
Part 1 General

1.1 RELATED SECTIONS

- .1 Section 32 11 23 – Granular Base Courses.
- .2 Section 32 11 16.01 – Granular Sub-Base.

1.2 REFERENCES

- .1 New Brunswick Department of Transportation and Infrastructure (NBDTI) Standard Specifications, January 2011.
- .2 Ministry of Transportation, Ontario – MTO Laboratory Testing Manual
 - .1 LS-618, Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
 - .2 LS-619, Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
 - .3 LS-614, Freezing and Thawing of Coarse Aggregate.
 - .4 LS-608, Percent Flat and Elongated Particles in Coarse Aggregate.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-04, Standard Test Method for Materials Finer than 75-µm (No. 200 Sieve in Mineral Aggregates by Washing.
- .4 American Association of State and Highway Transportation Officials (AASHTO)
 - .1 AASHTO T89-10, Standard Method of Test for Determining the Liquid Limit of Soils.
 - .2 AASHTO T90-00 (2008), Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Allow continual sampling by Departmental Representative during production.
- .3 Provide Departmental Representative with access to source and processed material for sampling.
- .4 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.

- .5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
- .6 Provide water, electric power and propane to Departmental Representative laboratory trailer at production site.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused granular materials from landfill to local facility as approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Aggregate shall be composed of clean, hard, sound, durable, uncoated particles that do not contain friable, soluble or reactive minerals or other deleterious materials or conditions that would make the aggregate prone to decomposition or disintegration, or present any environmental hazard, from the presence of the parent material or its by-products, when exposed to the natural elements after placement in the Work.
- .2 Aggregate shall meet the requirements of the NBDTI Standard Specifications, Item 201, Table 201-1 - Properties of Rock and Gravel Aggregate.
- .3 Blending of Aggregates: As per NBDTI Standard Specifications, Item 201.2.3 – Blending of Aggregates.

2.2 SOURCE QUALITY CONTROL

- .1 All crushed rock aggregates shall be supplied by Contractor from an approved source.
- .2 If, in opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Aggregate materials found within the project limits must be tested at the Contractors expense to confirm that material in question is acceptable.
- .4 Advise Departmental Representative two (2) weeks in advance of proposed change of material source.
- .5 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 Execution

3.1 PREPARATION

.1 Handling

- .1 Handle and transport aggregates to avoid segregation, contamination and degradation.

.2 Stockpiling

- .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
- .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
- .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
- .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 h of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1.5 m for coarse aggregate and base course materials.
 - .2 Max 1.5 m for fine aggregate and sub-base materials.
 - .3 Max 1.5 m for other materials.
- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water. Restore site back to original condition or better.
- .2 Unused aggregates are to be removed from site at Contractor's expense.

END OF SECTION

PART 1 General

1.1 WORK INCLUDES

- .1 Excavating, trenching and backfilling for building footing and foundations, slabs, and subsurface utilities within building footprint.
- .2 Subgrade bearing capacities, structural fill thickness requirements and backfill requirements to be confirmed by Geotechnical Engineer in the field.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 – Cast- in-Place Concrete.
- .2 Section 07 21 13 – Board Insulation.
- .3 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.3 REFERENCES

- .1 New Brunswick Department of Transportation and Infrastructure (NBDTI) Standard Specifications for Highway Construction, January 2015.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C127, Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³
 - .5 ASTM D4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

1.4 DEFINITIONS

- .1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 0.76 cubic meters.
- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.
- .3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

- .4 Unsuitable materials:
- .1 Weak and compressible materials under excavated areas.
 - .2 Frost susceptible materials under excavated areas.
 - .3 Frost susceptible materials
 - 1. Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM C 136: Sieve sizes to CAN/CGSB-8.1.
 - 2. Table Sieve

Designation	% Passing
2.00 mm	100
0.1 mm	45 – 100
0.02 mm	10 – 80
0.005 mm	0 – 45
 - 3. Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

1.5 INSPECTION AND TESTING

- .1 Testing of materials and compaction will be carried out by the testing laboratory designated by the Departmental Representative.
- .2 Compaction densities are percentages of maximum standard dry density as determined by ASTM D1557.

1.6 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

1.7 PROTECTION

- .1 Conduct with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
- .2 Take necessary precautions to protect existing or newly constructed works.
 - .1 If undermining occurs, correct by breaking out and repairing existing structure and/or replacing disturbed foundation material with fill concrete, grout, sand etc., as directed by the Departmental Representative.
 - .2 All protective and corrective work to be at the expense of the Contractor.
- .3 The above applies to all electrical cables, poles, sewers and other appurtenances already constructed in the area, whether above ground or underground.

- .1 Should damage of any kind, including settlement or lateral movement of adjacent structures, utilities or surface features occur as a result of the work, such conditions and any resultant damage to be immediately rectified at the Contractor's expense and to the satisfaction of the Departmental Representative.

PART 2 Products

2.1 MATERIALS

- .1 Structural Fill: well-graded, granular soil with a maximum particle size of 75 millimeters and a maximum of 10 percent passing the 75 micron sieve such as quarried rock fill .

- .1 Aggregate to be quarried from a source that is solid in situ.

- .2 Aggregate to meet the following requirements:

<u>Test and Method</u>	<u>Maximum % Loss</u>
Micro-Deval (MTO LS-608)	30
Freeze Thaw (MTO LS-614)	20
Flat & Elongated Particle @ 4:1 (MTO LS-608)	35
Plasticity Index (ASTM D4318)	5

- .3 Aggregate to be produced by the processing of rock and conform to the grading limits specified in the following Table when tested to ASTM C136 and ASTM C117:

<u>ASTM Sieve Size</u>	<u>Percent Passing</u>
75.0 mm	95 - 100
63.0 mm	85 - 100
50.0 mm	73 - 95
37.5 mm	58 - 87
31.5 mm	-
25.0 mm	-
19.0 mm	35 - 69
12.5 mm	-
9.5 mm	25 - 54
4.75 mm	17 - 43
2.36 mm	12 - 35
1.18 mm	8 - 28
0.300 mm	4 - 16
0.75 mm	0 - 10

- .2 Drainage Fill: Drainage stone for foundation drainage piping, unfrozen and free from clay lumps, cementation, organic material, and other deleterious materials shall be 100% fractured, crushed stone aggregate devoid of mineral fines. All particles smaller than 6 mm shall be produced by manufactured means only. Rounded sands, semi-angular river rock and soft aggregates are prohibited.

<u>Sieve Size (mm)</u>	<u>Percent Passing</u>
60 mm	100
50 mm	90 - 100
25 mm	35 - 100
19 mm	15 - 85
12.5 mm	0 - 53
9.5 mm	0 - 30
4.75 mm	0 - 4
1.18 mm	0 - 2

- .3 Sand: Sand, free from clay, shale and organic matter, for bedding of slab and surround of underground services
- .4 Rigid Insulation: by Section 07 21 13.
- .5 Geotextile Filter Fabric: to NBDTI Table 601-1; Non-woven synthetic fibre fabric
1. Tearing Strength (ASTM D4533): Minimum 250 N.
 2. Grab Tensile Strength (ASTM D4632): Minimum 600 N.
 3. Elongation (ASTM D4632): Minimum 5%.
 4. Apparent Opening Size (ASTM D4751: 50 to 250µm.
 5. Permittivity (ASTM D4491): 1.25 to 2.75 sec⁻¹
 6. Acceptable Product: Trevira 1120, Terrafix 360R, Armtec 200 or approved equivalent.

PART 3 Execution

3.1 GENERAL

- .1 The Contractor shall advise Departmental Representative two weeks in advance of intended use of materials to allow sufficient time for sampling and testing.
- .2 Submit samples of granular materials to be used in the works when requested by the Departmental Representative.
- .3 Approval of a sample does not mean acceptance of the whole source.
- .4 Each load of material received at the job site shall be subject to all the requirements of that material.

- .5 The costs of any additional testing of backfill, as deemed necessary by the Departmental Representative, to determine the acceptability or degree of compaction shall be paid by the Contractor.
- .6 Operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained due to rain, freezing weather or other conditions of the field.
- .7 At all times, the Contractor shall drag, blade or slope the fill to provide proper surface drainage.
- .8 Materials to be compacted shall be placed in layers not exceeding 300 millimetres in loose thickness or no thicker than can be adequately compacted by anticipated compaction equipment, whichever is less, and be of the proper moisture content.
 - .1 Submit technical data for compaction equipment when requested by the Departmental Representative.
- .9 Final grades shall be within 13 mm of the levels shown on the drawings.
- .10 All areas shall be sloped to avoid puddles.
- .11 It shall be the responsibility of the Contractor to repair all damage and correct all deficiencies which may result from the settlement of backfill areas.

3.2 PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Identify required lines, levels, contours, and datum.
- .3 Identify known underground, above ground, and aerial utilities. Stake and flag locations.
- .4 Notify utility company to remove or relocate utilities.
- .5 Protect above and below grade utilities which are to remain.
- .6 Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- .7 Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

3.3 STOCKPILING AND DISPOSAL

- .1 All excess material suitable for backfill must be hauled to designated areas and spread to the lines and grades as directed by the Departmental Representative.
- .2 Stockpile fill materials in areas designated by the Departmental Representative.
 - .1 Stockpile granular materials in manner to prevent segregation.
- .3 Protect fill materials from contamination.
- .4 Excess material unsuitable for backfill shall become the property of the Contractor and be disposed of offsite.
 - .1 It will be the Contractor's responsibility to acquire permission and all permits for the disposal site.

- .2 Submit copies of all obtained permits to the Engineer- Architect when requested.
- .5 In case of a dispute, the Departmental Representative shall be the sole judge as to which material is unsuitable and shall be hauled away.

3.4 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Protect open excavations against flooding and damage due to surface run-off.
- .3 All excavations and trenches shall be kept free from water. Dams, dykes or other work necessary for dewatering including duplicate pumps of sufficient capacity for the purpose, shall be placed at the Trade Contractor's expense.
- .4 The discharge of water from any dewatering operation shall be in accordance with the Erosion and Sedimentation Control Plan.
- .5 Protect installed foundations from freezing and frost penetration prior to completion of Work as directed by the Departmental Representative.

3.5 EXCAVATION AND TRENCHING

- .1 Excavate to lines, grades, elevations and dimensions as indicated or required.
- .2 Excavate subsoil required to accommodate building foundations, slabs-on-grade, mechanical work electrical work and construction operations as required.
- .3 Trench-excavate rock for footings to a depth 300 mm lower than the bottom of footing.
- .4 Excavation shall include the removal of all water, ice, snow and material of any nature which interferes with construction work.
- .5 Excavation must not interfere with bearing capacity of adjacent foundations.
- .6 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations.
- .7 All earth banks created by excavating shall be sloped at sufficient angle to prevent sliding or caving in and if they are not adequately sloped, then shoring and/or trench boxes must be used.
- .8 Earth bottoms of excavations to be rock, level, free from loose, soft or organic matter.
- .9 Notify Departmental Representative when bottom of excavation is reached.
- .10 Obtain Departmental Representative approval of completed excavation.
- .11 Hand trim, make firm and remove loose material and debris from excavations.
- .12 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
- .13 Where excavation carried out exceeds the limits authorized by the Departmental Representative, the costs of such unauthorized excavation shall be borne by the Contractor as shall all necessary structural fill required to fill the void.

3.6 FILL TYPES, THICKNESS AND COMPACTION

- .1 Use fill of types as indicated or specified below. Compaction densities are obtained from ASTM D698. Fill type, thicknesses and compaction are to be reviewed and approved by a Geotechnical Engineer prior to placement of material.
 - .1 Under Footings not founded on rock:
 - .1 Use Granular Base (0 -31.5mm crushed stone).
 - .1 Refer to Section 32 11 23 Granular Base Courses.
 - .2 200mm thick layer placed over geotextile filter fabric
 - .3 Place unfrozen in lifts and compacted to a minimum of 98% of ASTM D698.
 - .2 Under Slab on grade/insulation:
 - .1 Use Granular Base (0 -31.5mm crushed stone).
 - .1 Refer to Section 32 11 23 Granular Base Courses.
 - .2 150mm thick layer placed over geotextile filter fabric
 - .3 Place unfrozen in lifts and compacted to a minimum of 98% of ASTM D698.
 - .3 Side of perimeter foundation walls
 - .1 Use Drainage fill or existing approved fill
 - .2 Place unfrozen in lifts not exceeding 300mm and compacted to a minimum of 98% of ASTM D698.
 - .4 Sand bed for subsurface utilities and trench installations: Compact to 100%.

3.7 BACKFILLING

- .1 Coordinate placement of underslab vapour barrier and rigid insulation prior to backfilling.
- .2 Do not proceed with backfilling operations until Departmental Representative has inspected and approved installations.
- .3 All compaction equipment and methods to be approved by a Geotechnical Engineer prior to use.
- .4 Only hand operated compaction equipment within 3 meters of foundation walls.
- .5 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .6 Do not use backfill material which is frozen or contains ice, snow or debris.
- .7 Place backfill material in uniform layers up to grades indicated.
 - .1 Compact each layer before placing succeeding layer.
- .8 Do not backfill around or over mechanical and electrical installations until Work has been reviewed by Departmental Representative.

3.8 PROTECTION

- .1 Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- .2 Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

3.9 REPAIRS DURING WARRANTY PERIOD

- .1 During the specified guarantee period, make good any damage to slabs, walks, roads, etc., due to settlement of backfilled areas.
 - .1 All such repairs shall be made at the Contractor's expense upon notification by the Departmental Representative.
- .2 Should the Contractor fail to carry out the necessary maintenance within 5 days after receiving written instruction from the Departmental Representative, the Departmental Representative will carry out the work and deduct the cost incurred from the money owing the Contractor.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section includes the supply of all labour, materials and equipment necessary for excavating to subgrade of new roadways, walkways and new water service. This section does not include the excavation, trenching and backfilling for building footing and foundations, slabs and subsurface utilities within building footprint.

1.2 RELATED SECTIONS

- .1 Section 31 32 19.01 – Geotextiles.
- .2 Section 32 11 16.01 – Granular Subbase
- .3 Section 32 11 23 – Granular Base Course
- .4 Section 33 11 16 – Water Service, Pipe Fittings and Valves

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-13, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C127-12 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D422-63 (2007), Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .6 ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .7 ASTM D4318-10e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 New Brunswick Department of Transportation and Infrastructure (NBDTI) Standard Specifications for Highway Construction, January 2015.

1.4 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

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- .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock. No rock is anticipated to be encountered during this project.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
 - .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
 - .3 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
 - .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
 - .5 Borrow material: material obtained from locations off PWGSC property, and required for construction of fill areas or for other portions of Work.
 - .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
 - .7 Unsuitable materials:
 - .1 There is to be no on-site excavated material removed from site unless directed by Departmental Representative.
 - .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 ACTION AND INFORMAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control.

1.6 QUALITY ASSURANCE

- .1 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of New Brunswick.
- .3 Keep design and supporting data on site.

- .4 Do not use Borrow material until test results and approval from a qualified geotechnical engineer outlining acceptable soil moisture contents are reviewed and approved by Departmental Representative.

- .5 Health and Safety Requirements:

- .1 Do construction occupational health and safety in accordance with Section 01 35 29

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.

1.8 EXISTING CONDITIONS

- .1 Buried services:

- .1 Before commencing work establish location of buried services on and adjacent to site. All effort has been made to show existing but there may be additional services present that are not indicated on the drawings.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .4 Prior to beginning excavation Work, notify applicable Departmental Representative to establish location and state of use of buried utilities and structures. Departmental Representative to clearly mark such locations to prevent disturbance during Work.
 - .5 Confirm locations of buried utilities by careful test excavations.
 - .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .7 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
 - .8 Record location of maintained, re-routed and abandoned underground lines.
 - .9 Confirm locations of recent excavations adjacent to area of excavation.

- .2 Existing buildings and surface features:

- .1 Conduct, with Departmental Representative, condition survey of existing buildings, structures, 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 as directed by Departmental Representative.

- .3 Existing soil conditions:

- .1 Soil test and conditions are available for inspection from the Engineer-Architect. These are for general information only.

Part 2 Products

2.1 MATERIALS

- .1 Granular base and sub-base material for roadway restoration shall conform to Section 32 11 23 Granular Base Courses and Section 32 11 16.01 Granular Sub-Base and NBDTI Standard Specification Section 203.
- .2 Sand (bedding for water service outside of building): hard, granular, free of impurities, chemicals or organic matter, and graded as follows:

Sieve Designation (mm)	Cumulative % Passing
5 mm	100
0.16 mm	0-5

- .3 Subgrade Quality Material: shall consist of soil and/or rock free of roots, stumps, organics and/or other deleterious substances and shall meet the following requirements:
 - .1 Dust content shall not exceed 25% when tested in accordance to ASTM C117.
 - .2 Mudstone, claystone, and/or siltstone will not be acceptable as subgrade quality material.
 - .3 Shall have a maximum plasticity index (PI) of 5.
- .4 Common Fill: shall consist of material excavated from site and be free from roots, stumps, organics and/or other deleterious substances, and shall have a dust content not exceeding 50% when tested in accordance with ASTM C117.
- .5 Geotextiles: to Section 31 32 19.01 - Geotextiles.

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, as shown on the Drawings and according to Section 01 35 43 Environmental Restrictions.
- .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 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.3 PREPARATION/PROTECTION

- .1 Keep excavations clean, free of standing water, and loose soil.
- .2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.
- .3 Conduct existing condition survey of existing building, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.4 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative review and approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 – Environmental Protection Procedures to approved collection or runoff areas and in a manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.5 TEMPORARY SHORING AND BRACING

- .1 Excavate all trenches according to the requirements of the General Regulation 91-191 under the Occupational Health and Safety Act of the Province of New Brunswick, latest revision.
- .2 Install and be responsible for shoring and bracing as required.
- .3 When support of excavation is required, engage services of qualified Professional Engineer who is registered or licensed in Province of New Brunswick, to design shoring and bracing and inspect its installation.

- .4 Provide record copy of drawings signed and sealed by Professional Engineer responsible for their preparation.
- .5 Submit design and supporting data at least two weeks prior to commencing Work.
- .6 Keep design and supporting data on site.

3.6 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Remove concrete and other obstructions encountered during excavation.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain.
- .5 Keep excavated and stockpiled materials safe distance away from edge of excavation as directed by Departmental Representative.
- .6 The contractor shall separately excavate or otherwise salvage materials meeting the definition of "Borrow or Common Fill", as indicated in the contract documents, for use in re-grading the site. Where the contractor includes borrow, the contractor shall conduct operations such that all usable material resulting from common excavation either has been used or shall be used in the Work, prior to the placement of any imported material.
- .7 Restrict vehicle operations directly adjacent to open excavations.
- .8 Dispose of surplus and unsuitable excavated material in approved location on site.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .11 Notify Departmental Representative when bottom of excavation is reached.
- .12 Obtain Departmental Representative approval of completed excavation.
- .13 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
- .14 Install geotextiles in accordance with Section 31 32 19.01 - Geotextiles.

3.7 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:

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- .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities and structures.
 - .2 Borrow shall not be placed in areas where excavated materials could be hauled and placed at a lesser cost to PWGSC, unless otherwise authorized by the Departmental Representative.
 - .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
 - .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
 - .5 Backfilling around installations:
 - .1 Place bedding and surround material as specified on drawings.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading.

3.8 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil in accordance with Section 32 91 19.13 Topsoil Placement and Grading.
- .3 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .4 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 WORK INCLUDES

- .1 Materials and installation of polymeric geotextiles used in filtration, drainage structures, and ditch bottoms for the purposes of which is to:
 - .1 Separate and prevent mixing of granular materials of different grading.
 - .2 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

1.2 RELATED SECTIONS

- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Section 32 11 16.01 - Granular Subbase

1.3 REFERENCES

- .1 New Brunswick Department of Transportation and Infrastructure (NBDTI) Standard Specifications, January 2011
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D4533-15, Standard Test Method for Trapezoid Tearing Strength for Geotextiles.
 - .2 ASTM D4632-15a, Test Method for Grab Breaking Load and Elongation of Geotextiles.
- .3 Canadian General Standards Board (CGSB)
 - .1 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

1.4 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittals Procedures.
- .2 Submit to Departmental Representative following samples at least 2 weeks prior to beginning Work.
 - .1 Minimum length of 2 m of roll width of geotextile.
 - .2 Minimum of 1 m seam with at least 300 mm of geotextile on both sides of seam.
- .3 Submit to Departmental Representative copies of mill test data and certificate at least 2 weeks prior to start of Work, and in accordance with Section 01 33 00 - Submittals Procedures.

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 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIAL

- .1 Geotextile: woven or non-woven synthetic fibre fabric, supplied in rolls.
 - .1 Sheet of woven plastic yarn: Type, W2, as per NBDTI Standard Specifications, Item 601, Table 601-1 – Requirements of Non-Woven and Woven Geotextiles.
 - .2 Composed of: minimum 85% by mass of propylene, ethylene, ester, amide or vinylidene-chloride with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure.
- .2 Physical properties: As per NBDTI Standard Specification, Item 601, Table 601-1 – Requirements of Non-Woven and Woven Geotextiles.
- .3 Hydraulic properties: As per NBDTI Standard Specification, Item 601, Table 601-1 – Requirements of Non-Woven and Woven Geotextiles.
- .4 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to CAN/CSA G164.
- .5 Factory seams: sewn in accordance with manufacturer's recommendations.
- .6 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 as recommended by manufacturer.

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- .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 Pin successive strips of geotextile with securing pins at manufacturer's recommended 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 hours of placement.
 - .8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
 - .9 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

3.2 CLEANING

- .1 Remove construction debris from Project 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