in accordance with local and provincial codes and requirements of authority having jurisdiction.
- .4 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak and avoid damage to adjacent structures.
- .5 Remove blast muck from rock face immediately following each shot. Make good exposed rock face to satisfaction of Departmental Representative.
- .6 Excavate rock to horizontal surfaces with slope not to exceed 5%.
- .7 Shatter rock remaining beneath Access Road to eliminate pockets and to prevent formation of ponding water in road structure. Refer to drawings for details.
- .8 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces.
- .9 Excavate trenches to lines and grades below applicable pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.
- .10 Cut trenches to widths as indicated.
- .11 Remove boulders and fragments which may slide or roll into excavated areas.
- .12 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.

### 3.9 BLAST MONITORING

- .1 Carry out a seismic survey for each blast to monitor and aid in the control of the intensity of vibrations and sound pressure levels resulting from the use of explosives:
  - .1 The seismographs for monitoring ground vibrations will be three component (vertical, transverse and longitudinal) with a magnification of at least 50. Provide the Departmental Representative with a film record of each seismographic measurement. Carry out blasting so that ground particle velocities are kept low enough to prevent damage to adjacent infrastructure, but in no instance exceed 12mm/second at the nearest structure.
  - .2 Use minimum of six (6) blast monitors (accelerometers). Their number, type, and location shall be approved by the Departmental Representative. Align in two (2) linear arrays, perpendicular to one another. For each linear instrument array, a wide range of instrument distances shall be used. The far position must be at least one hundred times farther from the blast than the closest. Establish spaced instrument positions in log distance increments, and span over three (3) logarithmic units (1000 units). Bear all costs involved in the seismic surveys by covering costs in the unit prices.

**3.10 USE OF ROCK**

- .1 Incorporate rock into construction in accordance with Sections 31 22 13 and 31 23 10.

**3.11 CLEANING**

- .1 Clean in accordance with Section 01 74 00.
- .2 Rock Disposal:
  - .1 Dispose of surplus removed rock in accordance with Section 01 74 22.
  - .2 Do not dispose removed rock into landfill. Send material to appropriate location as approved by Departmental Representative.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 22.

**3.12 PROTECTION**

- .1 Prevent damage to surroundings and injury to persons in accordance with Section 01 50 00 - Temporary Facilities. Post sentries, place traffic barriers and sound warnings, and display signs when blasting to take place.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 GENERAL**

- .1 Comply with requirements of Division 1.

**1.2 RELATED SECTIONS**

- .1 Section 31 23 33 - Excavating, Trenching and Backfilling.

**1.3 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM D4491-99a, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .2 ASTM D4595-86 (2001), Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
  - .3 ASTM D4716-01, Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  - .4 ASTM D4751-99a, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-4.2 No. 11.2-M89(April 1997), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
  - .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
    - .1 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
    - .2 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
    - .3 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
    - .4 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
    - .5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.

**1.4 QUALITY ASSURANCE**

- .1 Perform Work in accordance with the projects Erosion and Sedimentation Control Plan as specified at Section 01 57 14.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

**1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

**PART 2 - PRODUCTS**

**2.1 MATERIAL**

- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.
  - .1 Width: minimum 3500 mm to maximum 4400 mm.
  - .2 Length: 150 m minimum.
  - .3 Composed of: minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
  - .4 Tearing Strength: 300 N minimum.
  - .5 Grab Tension: 690 N minimum.
  - .6 Standard of Acceptance: Terrafix 360R or approved equivalent.
- .2 Siltation Fence: woven polypropylene fibres treated to resist degradation from ultra violet light to following standards:

Tensile Strength:	125 lbs	ASTM D-3775-79
Elongation at Break:	21%	ASTM D-4632-86
Mullen Burst:	300 psi	ASTM D-3786-80A
A.O.S.:	480 um	ASTM D-4751
Filter Efficiency:	67%	VA DOH VTM-51
UV Resistance:	90%	ASTM D-4355
Permeability:	0.013 cm/s	ASTM D-4491
Size:	0.9 m x 30 m	
Posts:	1.2m ht. Spaced at 2.4m	

- .3 Drains: non-woven synthetic fibre fabric, supplied in rolls.
  - .1 Width: 3500 mm or 4400 mm minimum.
  - .2 Length: 150 m minimum.
  - .3 Composed of: minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
  - .4 Tearing Strength: 300 N minimum.
  - .5 Grab Tension: 690 N minimum.
  - .6 Standard of Acceptance: Terrafix 360R or approved equivalent.
- .4 Factory seams: sewn in accordance with manufacturer's recommendations.
- .5 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with rocks.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Join successive strips of geotextile by sewing. Pin successive strips of geotextile with securing pins at 600 mm interval at mid-point of lap.
- .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .7 After installation, cover with overlying layer within 4 h of placement. Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .8 Place and compact soil layers in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.

#### **3.2 CLEANING**

- .1 Remove construction debris from site and dispose of debris in an environmentally responsible and legal manner.

#### **3.3 PROTECTION**

- .1 Vehicular traffic not permitted directly on geotextile.

**END OF SECTION**