## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Materials – General.

.2 Native Backfill.

.3 Fill.

.4 Granular Base Course.

.5 Subbase Course.

.6 Drain Rock.

.7 Pea Gravel.

.8 Bedding Sand.

.9 Compaction.

.10 Measurement and Payment.

### 1.2 RELATED REQUIREMENTS

.1 Section 31 23 10 – Excavation and Trenching

.2 Section 23 05 05 – Well Field Pipework.

### 1.3 REFERENCE STANDARDS

.1 Section 01 42 19 – Reference Standards.

.2 Abbreviations for electrical terms shall be to CSA Z85-1983.

.3 Abbreviations of standards organizations referenced in this and other sections are as follows:

| | |
|---|---|
| ACI | American Concrete Institute |
| CSA | Canadian Standards Association |
| CEC | Canadian Electrical Code |
| IEEE | Institute of Electrical and Electronic Engineers |
| ANSI | American National Standards Institute |
| NBC | National Building Code |
| NFPA | National Fire Protection Association |
| EEMAC | Electrical & Electronic Manufacturers Association of Canada (formerly CEMA) |
| FM | Factory Mutual |
| NEMA | National Electrical Manufacturers Association (U.S.) |
| JIC | Joint Industry Conference |

| | |
|---|---|
| IPCEA | Insulated Power Cable Engineers Association |
| ISA | Instrument Society of America |
| IES | Illuminating Engineering Society |
| NETA | National Electrical Testing Association |
| CUL | Canadian Underwriters Laboratories Inc. |
| ETL | Electrical Testing Laboratories, Inc. |

.4 ASTM American Society for Testing and Materials

.5 ASTM International (ASTM)

.1 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft$^3$) (600 kN-m/m$^3$).

.5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft$^3$) (2,700 kN-m/m$^3$).

.6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.6 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

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

.7 CSA Group (CSA)

.1 CAN/CSA-A3000, Cementitious Materials Compendium.

.1 CSA-A3001, Cementitious Materials for Use in Concrete.

.2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

## 1.4 DEFINITIONS

.1 Common excavation – Excavation of materials of whatever nature, which are not included under definitions of solid rock, including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.

.2 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.

.3 Subsoil: materials excavated directly beneath the topsoil layer. Capable of supporting root growth and suitable for use in landscape restoration.

.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded and required for construction of fill areas or for other portions of Work.

.6 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials under excavated areas.

.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 and ASTM C136: Sieve sizes to [CAN/CGSB-8.2] [CAN/CGSB-8.1].

.2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.7 SMDD: Standard Maximum Dry Density in accordance with ASTM D698.

.8 Corrected maximum dry density is defined as (correction applied for plus 20 mm material):

.1 1.4.9.1 D – (F1 x D1) + (0.9 x D2 x F2).

.2 Where: D = corrected maximum dry density kg/m. F1 = fraction (decimal) of total field sample passing 5 mm sieve. F2 = fraction (decimal) of total field sample retained on 5 mm sieve. (equal to 1.00 – F1) D1 = maximum dry density, kg/m of material passing 5 mm sieve determined in accordance with ASTM D698. D2 = bulk density, kg/m, of material retained on 5mm sieve, equal to 1000 G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.

.3 For free draining aggregates, determine D1 (maximum dry density) to ASTM D4253 wet method when directed by the Engineer.

## 1.5 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 condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.

.2 Submit to Engineer Testing/Inspection 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.

.4 Samples:

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

.2 Inform Engineer at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.

.3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.

.4 Ship samples prepaid to Engineer, in tightly closed containers to prevent contamination and exposure to elements.

.5 At least 4 weeks prior to beginning Work, inform Engineer source of fly ash and submit samples to Engineer.

.1 Do not change source of fly ash without written approval Engineer.

## 1.6 APPROVALS

.1 At least 4 weeks prior to commencing delivery of granular materials, the contractor must provide the Engineer with documentation specifying the source (i.e., origin) and environmental quality of all proposed materials and provide samples as required by the Engineer.

.2 If, in opinion of the Engineer, materials from the proposed off-site 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.

.3 Should a change of off-site material source be proposed during Work, advise Engineer 2 weeks in advance of proposed change to allow sampling and testing.

.4 Acceptance of material 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.

## 1.7 QUALITY ASSURANCE

.1 Qualification Statement: submit proof of insurance coverage for professional liability.

.2 Submit design and supporting data at least 2 weeks prior to beginning Work.

.3 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Alberta, Canada.

.4 Keep design and supporting data on site.

.5 Engage services of qualified professional Engineer who is registered or licensed in Alberta, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

.6 Do not use soil material until written report of soil test results are approved by Engineer.

.7 Health and Safety Requirements:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 – Health and Safety Requirements.

# PART 2 PRODUCTS

## 2.1 MATERIALS – GENERAL

.1 Materials to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrate particles.

.2 Materials should be free of unsuitable materials including:

.1 Frozen material or material containing snow or ice.

.2 Tree stumps, branches, roots, or other wood or lumber.

.3 Wire, steel, cast iron, cans, drums, or other foreign material.

.4 Materials containing hazardous or toxic constituents at hazardous or toxic concentrations.

.3 Compactable to specified density.

**2.2 NATIVE BACKFILL**

.1 Native excavated soil used to construct the Works on the Site, free of unsuitable materials.

.2 Unsuitable materials: Materials not approved for use as determined by the Engineer and include the following:

.1 Material containing loam, roots or organic matter.

.2 Clay which are classified as inorganic clays of high plasticity in accordance with ASTM D2487.

.3 Soft and/or organic clays and silts of low strength.

.4 Rock and lumps of material with dimensions greater than specified layer thickness before compaction.

**2.3 FILL**

.1 Native soil from on-site stockpiles or excavated native soils used to construct the Works on the Site, free of unsuitable materials.

.2 Unsuitable materials: Materials not approved for use as determined by the Engineer and include the following:

.1 Material containing loam, roots or organic matter.

.2 Clay which are classified as inorganic clays of high plasticity in accordance with ASTM D2487.

.3 Soft and/or organic clays and silts of low strength.

.4 Rock and lumps of material with dimensions greater than specified layer thickness before compaction.

**2.4 PEA GRAVEL**

.1 Size: 10 mm washed round stone

.2 Gradation:

| ASTM Sieve Size | Percent Passing by Weight |
|---|---|
| 12.5 mm | 100% |
| 6.3 mm | 0% |

.3 Content: No more than 3 percent limestone.

.4 Free of fine material prior to placement.

**2.5 BEDDING SAND**

.1 Washed sand.

.2 Gradation:

| ASTM Sieve Size | Percent Passing by Weight |
|---|---|
| 4.76 mm | 100% |
| 0.074 mm | 0% |

.3 Free of clay and other deleterious materials.

## PART 3 EXECUTION

### 3.1 EXAMINATION

.1 Ensure that all grades and elevations are as per Drawings.

.2 Suspend operations whenever climatic conditions, as determined by the Engineer, are unsatisfactory for placing fill to the requirements of this Section.

.3 Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, measurements, tests, or approvals.

.4 Obtain approval from Engineer for completed excavations and previously placed material prior to placement of successive lifts.

.5 Obtain approval from Engineer prior to placing fill against structures or around exposed buried utilities.

.6 Ensure areas to be backfilled are free from debris or water.

### 3.2 SITE PREPARATION

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

.2 Locate, identify, and protect utilities that remain from damage. Confirm locations of buried utilities and structures by careful test excavations or other suitable means.

.3 Protect plant life, vegetation, and other features which will be part of the final landscaping.

.4 Protect bench marks, survey control points, existing structures, fences, paving and curbs from excavating equipment and vehicular traffic.

.5 Maintain and protect wells, utilities, and structures encountered. In event of disturbance or damage to any wells, utilities, or structures, immediately notify the Engineer. Repair or replace any damaged wells, utilities, or structures damaged by Contractor operations.

.6 Protect existing surface features which may be affected by the Works.

.7 Protect existing structures where temporary unbalanced earth pressures may develop due to the Works. Utilize bracing, shoring or other approved methods to counteract unbalance.

.8 Protect excavations and trenches from contamination.

.9 Obtain directions from Engineer prior to moving or otherwise disturbing utilities or structures.

.10 Compact sub-grade to density requirements.

.11 Remove soft areas of sub-grade which are not capable of compaction in place. Backfill these areas with approved native fill and compact to density requirements.

.12 Remove debris, contamination, or water from areas to be backfilled.

.13 Proof roll sub-grade surface to identify soft spots. Fill and compact to required density.

**3.3 PLACEMENT**

.1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow or ice.

.2 Place material using methods which do not lead to segregation or degradation.

.3 Place material in uniform layers not exceeding 150 mm when compacted or to such other depth as approved.

.4 Shape each layer to a smooth contour and compact before succeeding layer is placed.

.5 Remove and replace portion of layer in which material has become segregated during spreading.

**3.4 FILLING – BACKFILLING**

.1 Place and compact suitable Native Backfill, stockpiled or excavated from the Site, as directed by Engineer.

.2 Place in equal continuous layers not exceeding 300 mm compacted depth.

.3 Fill areas to grades and elevations as shown on the Drawings.

.4 Employ a placement method that does not disturb or damage other Works.

.5 Maintain optimum moisture content of backfill materials to attain required compaction density.

.6 Do not use fill material which is determined unsuitable by Engineer.

.7 Do not operate heavy compaction equipment closer than 1 meter to foundations, underground utilizes, monitoring wells, or landfill gas extraction wells.

.8 Backfill around installations as follows:

.1 Do not dump directly against or over installations.

.2 Place layers on both sides of the installed Works to equalize loading and minimize movement of the installed Works.

.9 Do not operate heavy compaction equipment closer than 1 meter to foundations, underground utilities, monitoring wells, or landfill gas extraction wells.

.10 Do not backfill around or over cast-in-place concrete within 7 days of concrete placement.

.11 Grade changes shall be made gradual.

.12 Place backfill continuously and in uniform layers not exceeding specified compacted thickness up to grades shown on the Drawings.

.13 Compact each layer to specified densities specified in this Section prior to placing subsequent layers.

## 3.5 COMPACTION – GENERAL

.1 Apply potable water as necessary during compaction to obtain specified density. Excessively moist material shall be aerated with suitable equipment and methods until optimum moisture content is achieved. In areas where the use of rolling equipment is not possible, compact materials to specified density with mechanical tampers.

.2 When fill material is wetted to achieve desired moisture, ensure that finer materials are not washed out by jets of water.

.3 Compaction Equipment: The type, size, and efficiency of compaction equipment shall be capable of achieving the specified degree of compaction.

## 3.6 TOLERANCES

.1 Finish compaction surface to within ±10 mm of established grade but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.3 Payment will not be made for material placed outside the tolerance limits unless directed by Engineer.

## 3.7 QUALITY CONTROL

.1 Section 01 45 00 – Quality Control: Field Inspection and testing.

.2 Contractor shall test installed materials to confirm compliance with specifications.

.3 Submit copies of the test reports to the Engineer.

.4 Verification Testing by Engineer:

.1 Engineer may select samples of uncompacted fill intended for the Works and samples of compacted fill of the Works.

.2 Engineer may perform tests in the field and/or in the laboratory on samples of backfill and imported fill to determine if materials meet specifications. Imported fill tests will include analysis for the presence of contaminants, grain size analysis, moisture content, bulk wet density, maximum dry density, and permeability. Backfill testing will include moisture content determination, maximum dry density, and bulk wet density. Copies of the test reports will be supplied to the Contractor on request.

.3 Testing by Engineer will in no way relieve the Contractor of responsibility for testing all material prior to notifying Engineer of the material's suitability for the Works.

.5 Methods of Testing:

.1 Particle size analysis shall be performed in accordance with ASTM D422 or ASTM D1140, whichever is appropriate for the material tested.

.6 Failure to meet specified requirements: If material specifications cannot be achieved or obtained with the equipment in use, procedures, or materials, remove and replace the work and modify operations so that the equipment, procedures and materials will be able to produce the required results. Additional testing required by the Engineer will be to Contractor's account.

**3.8 ADJUSTING**

.1 Section 01 73 00 – Execution: Requirements for adjusting installed works.

.2 Finish compacted soil surfaces within 25 mm of grades shown in Drawings. Correct surface irregularities by loosening and adding or removing materials until the surface is within the specified grades.

.3 Grade works with slopes to permit proper drainage and free of depressions that can lead to ponding or collection of water and/or debris which may restrict flow.

**3.9 CLEANING**

.1 Section 01 73 00 – Execution: Requirements for cleaning installed works.

.2 Clean and reinstate work areas and areas affected by the Works to specified restoration condition.

.3 Upon completion of backfilling, remove excess materials and debris from work areas and travel routes.

**3.10 PROTECTION OF FINISHED WORKS**

.1 Section 01 73 00 – Execution: Requirements for protecting installed works.

**3.11 SCHEDULE**

.1 Bedding Sand: Compact to 95 percent SMDD.

.2 Fill: Compact to 95 percent SMDD.

.3 Native Backfill: Compact to 95 percent SMDD.

## PART 4 MEASUREMENT AND PAYMENT

**4.1 GENERAL**

.1 No separate payment will be made for Work under this Section.

**END OF SECTION**