

PART 1: GENERAL

1.1 WORK INCLUDED

- .1 The work to be performed under this section consists of construction related earthworks, site work and environmental protection and all related works, all as outlined on the drawings, or as described in these specifications, or as directed by the Departmental Representative.
- .2 This section includes earthworks related to the rehabilitation of existing paved areas and various infrastructure upgrades at the Dorchester Penitentiary, as outlined on the drawings, described in these specifications, or as directed by the Departmental Representative.
- .3 The work under this section is closely related to other project work, especially site work, building construction and pipe systems, and the proper construction sequence and co-ordination shall be undertaken.

1.2 RELATED SECTIONS

- .1 Section 31 14 13 : Soil Stripping and Stockpiling
- .2 Section 31 23 33.01 : Excavating, Trenching and Backfilling
- .3 Section 31 32 19.01 : Geotextiles
- .4 Section 32 91 19.13 : Topsoil Placement and Grading
- .5 Section 32 92 19.16 : Hydraulic Seeding
- .6 Section 33 05 16 : Manholes and Catchbasin Structures

1.3 GENERAL

- .1 The boundaries of the site shall be as laid out by the Departmental Representative. Any surface restoration required outside these boundaries due to disturbance by the Contractor during the work shall not be measure separately for payment but shall be carried out to the complete satisfaction of the Departmental Representative at the Contractor's expense.

- .2 All environmental structures, including sediment control fences, are to be installed prior to the start of the work. There shall be no separate payment for the supply and installation of sediment control fences, but shall be considered incidental to the work.
- .3 Where any trees, shrubbery, fences, poles or other property and surface structures have been damaged, removed or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the Contract documents, municipal ordinances, or the specific direction of the Departmental Representative, or through failure to employ usual and reasonable safeguards, such property and surface structures will be replaced and repaired at the expense of the Contractor.
- .4 The Contractor is required to strictly follow the construction methods and sequences of work identified herein and any other specific conditions which may be identified.

1.4 MEASUREMENT AND PAYMENT

- .1 Refer to Section 01 11 50 - Measurement and Payment.

1.5 COMPLIANCE REQUIREMENTS

- .1 American Society for Testing and Materials (ASTM) International:
 - .1 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
- .2 Canadian Standards Association (CSA) International:
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A3000-08, Cementitious Materials Compendium.

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Co-ordination: arrange with authority having jurisdiction for relocation of buried services that interfere with execution of work.

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- .1 Pay costs of relocating services.

1.7 SUBMITTAL GENERAL REQUIREMENTS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures
- .2 Provide the Departmental Representative with the following information before the commencement of the work and at any time during the construction at the request of the Departmental Representative (at no cost to the Owner).
 - .1 The analyses are to be completed by an approved testing geotechnical firm and samples must be collected at the proposed source by the same firm:
 - .1 Source of supply of aggregate;
 - .2 Soil testing resulted including sieve analysis to Item 121 of the NB Department of Transportation and Infrastructure Standard Specification (latest edition).
 - .3 When submitting results to the Departmental Representative, the geotechnical testing firm must confirm that the material either meets the specifications or that it is not suitable for the intended use. This is to be in letter report format submitted directly to the Departmental Representative on the letterhead of the testing firm.
 - .4 The Owner reserves the right to reject any source of supply of Borrow "A/A1" or crushed gravel on the basis of past field performance, documentation records, and the experience of the Owner and/or the Departmental Representative with a specific material, regardless of compliance with physical requirements of grading limits.

1.8 DELIVERY REQUIREMENTS

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Load and unload pipe and accessories by lifting with hoists and slings, on pallets, or careful skidding so as to prevent shock and damage.

- .3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .4 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes and coatings from damage.
 - .3 Replace defective or damaged materials with new.
 - .4 Do not drop or drag pipe.
 - .5 Avoid severe impact blows, abrasion damage, and gouging or cutting of PVC pipe by metal surfaces or rocks.
 - .6 For pipe handled on skidways, do not skid or roll pipe against pipe already on the ground.
 - .7 Avoid stressing bell joints and damage of bevel ends.

PART 2: PRODUCTS

2.1 MATERIALS

- .1 Granular Base and Sub-base to New Brunswick Department of Transportation and Infrastructure Specifications, (NBDTI, latest edition).
- .2 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum Portland cement content of 25 kg/m³.
 - .3 Minimum strength of 0.07 MPa at 24 hours.
 - .4 Concrete aggregates: to CSA A23.1/A23.2.
 - .5 Cement: to CSA A3000, Type GU.
 - .6 Slump: 160 to 200 mm.
- .3 Borrow "A/A1": to Item 121.2 of the N.B. Department of Transportation and Infrastructure Standard Specification (latest edition).
 - .1 Prior to the importing any Borrow "A/A1" material to the site, the Departmental Representative must approve the

Borrow "A/A1" pit and the area in the pit which is the source of material.

.2 Surplus material from excavation meeting the requirements of Borrow "A/A1" shall be used prior to importing additional Borrow "A/A1" material.

.3 Submit testing results for the proposed material and source to be used as Borrow "A/A1" material. Test results to be approved by the Departmental Representative prior to hauling and placement.

.4 No extra payment will be made when using suitable excess material from the previous excavation (including excavation, stripping and ditching) which meets the requirements of Borrow "A/A1" and will then be considered incidental to the work, including hauling, shaping and compaction. Only suitable imported Borrow "A/A1" material will be measured for separate payment.

.4 Granular Sub base and Base material: to Section 31 11 16.01 - Granular Base and Sub-base. Aggregate base properties shall meet the requirements of Table 201-1 of the N.B. Department of Transportation and Infrastructure Standard Specifications (latest edition). Under no circumstances will Pit Run material will be accepted as aggregate base.

.6 Earth or Common Material (Soil Borrow "A"): Approved material from excavations or approved imported borrow material from the Contractors own sources.

.1 Common material: soil or rock and contain no roots, stumps, organics and/or other deleterious substances or stones over 150 mm in greatest dimension.

.2 Borrow material: to NBDTI Specifications for "Soil Borrow A", Item 121 (latest edition). Borrow "B" material is not acceptable.

.3 The Departmental Representative must approve the pit and the area in the pit which the Contractor uses as his source of material. The Contractor will be required to provide testing results for the proposed material in accordance with Article 1.6 Submittal General Requirements, at his expense.

.7 Geotextile: in accordance with Section 31 32 19.01 - Geotextiles

.8 5-20mm Clear Stone:

.1 Free of clay, organic or deleterious matter,
conforming to the following grading limits:

<u>Sieve Size (5-20 mm)</u>	<u>Percentage of Weight Passing</u>
28	100 -
20	85 - 100
14	50 - 90
10	25 - 60
5	0 - 10
2.5	0 - 5

2.2 LAYOUT EQUIPMENT

- .1 In laying out the storm and culvert pipes, the Contractor is responsible for establishing the locations and elevations of manholes and/or catchbasins. The collection system shall be laid out by the Contractor in accordance with the Drawings. Refer to Drawings for survey benchmarks to be used for layout and coordination.
- .2 Use approved laser beam instrumentation and techniques to determine intermediate line and grade for all pipes except where and when the Departmental Representative may allow other methods to be used.
- .3 Use approved laser alignment equipment to control line and grade during all pipe laying.
- .4 Use an approved laser sighting triangle or template to set each pipe.

PART 3: EXECUTION

3.1 EXAMINATION

- .1 Evaluation and Assessment:
 - .1 Examine soil report prepared by Conquest Engineering Inc., included in this document in Appendix A.
 - .2 Before commencing work verify locations of buried services on and adjacent to site.

3.2 PREPARATION

- .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 drawings. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

- .2 Protection of in-place conditions:
 - .1 Protect excavations from freezing.
 - .2 Keep excavations clean, free of standing water, and loose soil.
 - .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.
 - .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 Removal:
 - .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
 - .2 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.

3.3 EXCAVATION

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial regulations.
- .2 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
 - .1 Stockpile topsoil on site for later use.
 - .2 Obtain approval of Departmental Representative prior to stockpiling material anywhere within the Institution.
 - .3 Maximum height of stockpile shall be 1.65 metres.
- .3 Excavate as required to carry out work.
 - .1 Excavate to the lines and grades as shown on the

drawings, or as laid out in the field or as directed by the Departmental Representative.

- .2 Do not disturb soil or rock below bearing surfaces.
- .3 Notify Departmental Representative when excavations are complete.
- .4 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
- .5 Excavation taken below depths shown without Departmental Representative's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .4 Excavate trenches to provide uniform continuous bearing and support for 150 mm thickness of pipe bedding material on solid and undisturbed ground.
 - .1 Trench widths below point 150 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .5 Excavate for slabs and paving to subgrade levels.
 - .1 In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.
- .6 Remove and dispose of all unsuitable material from the excavation. Disposal of surplus material will not be measured for separate payment.
- .7 Unsuitable material is that which, in the opinion of the Departmental Representative, cannot be used in the work or will not allow proper construction of the work.
- .8 Where suitable material from the excavation is encountered, in the opinion of the Departmental Representative, it will be stockpiled for later use either for backfilling, or for other uses on the site as designated by the Departmental Representative. Dispose of excess material off site.
- .9 If the Contractor has any doubts as to the bearing capacity at the bottom of the footing, he will obtain instructions from the Departmental Representative and failing this he will be responsible for any damage to the structure.
- .10 Provide three (3) days notice to the Departmental

Representative before beginning the actual excavation so that all necessary measurements can be taken.

- .11 Make ample provision for dewatering all excavations as required. This is to be taken into account in the calculation of price for individual concrete structures. No additional payment will be made due to the presence of ground water.
- .12 Use proper and acceptable methods for excavation which will at all times be subject to the Departmental Representative's approval and will employ such safe slope angles, shores, piling, bracing, etc., as may be necessary for the protection of workmen. Earth slides or slips and over excavation together with any subsequently required fill attributable to the negligence or carelessness of the Contractor will not be considered as part of the work. Over excavated areas will be filled with concrete or crushed rock as the Departmental Representative may elect at no additional cost to the Owner.
- .13 All material including rock shall be classed as common excavation.
 - .1 Rock excavation will not be measured for payment but shall be considered incidental to the work.

3.4 PLACING, SPREADING AND COMPACTION OF PREVIOUSLY EXCAVATED AND IMPORTED BORROW "A" MATERIAL

- .1 Fill areas will be brought to the lines and grades as shown on the drawings or as directed by the Departmental Representative.
- .2 Previously excavated and Borrow "A" material will be placed in layers not exceeding 300 mm and compacted until a minimum of 95% of maximum dry density is achieved, as determined by ASTM D698.
- .3 Thoroughly compact each layer over its entire width before placing the next layer. Where, in the opinion of the Departmental Representative, the required compaction is not being obtained, the further placing of material will cease and the material in place will be given additional compaction until acceptable.
- .4 At all times, operate sufficient compaction equipment to thoroughly compact the material at the rate at which it is

being placed. Choice of compaction equipment will be made by the Contractor and approved by the Departmental Representative.

- .5 In areas incapable of supporting earth moving equipment the thickness of the first layer of material may be increased sufficiently to support equipment. The layer will be placed over the full width of the section. The surface will be thoroughly compacted as required in these specifications, following which the remainder of the fill will be built in layers of the specified normal thickness.
- .6 Provide equipment suitable for the work requirements and soil conditions of this site.
- .7 The shaped and compacted surface must be smooth, hard, free from waves and undulations and competent in the opinion of the Departmental Representative to provide adequate support for the construction.
- .8 Fill areas will not be left unfinished for any length of time unless authorized by the Departmental Representative.
- .9 Where the pavement and parking areas have to be raised above the level achieved from the use of suitable on-site material, imported Borrow "A" material will be used. Finished surface will be graded to ensure the top surface is free of waves and undulations, smooth, hard and to the correct profile.
- .10 The cost of trucking, moving, placing, shaping and compacting of previously excavated material for the construction of dikes and related areas to be filled will be included in the price tendered for previously excavated material. No separate payment will be made for overhaul.
- .11 Dust prevention and control shall be done in accordance with Section 01 35 43 Environmental Procedures. If calcium chloride is directed to be used for dust control, it shall be measured and paid in accordance with Section 01 35 43 Environmental Procedures.

3.6 DITCHING AND RE-DITCHING

- .1 Excavate ditches/swales to the lines and grades indicated on the drawings or as staked in the field.
- .2 Carry out ditching as excavation progresses so as to ensure

that surface drainage is maintained at all times.

- .3 Place Type "C" erosion control structures in ditches as construction proceeds to prevent silt runoff to watercourses. Remove accumulated material from ditches and reconstruct the Type "C" structures as required through the work to ensure this protection.
- .4 Place fill sections in lifts having a maximum thickness of 300 mm and compacted to 95% maximum dry density as determined by ASTM D698.
 - .1 Moisture content during compaction: not more than three (3) percentage points above or below the optimum moisture content, as determined by ASTM D698.
- .5 At the completion of ditching and fill sections, shape and roll subgrade to give a smooth firm surface in accordance with the design grades and slopes.
- .6 Form ditches and slope ditch sides as shown on the drawings.
- .7 Seed and mulch ditches progressively and as soon as possible after their construction.
- .8 If excess material from the ditching operations is considered suitable by the Departmental Representative and meeting the requirements of Borrow "A" material (in accordance with Item 121 of the N.B. Department of Transportation and Infrastructure Standard Specification (latest edition) and free from organic material, it may be used, at no extra cost to the work, where fill is required to achieve proper level of sub-grade. If it is not suitable, dispose of excess excavated material off site at no extra cost.
- .9 All material including rock shall be classed as common excavation.
 - .1 Rock excavation will not be measured for payment but shall be considered incidental to the work.

3.7 DEWATERING

- .1 Maintain the site and all excavations in a dewatered condition to enable the work to be done properly and without delay. This includes dewatering of water from all

sources, including precipitation, runoff, snowmelt, groundwater, etc. This also includes maintaining the site properly dewatered for the pouring of concrete as required.

- .2 Provide pumping as required to maintain site dewatered as required. No claim will be entertained for wet site conditions. The environmental protection including the erosion control structures, sediment control ponds and silt fencing is also to be included in the price for dewatering.
- .3 Construct any temporary ditches, berms, sumps, etc. required and to provide any pumps, flumes, piping, hoses, etc. necessary to accomplish this. Direct all flows resulting from dewatering operations to sedimentation ponds prior to discharge to adjacent ditches and watercourses. Site work and site ditching shall be done to maintain continuous drainage.

3.8 FIELD QUALITY CONTROL

- .1 Testing of materials and compaction of backfill will be carried out by testing laboratory designated by the Departmental Representative.
- .2 Not later than 1 week minimum before backfilling or filling, submit to designated testing agency, samples of backfill as described in Article 1.6 - Submittal General Requirements.
- .3 Do not begin backfilling or filling operations until material has been approved for use by the Departmental Representative.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify the Departmental Representative to allow compaction tests to be carried out by designated testing agency.

3.9 PLACING, SPREADING AND COMPACTING BORROW "A/A1" MATERIAL AND BACKFILLING

- .1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .2 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

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- .3 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as fill.
 - .1 Fill excavated areas with selected subgrade material gravel and sand compacted as specified for fill.
 - .4 Placing:
 - .1 Place backfill, fill and base course material in 300 mm lifts: add water as required to achieve specified density.
 - .2 Backfill in such a way that relatively equal soil pressures will be exerted to all parts of the structure at all times.
 - .3 Place unshrinkable fill in areas as indicated: consolidate and level unshrinkable fill with internal vibrators.
 - .5 Compaction: compact each layer of material to following dry densities for material to ASTM D698:
 - .1 To underside of base courses: 95%.
 - .2 Base courses: 100%.
 - .3 Elsewhere: 95%.
 - .6 Under slabs and paving:
 - .1 Use 95% up to bottom of granular base courses.
 - .2 Use 100% for base courses.
 - .3 Place granular material in successive uniform layers not exceeding 150 mm across the entire slab and compacted 95% of maximum dry density, to ASTM D698.
 - .4 Backfill material used under the pre - cast wet well top section will not be measured separately for payment, but shall be considered incidental to the work.
 - .7 In trenches:
 - .1 Up to 300 mm above pipe or conduit: bedding material or sand unless otherwise shown on the drawings, placed by hand.
 - .2 Over 300 mm above pipe or conduit: native material

approved by the Departmental Representative.

- .8 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .9 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material

3.10 GRADING

- .1 Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by the Departmental Representative.
 - .1 Grade to be gradual between finished spot elevations shown on drawings.

3.11 CLEANING

- .1 All machinery shall be cleaned before being brought on-site.
- .2 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Dispose of cleared and grubbed material off site daily.
 - .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1: GENERAL

1.1 RELATED SECTIONS

- .1 Section 32 91 19.13 : Topsoil and Finish Grading

1.2 MEASUREMENT AND PAYMENT

- .1 Soil stripping and stockpiling shall be considered incidental to common excavation and will not be measured separately for payment.

1.2 COMPLIANCE REQUIREMENTS

- .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.

PART 2: PRODUCTS

1.1 NOT USED

- .1 Not used.

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 requirements 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 STRIPPIING OF TOPSOIL

- .1 Ensure that procedures are conducted in accordance with applicable Provincial requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal.
- .5 Remove brush from targeted area by non-chemical means and dispose of through mulching.
- .6 Strip topsoil by scraper to depths as directed by Departmental Representative.
 - .1 Avoid mixing topsoil with subsoil.
- .7 Pile topsoil by mechanical hoe in berms in locations as directed by Departmental Representative.
 - .1 Stockpile height not to exceed 1.65 m.
- .8 Dispose of unused topsoil off-site.
- .9 Protect stockpiles from contamination and compaction.
- .10 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

3.3 PREPARATION OF GRADE

- .1 Verify that grades are correct and notify Departmental Representative if discrepancies occur, do not begin work until instructed by Departmental Representative.
 - .1 Grade area only when soil is dry to lessen soil compaction.
 - .2 Grade soil with scrapers establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

3.4 PLACING OF TOPSOIL

- .1 Place topsoil only after Departmental Representative has accepted subgrade.

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- .2 Spread topsoil during dry conditions by mechanical hoe in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
 - .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
 - .4 Cultivate soil following spreading procedures.

3.5 SUB-SOILING

- .1 Apply sub-soil, following spreading and cultivating procedures to designated areas to improve drainage and agricultural potential of soil.
- .2 Work sub-soil area following natural grade contour lines, with vibrating sub-soiler to depth of 40 cm.
- .3 Cross sub-soil the area following the first pass.
- .4 Cultivate the soil with a chain harrow to de-clod the soil.

3.6 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 WORK INCLUDED

- .1 This section includes the supply of all labour, materials and equipment necessary for excavation and for trenching storm sewer mains, culverts and appurtenances, including bedding, backfilling, and restoration and maintenance of the trenches. If approved for re-used, the excavated and ditched material shall be stock-piled on-site at the designated area (as shown on the drawings) for re-use.

1.2 RELATED SECTIONS

- .1 Section 33 41 00 : Storm Utility Drains
- .2 Section 33 42 13 : Pipe Culverts

1.3 MEASUREMENT AND PAYMENT

- .1 No separate payment will be made for trench excavation in common material. All trenching in common material including excavation together with necessary sheeting and shoring, trench boxes where required, dewatering, traffic control, safety including temporary barricades, reuse or disposal of excavated material, clean-up and other work incidental thereto shall be included in the contract price for pipe or structures in place. Removal and disposal of existing pipes, structures and appurtenances (as directed) will be considered incidental to the excavation and will not be measured separately for payment.
- .2 Shoring, bracing, cofferdams, underpinning and de-watering of excavation will not be measured separately for payment.
- .3 No separate payment will be made for bedding material. Supply, hauling, placing and compaction of imported bedding material shall be considered incidental to the work. All costs associated with this item including testing, dewatering, protection of utilities and structures, and other incidental work required must be incorporated into bid items for pipe, structures and appurtenances.
- .4 No separate payment will be made for asphalt removal. Supply and transportation of all labour, equipment and materials, cutting, loading, transportation, disposal, traffic control, protection of structures, signage, traffic control, safety, clean-up and all work incidental thereto, all as specified or as shown on the Drawings or as directed by the Engineer shall be incorporated into bid item for pipe, structures and appurtenances.

- .5 Separate payment will be made for asphalt removal (pulverizing) in unit measurement of square metres as indicated on the Tender Form.
- .6 Unit price payment will include the supply and transportation of all labour, material and equipment, insulation where specified, supply, hauling, mixing, testing, placing, curing, clean-up and all work incidental thereto, all as specified or as directed by Engineer.
- .7 Trench maintenance shall not be measured for separate payment but is considered incidental to the work.
- .8 Dust control and prevention is not measured for separate payment but is considered incidental to the work, as per Section 01 35 43 Environmental Procedures or Section 32 15 60 Roadway Dust Control.

1.4 COMPLIANCE REQUIREMENTS

.1 American Society for Testing and Materials (ASTM) INTERNATIONAL

- .1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D422-63 (2002), Standard Test Method for Particle-Size Analysis of Soils.
- .4 ASTM D698 (00a1), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
- .5 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian GENERAL STANDARDS BOARD (CGSB)

- .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 CANADIAN STANDARDS ASSOCIATION (CSA) INTERNATIONAL

- .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
- .2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

- .4 New Brunswick Department of Transportation Standard Specifications (latest edition).

1.5 DEFINITIONS

- .1 Excavation classes: All material including rock shall be classed as common excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .5 Unsuitable materials:
- .1 Weak, chemically unstable, and compressible materials.
- .2 Frost susceptible materials:
- .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422: Sieve sizes to CAN/CGSB-8.1.

- .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 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 sieve.
- .6 Unshrinkable full: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.
- .7 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .8 Subgrade: the surface of mass excavation and embankment finished to lines and elevations indicated.

1.6 TEMPORARY SHORING AND BRACING

- .1 Install and be responsible for shoring and bracing as required.

- .2 When support of excavation is required, engage services of qualified Professional Departmental Representative who is registered or licensed in Province of New Brunswick, to design shoring and bracing and inspect its installation.
- .3 Provide record copy of drawings signed and sealed by Professional Departmental Representative responsible for their preparation.
- .4 Submit design and supporting data at least two weeks prior to commencing Work.
- .5 Keep design and supporting data on site.

1.7 SUBMITTAL GENERAL REQUIREMENTS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Testing and Quality Control:
 - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
 - .2 Submit to Departmental Representative testing results as described in PART 3 of this Section.
- .3 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
 - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field.
- .4 Provide the Departmental Representative with the following information before the commencement of the work and at any time during the construction at the request of the Departmental Representative (at no cost to the Owner):
 - .1 Approved testing geotechnical firm to complete the following analyses and collect samples at the proposed site:
 - .2 Source of supply of aggregate
 - .3 Sieve analysis
 - .4 Micro-Deval Analysis (not to exceed the requirements of Table 201-1 (25%) of the NBDTI Specifications (latest edition) for Aggregate Base Material
 - .5 Freeze-thaw - (not to exceed the requirements of Table 201-1 (20%) of the NBDTI Specifications (latest edition)

- .6 Flat and Elongated Particles (not to exceed the requirements of Table 201-1 (35%) of the NBDTI Specifications (latest edition)
- .7 Plasticity Index (not to exceed the requirements of Table 201-1 (3%) of the NBDTI Specifications (latest edition) for Aggregate Base Material
- .8 Standard Proctor and Optimal Moisture values.
- .5 When submitting results to the Departmental Representative, the geotechnical testing firm must confirm that the materials meets the Specifications and that it is or is not suitable for the intended use. This is to be in letter report format submitted directly to the Departmental Representative.
- .6 The Owner reserves the right to reject any source of supply of aggregate base on the basis of past field performance, document by the records and experience of the Owner and/or the Departmental Representative with a specific material, regardless of compliance with physical requirements of grading limits.
- .7 Samples:
 - .1 Allow continual sampling by the Departmental Representative during production if required.
 - .2 Provide the Departmental Representative with access to source and processed material for sampling.
 - .3 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

1.8 EXISTING CONDITIONS

- .1 Examine soil report prepared by Conquest Engineering Inc. appended to these Specifications.
- .2 Buried services:
 - .1 Before commencing work verify location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

- .5 Confirm locations of buried utilities by careful test excavations or soil hydrovac methods.
- .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
- .7 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Costs for such Work to be paid by Owner.
- .8 Record location of maintained, re-routed and abandoned underground lines.
- .9 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
 - .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 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.

PART 2: PRODUCTS

2.1 MATERIALS

- .1 Imported fill and Subgrade material: properties to meet NBDTI Borrow 'A' material as described in Item 121 of the Standard Specifications, latest edition.
- .2 Bedding material for all pipes (storm sewer and culverts outside of building footprint): material in accordance with NBDTI Standard Specifications, latest edition, Item 201 and following requirements, for normal dry trench conditions:
 - .1 Crushed stone:
 - .1 To consist of clean, hard, sound and durable uncoated particles that do not contain friable, soluble or reactive mineral, free from soft or disintegrated pieces, mud, dirt, clay, organic, frozen lumps or other deleterious materials or conditions that would make the crushed rock 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, as described in Item 201 of the NBDTI Standard Specifications (latest edition).

.2 The crushed rock, when tested in accordance with the N.B. Department of Transportation's method with standard laboratory sieves, will conform to Table 201-2 (Crushed Rock, 19 mm % Passing gradation) of the N.B. Department of Transportation Standard Specifications (latest edition).

.3 Other properties as noted in Clause 1.5.2.1.

.3 Bedding material in wet trench conditions (generally termed "drainage stone"): gradation as follows:

ASTM Sieve size	% passing
20.0 mm	100 -
14.0 mm	40 - 80
10.0 mm	20 - 62
5.0 mm	0 - 20
2.5 mm	0 - 10
0.08 mm	0 - 3

.1 Must have Departmental Representative's approval prior to use.

.2 Completely wrap in non-woven geotextile filter fabric in order to limit migration of fine materials into the rock.

.3 At least 50% of the particles retained on the 5 mm sieve shall have one or more surfaces formed by the fracture of a larger particle.

.4 The plasticity index of that fraction of the aggregate base material passing the No. 40 sieve shall not exceed 3 (three).

.5 Provide the Departmental Representative with the following information before the commencement of the work and at any time during the construction at the request of the Departmental Representative (at no cost to the Owner):

.1 Source of supply of aggregate;

.2 Sieve analysis

.6 The analyses are to be completed by an approved testing geotechnical firm and samples must be collected at the proposed site by the same firm:

.7 The Owner reserves the right to reject any source of supply of aggregate on the basis of past field performance, document by the records and experience of the Owner and/or the Departmental Representative with a specific material,

regardless of compliance with physical requirements of grading limits.

.8 In certain locations where it is important to prevent the flow of water through the granular bedding material typically used for the pipelines, clay bedding material may be specified.

.1 The source of clay material for this use shall be approved by the Departmental Representative.

.2 Provide the results of testing conducted by a certified testing laboratory to confirm that the following material specifications are met:

.3 Particle size range is to be determined by ASTM D2487 and 422-63. Acceptable size ranges by weight are:

.1 Percent fines (passing 75 um sieve):
greater than or equal to 50%

.2 Clay content: greater than or equal to 20%

.3 Sand content: less than or equal to 45%

.4 Atterberg Limits are to be determined by ASTM D4318. Acceptable Limits are:

.1 Plasticity Index (PI): greater than or
equal to 20%

.2 Liquid Limit (LL): greater than or equal to
30%

.5 Laboratory hydraulic conductivity shall be determined by ASTM 5084 on at least three (3) samples that have been compacted to 95% standard Proctor maximum dry density (as per ASTM D698). The hydraulic conductivity shall not exceed 5×10^{-10} m/s for the material to be suitable.

.4 Common backfill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from roots, brush, organic material, rocks larger than 200 mm, cinders, ashes, sods, refuse or other deleterious materials.

.5 Imported fill material shall be a sound, durable, granular material free from clay, frozen lumps, organic or deleterious matter and conform to the following gradation limits:

ASTM Sieve size	% passing
112 mm	100 -
80 mm	95 - 100
20 mm	15 - 100

5 mm	0 - 80
0.080 mm	0 - 10

- .6 Unshrinkable fill: proportioned and mixed to provide:
- .1 Portland cement: CSA Standard CAN3-A5-M, Type 10 or Type 30 (High Early Strength for winter construction).
 - .2 Supplementary cementing materials, when permitted, shall conform to the requirements of CSA Standard CAN3-A23.5-M.
 - .3 Fine and coarse aggregate: CSA Standard CAN3-A23.1-M. The gradation shall conform to Table 1 of the CSA Standard for 10 mm minus.
 - .4 Mixing water: CAN3-A23.1-M
 - .5 Air-entraining admixtures: CSA Standard CAN3-A266.1-M.
 - .6 Mix Design for Non-compressible Fill
 - .1 Maximum cement content: 25 kg/m³
 - .2 Maximum strength at 28 days (measured in accordance with CAN3-A23.2-9C): 0.40 MPa
 - .3 Slump (measured in accordance with CAN3-A23.2-5C): 150-200 mm
 - .4 Air content (measured in accordance with CAN3-A23.2) : 4% - 6%
 - .7 Prior to the production of unshrinkable fill for use, provide to the Owner a certificate from the Owner's testing company stating that the fill to be supplied conforms to the above requirements.
 - .7 Sand (bedding for conduits outside of building): hard, granular, sharp material, well-graded from coarse to fine, free of impurities, chemicals or organic matter, and graded as follows:

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

- .8 Granular base and sub-base material for trench restoration shall conform to Section 32 11 16.01 Granular Base and Sub-Base and NBDTI Standard Specification Section 203.

2.2 SOURCE QUALITY CONTROL

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks minimum before starting production.
- .2 If, in the opinion of the Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet specified requirements, locate alternative source or demonstrate that material from source in question can be processed to meet specified requirements the material cannot be used.
- .3 Advise Departmental Representative 4 weeks minimum in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if it is found to be unsatisfactory.

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 drawings.
- .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.
- .2 Cut pavement or sidewalk neatly along limit of proposed excavation so that the surface may break evenly and cleanly.

3.3 PREPARATION/PROTECTION

- .1 Protect existing features in accordance to applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.

- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the Departmental Representative's approval.
- .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 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative.
 - .1 Stockpile granular materials in a manner which prevents segregation.
 - .2 Maximum stockpile height: 1.65m
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements and the Health and Safety Act for the Province of New Brunswick.
 - .1 Where unstable, Departmental Representative to verify and advise methods.
- .2 Obtain permit from authority having jurisdiction for temporary diversion of water course.
- .3 Construct temporary works to depths, heights, and locations as directed by Departmental Representative.
- .4 During backfill operation:
 - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting,

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- .5 When sheeting is required to remain in place, cut off tops at elevations as indicated.
 - .6 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as directed by Departmental Representative.

3.6 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while work is in progress.
- .2 Provide for Departmental Representative's review and approval details of proposed dewatering or heave prevention methods.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
- .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 Procedures 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.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.
- .7 Construct any temporary ditches, berms, sumps, etc. required and provide pumps, hoses, power supplies, etc., as required to keep the site and all excavations acceptably dewatered to enable the work to be done properly and without delay.
 - .1 This includes dewatering from all sources, including precipitation, runoff, snowmelt, groundwater, pipe flows, etc.
 - .2 Maintain site work and site ditching to continuous drainage.
 - .3 Dispose of water pumped from the trench by directing flows to sedimentation ponds prior to discharge into adjacent ditches and watercourses.
 - .4 Dewatering shall not be measured for separate payment but is considered incidental to the work.

3.7 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Install "bump ahead" and "bump" signs at all trenches in roadways. Signs are to remain until final lift of asphalt is completed.
- .3 Repair removed or damaged pavement or surfaces beyond the limits specified above, at no expense to the Owner.
- .4 At all road crossings and other points as directed by the Departmental Representative, bridge trenches in a secure manner, and in such a manner as to prevent any serious interruption of traffic upon the roadway or sidewalks and to afford the necessary access to public and private premises.
 - .1 Under no circumstances will temporary dumping of material or stockpiling of material on the surface of the road be permitted during construction of the works.
- .5 At the end of each working day, restore all disturbed drainage ditches and re-install the culvert pipes that were removed or disturbed during the work in progress, incidental to the work.
- .6 Excavate to lines, grades, elevations and dimensions as indicated.
- .7 Excavation must not interfere with bearing capacity of adjacent foundations.
- .8 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .9 Install barricades on both sides of any area where the depth of the trench is greater than 3000 mm from the adjacent original ground surface. These barricades will not be measured for separate payment but shall be considered incidental to the work.
- .10 For trench excavation, unless otherwise authorized by Departmental Representative, do not excavate more than 20 m of trench in advance of installation operations.
 - .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 A certified trench box or cage may be required in all pipeline installations in order to keep the amount of surface restoration to a minimum.

.3 Multiple trench boxes or cages may be required in all pipeline installation exceeding the single trench box height.

.4 The requirement for trench box will be as shown on the drawings or as identified separately herein.

.5 Backfill all trenches at the end of the day unless special permission is given by the Departmental Representative to leave them open and that all traffic control and safety requirements are met.

.6 Protect trenches not backfilled at night with Jersey barriers on the traffic side and an acceptable continuous barricade on the side away from the roadway. These barricades will not be measured for separate payment but shall be considered incidental to the work.

.7 If work is stopped on the whole or any part of the trench and the trench is left open for an unreasonable length of time in advance of the placing of the pipe, when directed by the Departmental Representative, refill such trench or part thereof at his own expense, and will not again open such trench or part thereof until he is ready to proceed with construction.

.8 If the Contractor should refuse, neglect, or fail to refill completely such trench within two hours after receipt of notice in writing to do so, the Departmental Representative may order the refilling of the trench with the cost and expense thereof to be charged to the Contractor and the Owner will recover the amount of such cost and expense out of any monies due or to become due to the Contractor. The Departmental Representative may stop the excavation and any other portion of the work and require the Contractor to complete the system and backfilling up to such a point as he may direct. The Contractor will not become entitled to demand or receive any allowance or compensation other than an extension of time of completion for as many days as the Departmental Representative may determine.

.9 Protect all excavations during the course of the day's work.

.10 Width of trench at pipe depth in common excavation: 600 mm to no more than 900 mm greater than the outside diameter of the pipe.

.1 Trench width for multiple pipes in a common trench: one pipe plus a minimum of 300 mm clearance between service lateral pipes, and a minimum of 600 mm for main pipes, plus the width of the additional pipes.

.11 Remove and replace unstable or unsuitable soil within the limits of the specified trench excavation that cannot be re-used for backfill and replace with suitable material from the pipe trench excavation in 300 mm layers compacted to 95% of maximum dry density as determined by ASTM D698.

.1 Replace unsuitable soil removed with suitable material from the pipe trench, as determined by the Departmental Representative, included in the pipe price.

.2 Extra payment will only be made where it is necessary to import replacement fill material to the site.

.12 Excavate trench to the depth required for placing of the pipe bedding material.

.13 Excavate and remove unsuitable material where the bottom of the trench at sub-grade is found to be unstable or unsatisfactory, to the width and depth as directed by Departmental Representative.

.14 Dewater trench for the proper placing of the bedding material and pipe.

.15 Restore sub-grade by backfilling with suitable material from the trench excavation, as determined by the Departmental Representative or with pipe bedding material in 150 mm layers compacted to 95% of maximum dry density as determined by ASTM D698.

.16 Widen trenches where required and as appropriate to allow adequate clearances for the installation of manholes and other appurtenances.

.17 In locations where the trench must be excavated across or along paved surfaces, remove pavement and road surfaces as a part of the trench excavation. The amount removed will depend upon the width of trench specified for the installation of the pipe. The width of pavement removed along the normal trench will not exceed the required width of the trench specified by more than 150 mm on each side as laid out on site.

- .18 Comply with the trenching safety requirements of New Brunswick Regulation 91-191 under the Occupational Health and Safety Act, regardless of marked width of proposed pavement removal.
- .11 Where excavation depths and/or soil conditions require a trench width greater than 4 m at the surface, limit asphalt removal to 4 m and use a trench box (cage).
- .1 Ensure the height of the trench box is sufficient to keep the top width of the trench less than 4 m wide while meeting trench safety requirements.
- .12 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .13 Restrict vehicle operations directly adjacent to open trenches.
- .14 Dispose of surplus and unsuitable excavated material in approved location on site.
- .15 Do not obstruct flow of surface drainage or natural watercourses.
- .16 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .17 Notify Departmental Representative when bottom of excavation is reached.
- .18 Obtain Departmental Representative approval of completed excavation.
- .19 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .20 Correct unauthorized over-excavation as follows:
- .1 Fill under bearing surfaces and footings with approved fill material compacted to not less than 100% maximum dry density as determined by ASTM D698.
- .2 Fill under other areas with approved fill material fill compacted to not less than 95 % maximum dry density as determined by ASTM D698.
- .21 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.
- .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

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- .22 If rock as defined is encountered during any phase of construction, immediately notify the Departmental Representative. Any excavation done in rock prior to notification will not be considered for payment.
- .23 In the event when there is no tendered price for rock excavation, the owner will establish a fair price based on average prices currently in effect in the region, for excavation where drilling and blasting was carried out to facilitate excavation in rock.
- .24 There are two alternate methods which may be applied, with the Departmental Representative's authorization:
- .1 Bringing a larger excavator to the site to excavate the rock; or,
 - .2 Breaking the rock.
- .25 For trench excavation in rock, rock is defined as solid rock, boulders, concrete or masonry exceeding one-half cubic meter in volume for which drilling and blasting are required for removal.
- .26 Dimensions of trenches in rock: Excavate rock to a depth of at least 300 mm below the bottom of the pipe or structure to be installed.
- .1 Width of trench excavation in rock: at least 600 mm greater than the outside diameter of the pipe (300 mm each side) for a single main in a trench.
 - .2 Width of trench excavation for two or more mains in a common trench: as specified for a single main plus 600 mm clearance between pipes.
 - .3 Width of trench excavation for service laterals: minimum of 1 m.
- .27 Blasting will not be permitted.
- .28 Disposal of excavated rock: Use only rock fragments smaller than 200 mm in greatest dimension for trench backfill. Dispose of rock fragments larger than 200 mm in greatest dimension off site.
- .1 No separate payment will be provided for disposal of rock larger than 200 mm, but to be considered incidental to the work.
- .29 Surplus material: all surplus or unsuitable excavated material remains the property of the Contractor.
- .1 Remove this material off site on a daily basis.
 - .2 The cost of this work will not be measured separately for payment but will be considered incidental to the works.

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- .30 Common material: soft, layered broken rock or mudstone which can be excavated by a hydraulic excavator equipped with a 1.5 cubic meter general duty bucket (based on Crown Construction Contract Act's Schedule B) and operating normally.
- .1 Production slowdown due to excavation in this material shall not be compensated for in any way.
- .31 The Contractor may choose to bring on site a larger excavating machine than that stated above or larger than is presently on site in order to excavate the rock thus eliminating the need for drilling and blasting.
- .32 Compensation and payment for this option shall be limited to the difference in the rate between the machine originally on site and the larger machine, at the hourly rental rates as per General Conditions.
- .33 Compensation for the rental rate difference shall be made only for the time the larger machine is actually operating.
- .34 A maximum of two (2) hours transportation (float) time shall also be paid at the NBDTI's standard rate for the float used.
- .35 If the quantity of rock is appropriate and the type of rock permits, rock excavation using hydraulic breaking equipment such as jackhammers, a breaking attachment on a backhoe, or other suitable equipment may be permitted. Hydraulic breaking may also be required where the risk to nearby utilities and structures warrants a method other than drilling and blasting.
- .36 Cut and remove all asphalt or concrete as marked or specified, within the limits of the proposed work.
- .37 Cutting of asphalt must be done by using a saw to give a square, undamaged edge for bonding. UNDER NO CIRCUMSTANCES WILL RIPPING OR CUTTING OF ASPHALT BY EXCAVATION MACHINERY BE ALLOWED. Cut asphalt parallel to the centerline of the trench unless otherwise directed by the Departmental Representative.
- .1 This work must be done in a manner which leaves the sub-base undisturbed insofar as possible
- .38 Where concrete sidewalk has been overlaid by a layer of asphalt, the removal will be considered as removal of concrete only.
- .39 Provide traffic control and signage during the cutting and removal process to protect the public and ensure the work is carried out in a safe manner.

- .40 Place barricades and warning signs shall be placed around the work area in accordance with Section 01 00 01 General Requirements.
- .41 Restrict vehicle operations directly adjacent to open trenches.
- .42 Do not obstruct flow of surface drainage or natural watercourses.
- .43 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .44 Unless otherwise specified or directed by the Departmental Representative, all asphalt and concrete materials removed under this Section will become the property of the Contractor and shall be properly loaded, transported and disposed of incidental to the work.
- .45 Use proper and acceptable methods for excavation which will at all times be subject to the Departmental Representative's approval and will employ such safe slope angles, shores, piling, bracing, etc., as may be necessary for the protection of workmen. Earth slides or slips and over excavation together with any subsequently required fill attributable to the negligence or carelessness of the Contractor will not be considered as part of the work.

3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Bedding methods and materials must conform to the pipe manufacturer's requirements for all materials that are being bedded.
- .3 The use of excavated material for bedding is strictly forbidden unless otherwise directed and approved in writing.
- .4 Place bedding and surround material in unfrozen condition.
- .5 Place bedding in layers to a depth of 150 mm or 300 mm in rock and compacted to a density of 95% of maximum as determined by ASTM D698.
- .6 Place bedding in 150 mm lifts to a minimum height of 300 mm over the top of the pipe. The bedding shall be tamped or rodded by hand under the haunches of the pipe upon placing of the first lift. Place and compact succeeding layers to a density 95% of maximum as determined by ASTM D698.
- .7 Pipe-bedding material shall not be placed in water or trenches having soft and unstable bottom conditions.

- .1 Where water from any source is found in the trench, provide pumps, hoses, power supplies, etc., as required to keep the trenches acceptably dewatered during the work. Dispose of water pumped from the trenches in an environmentally acceptable method. Dewatering will not be measured for separate payment but is considered incidental to the work.
- .8 Compacting equipment for pipe bedding material shall be suitably sized so as not to cause damage to the pipe or movement of the pipe due to impact and vibration and of ample size to provide the degree of compaction specified.
- .9 The completed bedding shall meet the requirements for a Class "B" bedding, on PVC, Corrugated Metal Pipe, Ductile Iron and all lateral piping and for a modified Class "B" bedding on concrete pipe.

3.10 BACKFILLING

- .1 Do not proceed with backfilling operations until Departmental Representative has inspected and approved installations.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Clean and stockpile or dispose of excess backfill material at the end of each day's work.
- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 Where the excavated material is unsuitable for ordinary backfill, dispose of this material in accordance with the General Conditions, and backfill with imported granular material upon written order from the Departmental Representative.
 - .1 Backfill trenches with imported granular material in layers not exceeding 300 mm after compaction. Compact to 95% of the maximum density as determined by ASTM D698.
- .7 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .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.

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- .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative.
 - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
 - .8 Place unshrinkable fill in areas as indicated.
 - .1 When the Departmental Representative designates that unshrinkable fill is to be placed as backfill when a utility has been repaired or installed, bedded and protected with sand as required, fill the trench with non-viscous, non-compressible fill, up to the underside of pavement materials.
 - .2 When unshrinkable fill is being used in a watermain trench, place full-width horizontal 50 mm polystyrene board insulation at approximately 100 mm above buried pipe.
 - .3 Consolidate and level unshrinkable fill with internal vibrators.
 - .9 Install perimeter drainage and filter fabric in backfill as indicated.
 - .10 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 approved by the Departmental Representative. If any work is covered without approval of the Departmental Representative it must, if required, be uncovered for examination.

3.11 RESTORATION

- .1 Conduct and confine all construction operations within the limits of the work as shown on the Drawings or laid out by the Departmental Representative.
- .2 The entire site and all properties, facilities, structures, fences, shrubs, lawns, trees, signs, driveways, sidewalks, ditches, culverts, appurtenances, etc. affected by the work must be fully restored to original or better condition before issuance of the "Certificate of Final Acceptance".
- .3 Replace topsoil as indicated.

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- .4 Reinstall lawns to elevation which existed before excavation by hydraulic seeding or sodding. Hydraulic seeding shall be as required by Section 32 92 19.16. Sodding shall be as required by Section 32 92 23.
 - .5 Reinstall pavements disturbed by excavation to thickness, structure and elevation which existed before excavation.
 - .6 Clean and reinstall areas affected by Work as directed by Departmental Representative.
 - .7 Clean-up and re-establish ditches disturbed during the installation of pipelines at no extra cost to the Owner.
 - .8 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
 - .9 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.
 - .10 Trench maintenance: Maintain all trenches until issuance of the "Certificate of Final Acceptance".
 - .1 Maintain trenches in travelled roads with granular base course only until such time as asphalt can be placed to allow a smooth travel surface.
 - .2 Inspect trench backfill conditions and conduct a weekly program of trench maintenance or daily when weather or traffic conditions dictate, until issuance of the "Certificate of Final Acceptance".
 - .11 Dust Prevention:
 - .1 Assume responsibility for dust prevention on any street or site where works have been or are being carried out, until such works are restored to original condition or upon issuance of the "Certificate of Final Acceptance".
 - .2 Dust prevention includes sweeping of paved roadways and/or sidewalks and flushing of same, when deemed necessary by the Departmental Representative and at the end of each working day. All methods of dust prevention must be approved by the Departmental Representative.

END OF SECTION

PART 1: GENERAL

1.1 RELATED SECTIONS

- .1 Section 31 37 00 : Rip-Rap

1.2 MEASUREMENT AND PAYMENT

- .1 Geotextile is not measured for separate payment but is considered incidental to the placement rip-rap.

1.3 COMPLIANCE REQUIREMENTS

- .1 ASTM International
 - .1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM D4491-99a(2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .3 ASTM D4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - .4 ASTM D4716-08, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .5 ASTM D4751-04, 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-[2004], 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.7.3-91, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
 - .5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

1.4 SUBMITTAL GENERAL REQUIREMENTS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit following samples 4 weeks prior to beginning Work.
 - .1 Minimum length of 2 m of roll width of geotextile.
 - .2 Methods of joining.
- .4 Test and Evaluation Reports:
 - .1 Submit copies of mill test data and certificate at least 4 weeks prior to start of Work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect geotextiles from direct sunlight and UV rays.
 - .3 Replace defective or damaged materials with new.

PART 2: PRODUCTS

2.1 MATERIAL

- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.
- .2 Composed of: minimum 85% by mass of polyester with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
- .3 Physical properties:

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- .1 Tensile strength and elongation (in any principal direction): to ASTM D4632.
 - .1 Tensile strength: to ASTM D4632, minimum 445 N, wet condition.
 - .2 Elongation at break: to ASTM D4632, 50%
 - .3 Seam strength: equal to or greater than tensile strength of fabric.
 - .4 Grab tensile strength and elongation: to CAN/CGSB-148.1, No.7.3.
 - .1 Breaking force: minimum 445 N, wet condition.
 - .2 Elongation at future: 50%.
 - .4 Hydraulic properties:
 - .1 Apparent opening size (AOS): to ASTM D4751, 0.212 mm.
 - .2 Filtration opening size (FOS): to CAN/CGSB-148.1 No.10 OPSS 1860.
 - .3 Transmissivity: to ASTM D4491, minimum 5689 l/min/m².
 - .4 Permittivity: to ASTM D4491, 2.00 sec⁻¹.
 - .5 Securing pins and washers: to CSA G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to ASTM A123/A123M.
 - .6 Factory seams: sewn in accordance with manufacturer's recommendations.
 - .7 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

PART 3: EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for geotextile material installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position
- .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.
- .6 Pin successive strips of geotextile with securing pins at interval recommended by manufacturer at mid point of lap.
- .7 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .8 After installation, cover with overlying layer within 4 hours of placement.
- .9 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .10 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

PART 1: GENERAL

1.1 RELATED SECTIONS

- .1 Section 33 42 13 : Pipe Culverts

1.2 MEASUREMENT AND PAYMENT

- .1 Refer to Section 01 11 50 - Measurement and Payment.

1.3 COMPLIANCE REQUIREMENTS

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C144 99, Standard Specification for Aggregate for Masonry Mortar
 - .2 ASTM C618 00, Standard Specification for Coal Fly Ash and Raw of Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA - A23.1 00, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA - A3000 98, Cementitious Materials Compendium.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 22 - Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Fold up metal banding, flatten and place in designated area for recycling.
- .5 Divert left over aggregate materials from landfill to local quarry or for reuse as approved by Departmental Representative.
- .6 Divert left over hardened cement materials from landfill to local quarry or for reuse as approved by Departmental Representative.
- .7 Divert left over geotextiles to local plastic recycling facility as approved by Departmental Representative.

PART 2: PRODUCTS

2.1 STONE

- .1 Hard, with relative density (formally specific gravity) not less than 2.65, durable quarry stone, free from seams, cracks or other structural defects, to meet following size distribution for use intended:
 - .1 Armour rip-rap:
 - .1 Not more than 10% of total volume of stones with individual volume less than 30 dm³.
 - .2 Not less than 50% of total volume of stones with individual volume of 225 dm³ or more.
 - .3 Remaining percentage of total volume to have uniform distribution of stones between 30 and 225 dm³ size.
 - .2 Heavy rip-rap:
 - .1 Not more than 10% of total volume of stones with individual volume less than 30 dm³.
 - .2 Not less than 50% of total volume of stones with individual volume of 140 dm³ or more.
 - .3 Remaining percentage of total volume to have uniform distribution of stones between 30 and 140 dm³ size.
 - .3 Random rip-rap:
 - .1 Not more than 10% of total volume of stones with individual volume less than 15 dm³.
 - .2 Not less than 50% of total volume of stones with individual volume of 85 dm³ or more.
 - .3 Remaining percentage of total volume to have uniform distribution of stones between 15 and 85 dm³ size.
 - .4 Hand placed rip-rap:
 - .1 Minimum size of individual stones 10 dm³.
 - .2 Not less than 75% of total volume of stones with individual volume of 2] dm³ or more.
 - .3 Supply rock spalls or cobbles to fill open joints.

2.3 GEOTEXTILE FILTER

.1 Geotextile: in accordance with Section 31 32 19.01 -
Geotextiles.

PART 3: EXECUTION

3.1 PLACING

- .1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
- .2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3 Place geotextile on prepared surface in accordance with Section 31 32 19.01- Geotextiles and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.
- .4 Place rip-rap to thickness and details as indicated.
- .5 Place stones in manner approved by Departmental Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.
- .6 Hand placing:
 - .1 Use larger stones for lower courses and as headers for subsequent courses.
 - .2 Stagger vertical joints and fill voids with rock spalls or cobbles.
 - .3 Finish surface evenly, free of large openings and neat in appearance.

END OF SECTION