

**SECTION 02300
EARTHWORK**

PART 1 - GENERAL

1.1 SUMMARY

- .1 Prepare sub grades for slabs-on-grade, walks, pavements and foundations.
- .2 Excavate and backfill for building and structures.
- .3 Provide drainage course for slab-on-grade.
- .4 Provide cleanouts at changes in direction and in pipe runs longer than 15.2 m (50'-0").
- .5 Provide subsurface drainage backfill for walls and trenches.
- .6 Excavate and backfill trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- .7 Stock pile top soil and potential fill as directed by the Geotechnical Consultant at a location acceptable to the Owner.
- .8 Ensure final ground surfaces around buildings are graded to direct surface run off away from building foundation walls at 2% slope minimum.

1.2 RELATED SECTIONS

- .1 02104 Tree Protection.
- .2 02740 Asphalt Paving.
- .3 02912 Soil Placement and Preparation.
- .4 03300 Cast-in-Place Concrete.
- .5 Division 15 Mechanical.
- .6 Structural, Mechanical and Electrical Drawings for excavating and backfilling and buried mechanical and electrical utilities and buried utility structures.

1.3 REFERENCES

- .1 Conform to the current edition of the following referenced standards, current at date of Bid, unless noted otherwise.
- .2 ASTM D448-03 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
- .3 ASTM D 1557-02 e1 Test Methods for Laboratory Compaction Characteristics of Soil Using Modified effort (56,000 ft-lbs/ft³ (2700 kN-m/m³)).
- .4 ASTM D2487-00 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .5 Geotechnical Engineering Assessment Report by Levelton Consultants Ltd dated July 9, 2008.
- .6 Master Municipal Construction Documents, 2005 edition.

1.4 DEFINITIONS

- .1 Backfill: Soil materials used to fill an excavation.

- .2 Base Course: Layer placed between the sub-base course and asphalt paving.
 - .3 Bedding Course: Layer placed over the excavated sub-grade in a trench before laying pipe.
 - .4 Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
 - .5 Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
 - .6 Engineered Fill: Well graded 75 mm minus sand and gravel with less than eight percent fines passing the 0.075 mm sieve.
 - .7 Excavation: Removal of material encountered above subgrade elevations.
 - .8 Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Consultant. Unauthorized excavation, as well as remedial work directed by Consultant, shall be without additional compensation.
 - .9 Fill: Soil materials used to raise existing grades.
 - .10 Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume.
 - .11 Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
 - .12 Sub-base Course: Layer placed between the subgrade and base course for asphalt paving and a concrete pavement or walk.
 - .13 Sub-grade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below sub-base, drainage fill, or topsoil materials.
 - .14 Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- 1.5 SUBMITTALS**
- .1 Submit in accordance with Division 1 Submittal Procedures (under separate cover).
 - .2 Product Data: Provide data as specified on structural drawings for Structural Consultant's review.
 - .3 Samples: Submit proposed backfill and fill samples to Geotechnical Consultant for review and approval prior to ordering material.
- 1.6 QUALITY ASSURANCE**
- .1 Compaction of fills to Proctor Density Standards.
 - .2 General Materials testing in accordance with ASTM standards.
 - .3 Conform to Master Municipal Construction Document requirements and to Owner's Geotechnical Consultant recommendations.
- 1.7 PROJECT CONDITIONS**
- .1 Examine the site and make every enquiry to determine the character of materials to be encountered, and allow in the Bid Price, the cost of excavation and filling to produce the stated finished rough grades and excavations for building and services as indicated and specified.
 - .2 Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Consultant and then only after arranging to provide temporary utility services according to requirements indicated:

- .1 Notify Consultant not less than two days in advance of proposed utility interruptions.
 - .2 Do not proceed with utility interruptions without Consultant's written permission.
 - .3 Contact utility-locator service for area where Project is located before excavating.
 - .3 Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 - .4 Coordinate the work of this section with installation of Landscaping and Civil works.
- 1.8 INSPECTION AND TESTING**
- .1 Owner will engage an independent soil testing and inspection service for quality control testing during earthwork operations.
 - .2 Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.
 - .3 If, in Consultant's opinion based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, provide additional compaction and testing at no additional cost to the Contract.

PART 2 - MATERIALS

2.1 GENERAL

- .1 General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. Fill and Backfill shall be subject to the Geotechnical Consultant's approval.
- .2 Satisfactory Soils: ASTM D2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- .3 Unsatisfactory Soils: ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- .4 Backfill for foundations: Satisfactory soil materials. Well-graded, 75 mm minus, pit-run sand and gravel with less than 5% finer than the #200 sieve.
- .5 Engineered Fill: well graded 75 mm minus sand and gravel with less than eight percent fines passing the 0.075 mm sieve.

2.2 ACCESSORIES

- .1 Vapour Barrier: 6 mil polyethylene.
- .2 Erosion protection material: 6 mil polyethylene.
- .3 Drainage Mat: Prefabricated, 3 dimensional dimpled core and geotextile fabric: "MiraDRAIN 6000XL / 6200XL" or approved alternative.

PART 3 - EXECUTION

3.1 SETTING OUT

- .1 Set out lines and levels for buildings as indicated. Maintain stakes, bench marks and witness points during construction.
- .2 See Landscaping Drawings and Architectural drawings for rough grading of the site by others.

3.2 PREPARATION

- .1 Protect existing vegetation that is indicated to be retained. Where doubt exists as to whether or not plant material is to be retained review with Consultant prior to proceeding.
- .2 Ensure bearing surfaces are reviewed and approved by the Contractor's Geotechnical Consultant prior placing anything on them.
- .3 Storage Of Soil Materials
 - .1 Stockpile borrow materials and satisfactory excavated soil materials and store according to slopes recommended in Geotechnical Report. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - .2 Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.3 PROTECTION, SHORING, DEWATERING AND EROSION CONTROL

- .1 Protection:
 - .1 Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by erosion, settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - .2 Protect sub-grades from softening, undermining, washout, and damage by rain or water accumulation. Firmly secure polyethylene sheeting over exposed banks for erosion protection.
 - .3 Protect bearing surfaces from deterioration.
 - .4 Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 1°C (35°F). Sub-grade soils and fills below buildings must not be allowed to freeze at anytime.
- .2 Shoring:
 - .1 Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
 - .2 Provide shoring, bracing, or stabilization required to prevent caving in of banks and excavations. Place shoring so as to be independent of footings and foundation walls. Leave in position until forms have been removed, dampproofing or waterproofing completed, building drainage installed and approval given to proceed with backfilling.
- .3 Dewatering:
 - .1 Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
 - .2 Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary storm water management system and sedimentation control system. Do not use trench excavations as temporary drainage ditches.
 - .3 Make good immediately damage or disturbance, settlement or collapse caused due to inadequate measures being taken to prevent same at no additional cost to Owner.
- .4 Erosion Control:
 - .1 Adapt construction practices and install appropriate measures to prevent erosion and minimize suspended sediments in water leaving the Work area.

3.4 BULK OR MASS EXCAVATION

- .1 Clear organic material from the building footprint and other structures. Coordinate with Landscaping requirements to avoid duplication. See Geotechnical Report for specific requirements.
- .2 Completely sub-excavate from beneath the proposed buildings and dispose of surficial soils fills and other deleterious materials.
- .3 Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1" (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- .4 Cut and fill as required, bring to contours, grades and elevations allowing for slab and granular subbase. Compact to densities specified.
- .5 Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. Set excavations back from footing locations with a minimum slope of 2 horizontal to 1 vertical.
- .6 Grading Surface of Fill Under Building Footings and Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of + or - 12mm when tested with a 3 meter straight edge.
- .7 Temporary Slopes: Temporary excavation slopes conducted in native soils shall not exceed 1 horizontal to 1 vertical. Protect temporary slopes from surface runoff with plastic sheeting securely fastened at the slope crest and toe. Where ground water seepage occurs provide flatter slopes to the Geotechnical Consultant's satisfaction.
- .8 Permanent Slopes: Where a permanent cut slope is indicated provide a maximum permanent cut slope of 3 H : 1 V using compact natural granular soil.
 - .1 Fertilize the cut slope and hydro seed upon completion of the Work.
 - .2 Protect the un-vegetated slopes from foot traffic and surface water movement.
 - .3 Install a degradable straw erosion control blanket to protect the slope while vegetation becomes established.
 - .4 Should seepage be observed in the cut slope, immediately contact the Consultant and the Owner's Geotechnical Consultant for remediation instructions.

3.5 OVER EXCAVATION

- .1 If soft silt or sand-silt soil mixtures are present at the footing level it may be necessary to excavate and lower the footing elevation to competent native soil or place fill over competent sub-grade to restore footing level.
 - .1 Prior to over-excavating, identify areas to be over-excavated and estimate volume of material to be excavated.
 - .2 Do not proceed with over excavation without Consultant's approval.
 - .3 Over excavations to be approved by Geotechnical Consultant.
 - .4 Additions to the Contract will be dealt with by Change Order.

3.6 EXCAVATION FOR TRENCHES

- .1 Provide shoring and bracing to trenches, pits and excavations to meet the Workers' Compensation Board Standards and requirements of local authorities having jurisdiction.

- .2 Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room.
 - .3 Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
 - .4 Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
 - .5 Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Consultant. See Geotechnical Report for fill of service trenches.
- 3.7 BACKFILL AND FILL**
- .1 General: Place acceptable material in lifts not exceeding 300 mm thickness, to required subgrade elevations, as specified.
 - .2 Place and compact backfill in excavations promptly, but not before completing the following:
 - .1 Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - .2 Surveying locations of underground utilities for record documents.
 - .3 Inspecting and testing underground utilities.
 - .4 Removing concrete formwork.
 - .5 Removing trash and debris.
 - .6 Removing temporary shoring and bracing, and sheeting.
 - .7 Installing permanent or temporary horizontal bracing on horizontally supported walls.
 - .3 Do not backfill trenches or foundations until tests and inspections have been made and backfilling authorized by Consultant. Use care in backfilling to avoid damage or displacement of pipe systems and concrete works.
 - .4 Backfill: Fill under strip footings and slabs on grade shall conform to the recommendations of the Geotechnical Report.
 - .5 Backfill Against Structure/Structural Backfill:
 - .1 Material for backfill against foundations walls, retaining walls and grade beams: as per Geotechnical report.
 - .2 Imported material shall be free from building or organic debris, large rocks or excess vegetable matter.
 - .3 Do not use heavy equipment for compaction adjacent to basement walls or crawl space, perimeter grade beams and footings.
 - .4 Do not over compact fills within 16" (400 mm) of these elements.
 - .6 Slab Underlayment - Fills supporting exterior slabs and sidewalks: 1.2m thick layer of compacted free-draining granular material below slab.
 - .7 Fill Supporting Road, Parking Area, and Pavement Structures: native granular fill or till sub-grade, free of organics, or Engineered Fill, subject to Geotechnical Consultant's approval.

.8 Backfill of utility and service trenches: Backfill service trenches and around pits, sumps, catch basins, with granular materials approved by the Geotechnical Consultant using vibratory compactors to ensure a permanent level at finish grade.

.1 Engineered Fill Pads: See Geotechnical Report

.9 Test Pit Locations: Remove loose test pit backfill and replace with properly placed and compacted Engineered Fill.

3.8 COMPACTION

.1 General: Control compaction during construction providing minimum percentage of density specified. Utilize double drum vibrating roller driven or hand type to suit conditions and as approved by Consultant. Utilize sled type vibrator adjacent to confined areas.

.2 Structures: Compact backfill or fill material in maximum 8 inches (200 mm) layers.

.3 Surface compact Sub-grade elevation by several passes with a heavy vibratory roller to 98 per cent of Standard Proctor maximum dry density prior to placing Fill to raise grades, footings or floor slabs.

.4 Place backfill and fill materials in layers not more than 12 inches (300 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 9 inches (225 mm) in loose depth for material compacted by hand-operated tampers.

.5 Compact soil to not less than the percentages indicated for the following:

PART OF STRUCTURE	PROCTOR DENSITY
Under Slabs on Grade	95 % ASTM D698 (Standard)
Sidewalks	95 % ASTM D698 (Standard)
Under Parking and Roads	95 % ASTM D698 (Modified)

3.9 GRADING

.1 General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

.1 Provide a smooth transition between adjacent existing grades and new grades.

.2 Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

.2 Site Grading: Slope grades minimum 2% to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances: Lawn, Unpaved Areas and Walks: Plus or minus 1 inch (25 mm). Pavements: Plus or minus 1/2 inch (13 mm).

.3 Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10 foot (3 m) straightedge.

.4 Ensure finish grades match existing to a tolerance of 1/2 inch tolerance when tested with a 10 foot (3 m) straight edge.

3.10 DRAINAGE

.1 Provide perimeter drains with a minimum 150mm cover of drain rock. Provide filter fabric over the drain rock.

3.11 PROTECTION

- .1 Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- .2 Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.
- .3 Reconditioning compacted areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, refill as required and compact to required density prior to further construction.

3.12 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- .1 Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of off Owner's property.

END OF SECTION