

## **1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 03 30 00 - Cast-in-Place Concrete.
- .4 Section 32 11 16.01 - Granular Sub-Base.
- .5 Section 32 11 23 - Aggregate Base Courses.
- .6 Section 32 12 16.01 - Asphalt Paving.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

### **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.

### **1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert unused granular materials from landfill to facility to satisfaction of Departmental Representative.

## **2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

- .2 Flat and elongated particles of coarse aggregate: to ASTM D 4791.
  - .1 Greatest dimension to exceed five times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
  - .1 Natural sand.
  - .2 Manufactured sand.
  - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be crushed rock:
  - .1 Gravel or crushed gravel will not be acceptable.
  - .2 River or beach gravels will not be acceptable.
  - .3 Salt water submerged deposits will not be acceptable.
- .5 Aggregate to be placed in watercourses to be clean, non-erodible, non-orebearing and non-toxic. Aggregate material must be obtained from a non-watercourse source.

## **2.2 SOURCE APPROVAL AND QUALITY CONTROL**

- .1 Source(s) of materials to be incorporated into work or stockpiled to be to satisfaction of Departmental Representative.
- .2 Provide all necessary test data to demonstrate that aggregate materials meet the specified requirements in this and all related sections.
- .3 Inform Departmental Representative of proposed source of aggregates and provide access for sampling within four (4) weeks of commencing production.
- .4 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.
- .5 Advise Departmental Representative four (4) weeks in advance of any change in material source to allow sampling, testing and approval.
- .6 The Contractor will pay all costs associated with sampling, testing, and approval of any material source change made after approval of the initial source.
- .7 Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

## **3 EXECUTION**

### **3.1 PREPARATION**

- .1 Processing
  - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
  - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment to the satisfaction of Departmental Representative.

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- .3 Wash aggregates, if required to meet specifications. Use only equipment satisfactory to Departmental Representative.
- .4 When operating in stratified deposits, use excavation equipment and methods that produce uniform, homogeneous aggregate.
- .2 Handling
  - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .3 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.
- .2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.
- .3 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

**END OF SECTION**

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## **1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction Demolition Waste Management and Disposal.
- .2 Section 31 23 33.01 - Excavation, Trenching, and Backfilling.
- .3 Section 31 14 13 - Soil Stripping and Stockpiling.
- .4 Section 01 35 43 - Environmental Procedures.

### **1.2 REFERENCES**

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- .2 Environment Canada.
- .3 When conflicts occur between EPA and Environment Canada, the more stringent requirement shall apply.

### **1.3 DEFINITIONS**

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

### **1.4 QUALITY ASSURANCE**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Safety Requirements.

### **1.5 STORAGE AND PROTECTION**

- .1 Prevent damage to fencing, root systems of trees, bench marks, survey markers and monuments, existing pavement, landscaping, natural features, utility lines,

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site appurtenances, and water courses which are to remain.

- .1 Repair damaged items to approval of Departmental Representative.
- .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

## **2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Soil Material for Fill:
  - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials. Must be approved for use by the Departmental Representative for use on this project.

## **3 EXECUTION**

### **3.1 PREPARATION**

- .1 Inspect site and verify with Departmental Representative items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
  - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
- .3 Notify all applicable utility authorities before starting clearing and grubbing.

### **3.2 CLEARING**

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

### **3.3 ISOLATED TREES**

- .1 Cut off isolated trees as indicated or as directed by Departmental Representative at height of more than 300 mm above ground surface.
- .2 Grub out isolated tree stumps.

### **3.4 GRUBBING**

- .1 Remove and dispose of roots larger than 75 mm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 mü.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

### **3.5 REMOVAL AND DISPOSAL**

- .1 Remove cleared and grubbed materials off site in accordance with all applicable municipal, provincial and federal regulations.
- .2 Cut timber greater than 125 mm diameter and stockpile. Stockpiled timber becomes property of Contractor.
- .3 Remove diseased trees identified by Departmental Representative and dispose of this material in accordance with all applicable municipal, provincial and federal regulations.

### **3.6 FINISHED SURFACE**

- .1 Leave ground surface in condition suitable for immediate grading operations and stripping of topsoil, to approval of Departmental Representative.

### **3.7 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**

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## **1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 35 43 Environmental Procedures.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **1.2 REFERENCES**

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- .2 Environment Canada.
- .3 When conflicts occur between EPA and Environment Canada, the more stringent requirement shall apply.

## **2 PRODUCTS**

### **2.1 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.1 STRIPPING OF TOPSOIL**

- .1 Ensure that procedures are conducted in accordance with applicable federal, provincial and municipal 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 alternative disposal.
- .6 Strip topsoil to depths as indicated and to satisfaction of Departmental Representative.
  - .1 Avoid mixing topsoil with subsoil.
- .7 Pile topsoil in berms in locations approved by Departmental Representative. There is no designated stockpile location being provided by the Owner.
  - .1 Stockpile height not to exceed 2 m.

- .8 Dispose of unused topsoil as indicated and in accordance with all applicable federal, municipal and provincial regulations.
- .9 Protect stockpiles from contamination and compaction.
- .10 Cover topsoil that has been piled for long term storage with anchored waterproof and insulated tarps, as required to resist wind, water and winter conditions. Place straw bales around the stockpile to filter sediment entering or exiting the pile.

### **3.2 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 establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

### **3.3 PLACING OF TOPSOIL**

- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions 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.

### **3.4 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**



## 1 GENERAL

### 1.1 REFERENCES

- .1 Definitions:
  - .1 Rock: any solid material in excess of 1.00 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.

### 1.2 WORK INCLUDED

- .1 This work consists of scaling, excavation, and disposal of all materials in the excavation and limits of work areas in accordance with these specifications and in conformity with the limits, lines and grades shown on the plans or as established in the field by the Departmental Representative.

## 2 PRODUCTS

### 2.1 MATERIALS

- .1 Not used.

## 3 EXECUTION

### 3.1 ROCK REMOVAL

- .1 Prior to any rock removal, allow exposed rock surfaces to be inspected by professional geotechnical engineer designated by Departmental Representative as required.
- .2 Perform excavation in accordance with Erosion and Sedimentation Control Plan.
- .3 Co-ordinate this Section with Section 01 35 29.06 - Health and Safety Requirements.
- .4 Remove rock as required to construct, to alignments, profiles, and cross sections as indicated or as directed by Departmental Representative.
- .5 Explosive blasting is not permitted.
- .6 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and avoid damage to adjacent structures and rock slopes.
- .7 Excavate rock in areas of bearing to horizontal surfaces.
- .8 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces.
- .9 Cut trenches to widths as indicated.

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- .10 Remove boulders and fragments which may slide or roll into excavated areas.
- .11 Correct unauthorized rock removal at no extra cost, to satisfaction of Departmental Representative.

### **3.2 ROCK SCALING**

- .1 Prior to the start of excavation the Contractor shall scale loose rock and debris and inspect rock surfaces adjacent to and above the travelled way.
- .2 All rock on the existing rock face that is loose, hanging, or that creates a potentially hazardous situation shall be removed or stabilized, to the Departmental Representative's satisfaction, during or upon completion of excavation or installation or operation for the proposed detour lane.
- .3 The slopes shall be scaled throughout the duration of the Contract within the limits of Work at such frequency as required to remove all hazardous loose rock or overhangs.
- .4 Loose or falling rock shall not be permitted in the travel lanes or detour lanes at any time.

### **3.3 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Rock Disposal:
  - .1 Dispose of surplus removed rock off site.
  - .2 Do not dispose removed rock into landfill. Send material to appropriate facility in accordance with applicable municipal, provincial and federal guidelines.
  - .3 Move removed rock to locations as directed by Departmental Representative for stockpiling. Stockpile heights not to exceed 2 m.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management Disposal.

### **3.4 PROTECTION**

- .1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**END OF SECTION**

## 1 GENERAL

### 1.1 RELATED SECTIONS

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 32 11 16.01 - Granular Sub Base.
- .3 Section 32 11 23 - Aggregate Base Courses.
- .4 Section 33 42 13.01 - Precast Concrete Box Culverts.

### 1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C 117-13, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D 422-63(2007), Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D 698-10, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .5 ASTM D 4318-10, 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 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c.33.
  - .2 Transportation of Dangerous Goods Act(TDGA), 1992, c.34.
- .4 Nova Scotia Department of Transportation and infrastructure Renewal (NSTIR)
  - .1 Standard Specification - Highway Construction and Maintenance (latest edition).

### 1.3 DEFINITIONS

- .1 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.
- .2 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .3 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

- .4 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .5 Unsuitable materials:
  - .1 Weak, chemically unstable, wet and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318-10, and gradation within limits specified when tested to ASTM D 422-63(2007) and ASTM C 136-06: Sieve sizes to CAN/CGSB-8.2-M88.
    - .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 mm sieve.
- .6 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

#### 1.4 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control: in accordance with Section 01 45 00 - Quality Control:
  - .1 Submit to Departmental Representative testing results and reports 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.
- .4 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source(s) of fill materials and provide access for sampling.

#### 1.5 QUALITY ASSURANCE

- .1 For design of ant temporary structures submit design and supporting data at least 2 weeks prior to installation or construction.
- .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .3 Keep design and supporting data on site.
- .4 Engage services of qualified professional Engineer who is registered or licensed in Province of Nova Scotia, Canada in which Work is to be carried out to design and inspect shoring, bracing and underpinning required for Work.

## **1.6 EXISTING CONDITIONS**

- .1 Examine geotechnical report prepared by Conquest Engineering, dated November 17, 2015, (Ref. No. 071-170) attached in Appendix A.
- .2 Existing buried utilities and structures:
  - .1 Before commencing work obtain all required digging permits from local utilities and/or authorities, and verify and establish 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 and/or structures: 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 Prior to beginning excavation Work, notify applicable owner or authorities to clearly mark such locations to prevent disturbance during Work.
  - .6 Confirm locations of buried utilities by hand digging or careful test excavations in presence of Departmental Representative. Hand dig all cables one metre either side of cable prior to machine excavation.
  - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
  - .8 Where unidentified utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or otherwise disturbing utilities or structures.
  - .9 Record location of maintained, re-routed and abandoned underground lines.
- .3 Existing surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing fencing, trees and other plants, service poles, wires, lighting fixtures, pavement, survey benchmarks and monuments, and all other surface features which may be affected by Work.
  - .2 Protect existing surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
  - .3 Protect existing asphalt and concrete pavements which may be affected by Work from damage while work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
  - .4 Where required for excavation, cut roots or branches as directed by Departmental Representative.

## **1.7 SHORING, BRACING, AND UNDERPINNING**

- .1 Shoring, Bracing or underpinning may be required to prevent undermining of adjacent structures, underground utilities and/or traffic areas.
- .2 Comply with safety requirements and applicable local legislation to protect existing features.
- .3 Engage services of qualified Professional Engineer who is registered in the Province of Nova Scotia to design and inspect cofferdams, shoring, bracing and underpinning required for work.
- .4 At least 2 weeks prior to commencing work, submit design and supporting data.

- .5 Design and supporting data submitted to bear the stamp and signature of qualified Professional Engineer licensed in the Province of Nova Scotia.

## **2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Clean Rock Fill:
  - .1 Well graded 200 mm minus crushed rock meeting NSTIR durability specifications, or
  - .2 Durable quarried rock, well graded with a maximum particle size of 400 mm.
- .2 Type 2 Granular Sub-Base: in accordance with Section 32 11 16.01 - Granular Sub-base
- .3 Select Backfill Material: from excavations or other sources, approved by the Departmental Representative for use intended, dry, unfrozen and free from rocks larger than 80 mm, cinders, ashes, sods, refuse or other deleterious or unsuitable materials.
- .4 Geotextiles: to Section 31 32 19.01 - Geotextiles.
- .5 Unshrinkable Fill: proportioned and mixed to provide:
  - .1 Maximum compressive strength of 1.0 MPa at 28 days.
  - .2 Maximum Portland cement content of 25 kg/m<sup>3</sup>.
  - .3 Minimum strength of 0.07 MPa at 24 h.
  - .4 Concrete aggregates: to CAN/CSA-A23.1.
  - .5 Portland cement: Type GU.
  - .6 Slump: 150 minimum.
- .6 Lean concrete backfill: Refer to Section 03 30 00 - Cast In Place Concrete.

## **3 EXECUTION**

### **3.1 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Sawcut pavement neatly along limits of proposed removal in order that surface may break evenly and cleanly in accordance with Section 02 41 13.14 - Asphalt Paving Removal.

### **3.2 STOCKPILING**

- .1 Stockpile fill materials in areas approved by Departmental Representative. There is no designated stockpile area being provided by the Owner.
  - .1 Stockpile granular materials in manner to prevent segregation.
- .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.

### **3.3 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 Health and Safety Act for the Province of Nova Scotia.
- .2 Obtain permit from authority having jurisdiction for any temporary diversion or pumping of water course.
- .3 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.
- .4 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.

### **3.4 DEWATERING**

- .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Departmental Representative's review 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 Procedures to approved runoff areas and in manner not detrimental to public and private property, existing facilities, 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.

### **3.5 EXCAVATION**

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 For foundation and structures:
  - .1 Excavate as required to carry out work, in all materials encountered, to level of competent bearing stratum, described in geotechnical report as compact to dense glacial till or 'bedrock'. Do not disturb soil or rock

- below bearing surface.
- .2 Inspection by professional geotechnical engineer designated by Departmental Representative, as required.
- .3 If bearing surface is unsatisfactory, perform additional excavation as directed by Departmental Representative. Replace excavated material to satisfaction of Departmental Representative.
- .4 Obtain Departmental Representative's approval of completed excavation.
- .3 Remove concrete and asphalt paving, demolished foundations and rubble and other obstructions encountered during excavation.
- .4 Excavation must not interfere with normal 1:1 (H:V) splay of bearing capacity of adjacent foundations and traffic areas. If interference will occur, excavation must be shored, braced or underpinned as described elsewhere in this specification.
- .5 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.
- .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 and do not leave open more than 15 m at end of day's operation.
- .7 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .8 Restrict vehicle operations directly adjacent to open trenches.
- .9 Dispose of surplus and unsuitable excavated materials off-site in accordance with applicable provincial and municipal regulations.
- .10 Do not obstruct flow of surface drainage or natural watercourses. Diversions of flow are to be submitted in detailed plan and approved by Departmental Representative and other authorities before proceeding.
- .11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .12 Notify Departmental Representative when bottom of excavation is reached and/or appears unsuitable and proceed as directed by Departmental Representative.
- .13 Obtain Departmental Representative's approval of completed excavation.
- .14 If encountered, remove unsuitable material from excavation bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
  - .1 In areas occupied by foundations or structures, replace excavated material with Fill Against Structure compacted to not less than 100% Standard Proctor maximum dry density.
- .15 Correct unauthorized over-excavation as follows:
  - .1 In areas not occupied by foundations or structures, replace excavated material with Select Backfill Material compacted to not less than 98% of Standard Proctor Maximum Dry Density.
- .16 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.
- .17 Install geotextiles in accordance with Section 31 32 19.01 - Geotextiles.

### 3.6 BACKFILL TYPES AND COMPACTION

- .1 Use types of backfill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 698.
  - .1 Clean Rock fill: compact to 100% of maximum dry density.
  - .2 Fill Against Structure: compact to 95% of maximum dry density.
  - .3 Select Backfill Material: compact to 95% of maximum dry density.

### 3.7 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
  - .1 Departmental Representative has inspected and approved installations.
  - .2 Removal of concrete formwork.
  - .3 Removal of shoring and bracing;
  - .4 Backfilling of voids with satisfactory soil material.
- .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 Place backfill material in uniform layers not exceeding 200 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer. Departmental Representative may authorize thicker lifts if it can be shown specified compaction can be achieved.
- .5 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.
  - .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 obtain approval from Departmental Representative.
  - .5 Place unshrinkable fill in areas as indicated or directed by Departmental Representative. Consolidate and level unshrinkable fill with internal vibrators.

### 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, seed and fertilize as indicated.
- .3 Reinstall pavements and sidewalks disturbed by excavation to thickness, structure

and elevation which existed before excavation.

- .4 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .5 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

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## **1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 31 14 13 - Soil Stripping and Stockpiling.
- .2 Section 32 11 16.01 - Granular Sub-Base.
- .3 Section 32 11 23 - Aggregate Base Courses.
- .4 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **1.2 REFERENCES**

- .1 Reference Standards:
  - .1 ASTM International
    - .1 ASTM D 698-12eal, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).

### **1.3 EXISTING CONDITIONS**

- .1 Examine geotechnical report prepared by Conquest Engineering, dated November 2015, (Ref. No. 071-170) attached in Appendix A.
- .2 Protect existing fencing, trees, landscaping, natural features, bench marks, pavement, surface features which are to remain. If damaged, restore to original or better condition unless directed otherwise by Departmental Representative.

## **2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Embankment materials require approval by Departmental Representative.
- .2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.
- .3 Embankment Material:
  - .1 Obtain from sources such as quarry, or borrow pit as approved by Departmental Representative.
  - .1 Embankment Material to consist of acceptable earth material and processed rock material free from objectionable quantities of organic matter, frozen soil, stumps, trees, moss, and other unsuitable materials, with less than 25% fines passing the No. 200 sieve, and free of cobbles and boulders with a maximum particle size no greater than 200 mm.

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### **3 EXECUTION**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work:
  - .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 COMPACTION EQUIPMENT**

- .1 Compaction equipment: vibratory rollers or small compactors capable of obtaining required density in materials on project.
  - .1 Demonstrate compaction equipment effectiveness on specified material and lift thickness by documented performance of test-strip before start of Work.
  - .2 Replace or supplement equipment that does not achieve specified densities.
- .2 Operate compaction equipment continuously in each embankment when placing material.

#### **3.3 WATER DISTRIBUTORS**

- .1 Apply water with equipment capable of uniform distribution.

#### **3.4 STRIPPING OF TOPSOIL**

- .1 Strip top soil and unsuitable materials as required in accordance with Section 31 14 13 - Soil Stripping and stockpiling.
- .2 Remove clearing and grubbing debris from stripping.

#### **3.5 EMBANKMENTS**

- .1 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.
  - .1 Method used to be to be pre-approved by Departmental Representative.
- .2 Break up or scarify existing road surface prior to placing embankment material.
- .3 Do not place material which is frozen nor place material on frozen surfaces.
- .4 Maintain crowned surface during construction to ensure ready run-off of surface water.
- .5 Drain low areas before placing materials.
  - .1 Place and compact to full width in layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts

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if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.

- .6 Where material consists of rock:
  - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1 m.
  - .2 Distribute rock material to fill voids with smaller fragments to form compact mass.
  - .3 Fill surface voids at subgrade level with rock spalls or selected material to form earth-tight surface.
  - .4 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 300 mm of travel surface subgrade elevation.

### 3.6 COMPACTION

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
- .2 Deposit, spread, and level, embankment material in layers 300 mm maximum thickness before compaction.
  - .1 Compact each layer of embankment until compaction equipment achieves no further significant consolidation.
  - .2 Ensure required compaction for each layer before placing any material for next layer.
- .3 Use specialized compaction equipment supplemented by routing, hauling, and levelling equipment over each layer of fill.
- .4 Obtain written approval from Departmental Representative before using specialized compaction equipment such as tamping rollers, vibratory rollers, or other alternate compaction equipment that produces the required results
  - .1 For tamping rollers, use equipment that exerts 1000 kPa minimum of pressure on tamping surface of each tamping foot in transverse row.
- .5 Compact each layer to minimum 98% maximum dry density: ASTM D 698
- .6 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

### 3.7 FINISHING

- .1 Shape entire roadbed to within 25 mm of design elevations.
- .2 Finish slopes true to lines, grades and drawings where applicable.
- .3 Hand finish slopes that cannot be finished satisfactorily by machine.
- .4 Round top of backslope 1.5 m both sides of top of slope.
- .5 Provide graded travel surface over embankment material, smooth and free of pot hole.
  - .1 Place and compact granular sub-base in accordance with Section 32 11 16.01 - Granular Sub-Base.
  - .2 Place and compact removed asphalt pavement (millings) sufficiently to stabilize the surface to the satisfaction of the Departmental

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Representative.

### **3.8 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.

### **3.9 PROTECTION**

- .1 For temporary roadway embankments, maintain finished surfaces in condition conforming to this section until removal of embankment.
- .2 Provide silt fences and erosion protection as required to mitigate and prevent impacts to adjacent properties.

### **3.10 REMOVAL OF TEMPORARY EMBANKMENTS**

- .1 Remove all temporary embankment materials and reinstate all areas, not otherwise impacted by new work or infrastructure, to a condition equal to or better than existed prior to work.

**END OF SECTION**

## **1      GENERAL**

### **1.1    RELATED SECTIONS**

- .1      Section 01 33 00 - Submittal Procedures
- .2      Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3      Section 31 24 13 - Roadway Embankments.

### **1.2    REFERENCES**

- .1      American Society for Testing and Materials International, (ASTM)
  - .1      ASTM D 4491-99a(2011), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .2      ASTM D 4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
  - .3      ASTM D 4716-08(2013), Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  - .4      ASTM D 4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .2      Canadian General Standards Board (CGSB)
  - .1      CAN/CGSB-4.2 No. 11.2-M89(2004), Textile Test Methods - Bursting Strength - Ball Burst Test (Reaffirmation of September 1989).
  - .2      CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
    - .1      No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
    - .2      No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
    - .3      No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
    - .4      No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
    - .5      No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.
- .3      Canadian Standards Association (CSA International)
  - .1      CAN/CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2      CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4      Nova Scotia Department of Transportation and infrastructure Renewal (NSTIR)
  - .1      Standard Specifications - Highway Construction and Maintenance, (latest edition).

### **1.3    SUBMITTALS**

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

- .2 Submit to Departmental Representative following samples at least 4 weeks prior to beginning Work.
  - .1 Minimum length of 2 m of roll width of geotextile.
- .3 Submit to Departmental Representative copies of mill test data and certificate at least 4 weeks prior to start of Work, and in accordance with Section 01 33 00 - Submittal Procedures.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

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

#### **1.5 WASTE MANAGEMENT AND DISPOSAL**

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

### **2 PRODUCTS**

#### **2.1 MATERIAL**

- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.
  - .1 Medium Weight geotextile to Division 6, Section 12 of NSTIR Standard Specification - Highway Construction and Maintenance, (latest edition).
- .2 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m<sup>2</sup> to CAN/CSA G164.
- .3 Factory seams: sewn in accordance with manufacturer's recommendations.
- .4 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

### **3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with.
- .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 in accordance with manufacturer's instructions.
- .5      Join successive strips of geotextile by sewing in accordance with manufacturer's instructions.
- .6      Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .7      After installation, cover with overlying layer within 4 h of placement.
- .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 and Section 31 24 13 - Roadway Embankments.

### **3.2    CLEANING**

- .1      Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner in accordance with applicable federal, municipal and provincial regulations.

### **3.3    PROTECTION**

- .1      Vehicular traffic not permitted directly on geotextile.

**END OF SECTION**

## 1 GENERAL

### 1.1 RELATED SECTIONS

- .1 Section 31 32 19.01 - Geotextiles.
- .2 Section 32 91 19.01 - Precast Concrete Box Culverts.

## 2 PRODUCTS

### 2.1 STONE

- .1 Hard, dense with relative density 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 Rip rap at Culvert outlet apron:
    - .1 70% (min) of stone shall be between 500 to 1,200 mm individual diameter.
  - .2 Rip rap in ditches and at culvert inlet:
    - .1 70% (min) of stone shall be between 200 to 450 mm individual diameter.
  - .3 Rip rap at offtakes:
    - .1 Median diameter ( $D_{50}$ ) of stone shall be 200 mm.
- .2 Rip-rap to be clean, inorganic, non ore-bearing, non-toxic material from a non-watercourse source. It shall be hard, resistant to weathering and angular in shape.
- .3 Where specified for stream beds, rip-rap shall be placed in lifts and washed following placement.
- .4 Sulphur Bearing Rock Potential:
  - .1 Rip Rap made from quarried rock shall have a total Sulphur content of less than 0.3%; or a(Neutralization Potential (NP) at least three times the Acid-generating Potential (AP), as represented by the Neutralization Potential Ratio, where  $NPR = NP/AP = 3$ .
  - .2 The NPR shall be determined by the Modified Sobec procedure (acid-base accounting), based on total Sulphur.

### 2.2 GEOTEXTILE FILTER

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

## 3 EXECUTION

### 3.1 PLACING

- .1 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

- .2 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.
- .3 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
- .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**