DIVISION 31

EARTHWORK

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 21 13 - Board Insulation: perimeter foundation insulation and frost barrier.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)
- .1 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

1.3 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
- .1 Rock : any solid material in excess of 0.25 m n and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.
- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.3 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 and compressible materials under excavated areas.
- .2 Frost susceptible materials under excavated areas.
- .3 Organic material under slabs and bearing surfaces.

1.4 SAMPLES

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

.2 At least 4 weeks prior to commencing work inform Contract Administrator of proposed source of fill materials and provide access for sampling.

.3 Submit 20 kg samples of granular fill materials specified including representative samples of excavated material. In case of coarse gravelly soil or coarse crushed stone submit 70 kg samples.

.4 Ship samples prepaid to testing agency clearly marked in tightly closed containers to prevent contamination.

1.5 PROTECTION OF EXISTING FEATURES

.1 Protect existing features in accordance applicable local regulations.

.2 Existing utilities and structures:

.1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
.2 Prior to commencing any excavation work, notify applicable owner or authorities, establish location and state of use of buried utilities. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
.3 Confirm locations of buried utilities by careful test excavations.
.4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities encountered.
.5 Where utility lines or structures exist in area of excavation, Obtain direction of Contract Administrator before moving or re-routing or otherwise disturbing utilities or structures.
.6 Record locations of maintained, re-routed, abandoned underground utility lines.
.7 Confirm locations of recent excavations adjacent to area of excavation.

.3 Existing buildings and surface features:
.1 Conduct, with Contract Administrator, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, paving, 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 to approval of Contract Administrator.
.3 Provide adequate protection around bench markers, layout markers, survey markers and geodesic monuments.

.4 Protect bottoms of excavations from softening. Should softening occur, remove softened soil and replace with compacted low density concrete fill to satisfaction of Contract Administrator.

.5 Protect bottoms of excavations from freezing.

.6 Effect approved methods to minimize dust as a result of this work.

1.6 EXISTING CONDITIONS

.1 A sub-surface soils investigation report of the site has been prepared and is available for viewing at the offices of the Contract Administrator.

.2 The report indicated properties of soils and by its nature cannot reveal all conditions that exist or can occur on the site and is provided for general information only.

.3 The Contractor and Subcontractors are responsible for assuring themselves of the actual site and sub-surface soil conditions.

1.7 COMPACTION DENSITIES

.1 Compaction densities are percentages of maximum densities obtained from ASTM D698 Standard Proctor Dry Density.

Part 2 Products

2.1 FILL MATERIALS

.1 Granular fill: crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious substances, and graded within the Manitoba Department of Highways 2002 Aggregate Grading Specification:

Passing Sieve Size		Type A (base course 'A')		Type C (base course 'C')	
Metric	Imp.	Granular	Crushed Stone	Granular	Crushed Stone
37.5 mm	1½"			100%	
25 mm	1"			85-100%	100%
19 mm	3/4"	100%	100%		
16 mm	5/8"	80-100%			
4.75 mm	No.4	40-70%	35-70%	25-80%	25-80%
2 mm	No.10	25-55%			
425 µm	No.40	15-30%	15-30%	15-40%	
75 µm	No. 200	8-15%	8-17%	8-18%	8-20%
Min. Crush Count		35%	100%	15%	100%
Maximum Los Angeles Abrasion Loss		35%	35%	40%	40%
Maximum Shale Content		12%		20%	
Maximum Clay Balls		10%			

.2 Earth Fill: selected earth material from excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 76 mm (3"), cinder, ash, sods, refuse or other deleterious materials.

.3 Sand: clean, washed, course sand free from clay, shale and organic matter.

Part 3 Execution

3.1 SITE PREPARATION

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

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 STRIPPING OF TOPSOIL

.1 Do not use topsoil stripped from site for finish grading or landscaping work. Remove from site.

3.3 STOCKPILING

.1 Stockpile fill materials in areas designated by Contractor. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

.3 Do not stockpile material on completed pavement where damage to pavement may occur.

3.4 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while work is in progress.

.2 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.3 Protect open excavations against flooding and damage due to surface run-off.

.4 Dispose of water in manner not detrimental to public and private property, or any portion of Work completed or under construction.

3.5 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions indicated for installation, construction and inspection of work specified.

.2 Excavate to well defined lines to minimize quantity of fill material required.

.3 Remove concrete, masonry, paving, walks, and other obstructions encountered during excavation.

.4 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.

.5 Dispose of surplus and unsuitable excavated material off site.

.6 Do not obstruct flow of surface drainage.

.7 Earth bottoms of excavations to be dry undisturbed soil, level, free from loose, soft or organic matter. Notify Contract Administrator when soil at bottom of excavation appears unsuitable and proceed as directed by Contract Administrator.

.8 If frozen material is encountered during excavation remove frozen material before installation of any foundations.

.9 Correct unauthorized excavation at no extra cost as follows:
- .1 Fill under bearing surfaces and footings with concrete specified for footings.
- .2 Fill under non-bearing surfaces with earth fill compacted to 95% density.

.10 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.11 Upon completion of excavation notify Contract Administrator for review and verification of soil bearing capacity, depths, and dimensions.

3.6 FILL TYPES AND COMPACTION

.1 Compaction densities are percentages of maximum densities obtained from ASTM D698 – Standard Proctor Dry Density. Dimensions specified herein are minimum dimensions after compaction.

.2 Use fill types indicated or specified below.

.3 Exterior side of perimeter foundation walls and grade beams:

.1 Where slabs-on-grade are adjacent to building: use Type A granular fill to sub-grade level; compact to 98% density.

.2 Where landscaped areas are adjacent to building: use Type A granular fill to sub-grade level; compact to 95% density. Cap with 300 mm clay fill extending out minimum 1 m from building; compact to 95% density. Sloped clay cap away from building for positive drainage.

.4 Under structurally supported concrete slabs: use earth fill to underside of void form. Compact to 98% density.

.5 Under slabs-on-grade (sidewalks): provide minimum 150 mm thickness of Type A granular fill to underside of slab; compact to 95% density.

3.7 BACKFILLING

.1 Do not proceed with backfilling operations until Contract Administrator has reviewed installations and work that backfilling will conceal.

.2 Areas to be backfilled to be free from debris, snow, ice, water or frozen ground.

.3 Do not use backfill material that is frozen or contains ice, snow or debris.

.4 Prior to placing fill under slabs on grade compact existing subgrade to obtain same compaction as specified for fill. Remove soft and unsuitable material and fill with acceptable material.

.5 Do not backfill around or over cast-in-place concrete until concrete has fully cured and backfilling operations have been reviewed by Contract Administrator.

.6 Place backfill material in uniform layers not exceeding 150 mm loose thickness. Compact each layer before placing succeeding layer.

.7 Backfill simultaneously on both sides of walls, grade beams, piles and other installations to equalize loading. Difference not to exceed 1000 mm.

.8 Place materials under, around and over installations until 600 mm cover is provided. Do not dump or place material directly on installations.

.9 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure until it has sufficient strength to withstand earth and compaction pressure; or

.2 If acceptable to Contract Administrator, erect bracing or shoring to counteract unbalance, and leave in place until removal is authorized by Contract Administrator.

.10 Use methods to prevent disturbing or damage to foundations, piles, buried services, drainage system or other installations that backfilling will conceal. Notify Contract Administrator of any damage and make good at no additional cost to Contract.

3.8 RESTORATION

.1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects noted by Contract Administrator. Dispose of surplus or unsuitable material from site.

.2 Clean and reinstate areas affected by work as directed by Contract Administrator.

3.9 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping off site.

3.10 INSPECTION AND TESTING

.1 Testing of fill materials and compaction will be carried out by an independent testing agency appointed by the Contract Administrator under separate contract.

.2 Costs for inspection and testing by independent agency will be included in tender price, no payment shall be made separately for this item.

.3 If, during progress of work, tests indicate fills and compaction do not meet specified requirements, remove defective fills, replace, compact and retest at no extra cost to the Contract.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 Measurement and Payment for Excavating, Trenching and Backfilling, including disposal of surplus excavated material, shall be included with the construction of the associated underground works for which it is required.

1.2 REFERENCES

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

.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 D422-632002, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00ae1, 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 D1557-02e1, 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 D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of surplus excavated material as directed by the Contract Administrator.

.2 Drill cuttings and/or spent drilling fluids must be collected and removed from site and properly disposed of at the cost of the Contractor.

1.4 EXISTING CONDITIONS

.1 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 Prior to beginning excavation Work, notify applicable Contract Administrator and authorities having jurisdiction to establish location and state of use of buried utilities and structures.

.6 Confirm locations of buried utilities by careful soft digging or soil hydrovac methods.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Contract Administrator.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Conduct, with Contract Administrator, 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 Contract Administrator.

.3 Where required for excavation, cut roots or branches as directed by Contract Administrator.

Part 2 Products

2.1 MATERIALS

.1 For backfill material requirements, refer to CW 2030.

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 of authorities having jurisdiction.

.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 limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION/PROTECTION

.1 Keep excavations clean, free of standing water, and loose soil.

.2 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.

.3 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF TOPSOIL

.1 Do not use topsoil stripped from site for finish grading or landscaping work. Remove from site.

3.5 STOCKPILING

.1 Stockpile fill materials in areas designated by Contract Administrator.

.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.

.4 Implement ground protection underneath stripped, excavated or stockpiled materials.

3.6 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated on the design drawings.

.2 Excavation must not interfere with bearing capacity of adjacent foundations.

.3 Excavation of shafts to be kept to a minimum as pipe installation shall be installed by trenchless methods.

.4 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.

.5 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Contract Administrator.

.1 Implement ground protection underneath striped, excavator or stockpiled materials.

.2 Excavations shall be excavated with walls as nearly vertical as possible, and with shoring or bracing, where required. Bracing and shoring shall be constructed at the Contractor’s expense and in accordance with current standards. Placing and removal of shoring, bracing, sheet piling or cages shall be undertaken in a manner that permits proper backfilling.

.6 Restrict vehicle operations directly adjacent to open trenches.

.7 Dispose of surplus and unsuitable excavated material off site or as directed by the Contract Administrator.

.8 Do not obstruct flow of surface drainage or natural watercourses.

.9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.10 Notify Contract Administrator when bottom of excavation is reached.

.11 Obtain Contract Administrator approval of completed excavation.

.12 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Contract Administrator.

.13 Correct unauthorized over-excavation as follows:

.1 Fill areas with Class 2 fill compacted backfill.

.14 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.

3.7 FILL TYPES AND COMPACTION

.1 Use types of fill as indicated or specified below:

.1 Class 3 Backfill – As per CW 2030.

.2 Class 5 Backfill – As per CW 2030.

3.8 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place compacted sand bedding a minimum of 100 mm below the invert of the pipe being installed and pipe surround sand a minimum of 200 mm above the top of the pipe for the entire trench width.

3.9 BACKFILLING

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

.1 Contract Administrator 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 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 Class 3 Backfill shall be used in all excavations under or within 1.0 m of any existing or proposed paved or granular surface.

.4 Class 5 Backfill shall be used in all excavations in a landscaped area.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Supply, pick-up, delivery and install piles.

.2 Design Requirements

.3 Design loads as indicated on structural drawings.

.4 Do not splice piles without Contract Administrator's permission. When permitted, provide details for Contract Administrator review. Design details of splice to bear signature and stamp of professional engineer registered or licensed in Province of Manitoba.

1.2 QUALITY ASSURANCE

.1 Precast concrete components shall be fabricated by manufacturer certified by CSA as meeting requirements of CSA A251.

.2 All work shall be performed by a Contractor experienced in related type or work and having at his disposal all necessary equipment.

.3 Allowable tolerances:

.1 Lateral tolerances: units shall be located so as to have maximum lateral deviation at top of unit of 50 mm.

.2 Vertical tolerance: piles shall be driven without varying more than 2% from vertical.

.3 Pile cutoffs at elevations indicated ±38 mm.

.4 Piles not meeting these requirements will be rejected. City will not bear cost for replacement of installation of rejected piles.

.4 Drive units to develop loads as indicated on drawings.

.5 All work shall comply with local and provincial safety codes and regulations.

1.3 TEST REPORTS

.1 Upon request, submit certified copies of quality control tests related to this project as specified in CSA A251.

1.4 SITE CONDITIONS

.1 Visit site to ascertain special conditions which may affect work.

.2 Review the Geotechnical Report to identify subsurface conditions that may be encountered.

1.5 DELIVERY AND STORAGE

.1 Minimum size holes are permitted to facilitate handling and lifting to vertical position.

.2 Provide identification for points of lifting by painted stripes or lift hooks set in.

.3 Provide identification for points of support for storage. Store all units at site in such a way as to avoid undue stresses before driving.

.4 During delivery and storage support long piles continuously along their lengths.

.5 All foundation units delivered to site, which do not conform to terms of this specification may be rejected by Contract Administrator or his representative.

1.6 PROTECTION

.1 Protect public and construction personnel, adjacent structures and work of other sections from hazards attributable to pile driving operations.

.2 Protect pile surfaces from damage and spalling.

1.7 SCHEDULING

.1 Submit schedule of planned sequence of driving to Contract Administrator for review, not less than two (2) weeks prior to commencement of pile driving for structure.

.2 Do not commence pile driving until authorized to proceed by Contract Administrator.

Part 2 Products

2.1 MATERIALS

.1 Piles: standard hexagonal, precast, prestressed, to sizes indicated on drawings, by an approved supplier.

.2 Cement: Type HS, sulphate resistant.

.3 Concrete strength: 35 MPa at time of driving. Concrete strength at transfer of pre-stress shall be minimum 25 MPa.

.4 Pre-stressing steel: to CSA G279 steel for pre-stressed concrete tendons.

.5 Welded wire mesh: to CSA G30.5.

.6 Spiral reinforcement: to CSA G30.3, cold drawn steel wire.

.7 Pile connections: capable of providing positive means to hold pieces together, maintaining alignment for full depth and transmitting full design load. Submit details of connector for review by Contract Administrator.

2.2 FABRICATION

.1 Fabricate precast concrete piles to lengths, cross sectional areas, reinforcement pile connectors pile rock points as indicated.

.2 Fabricate piles to following finish tolerances:

.1 Length: ±3 mm/metre of length.

.2 Cross section: solid section -6 to +12 mm.

.3 Deviation from straight line: not more than 3 mm/metre of length, 12 mm in full length.

.4 Pile head: ±10 mm/metre from true right angle plane. Surface irregularities ±3 mm.

.5 Location of reinforcing steel main reinforcing cover: -3 to +6 mm. Spacing of spiral ±12 mm.

Part 3 Execution

3.1 INSTALLATION

.1 Provide approved type of protection cap with cushion block to top of pile when driving. Cushion block material softwood such as green hemlock. Plywood not acceptable.

.2 Splice piles, if required, using approved method of splicing.

.3 On completion of driving, cut off pile at required elevation. Make circumferential cut with a concrete saw to prevent spalling of pile below cut-off elevation. Make pile cut off absolutely horizontal.

.4 Drive piles at locations indicated and to depth sufficient to develop required loading.

.5 Minimum prebored depth for piles from excavation: 2.0 metres or as specified by geotechnical consultant.

.6 Make prebored holes 50 mm larger in diameter than piles to be placed unless indicated otherwise on the drawings. Prebore as required in geotechnical report.

.7 Remove boulders or existing concrete foundations encountered in prebored holes using a core barrel or other approved method.

.8 Remove, relocate, re-drive and provide additional piles where directed when boulders or other obstructions prevent driving piles to an adequate bearing strata or within allowable tolerances in locations indicated on the drawings. Perform such work no additional cost to the Contract.

.9 Perform pile driving with a diesel hammer capable of delivering a rated energy of at least 40,600 joules.

.10 Refusal criteria for driving piles shall be established by inspection at time of driving.

.11 Replace piles excessively damaged through driving or which are believed to be broken, with a new pile at a suitable location at no additional cost to Contract.

.12 Piles shall be of sufficient length to allow approximately 460 mm of strand to extend into structure above.

.13 If a pile or piles should be driven below required elevation to accommodate exposed strand requirements, cut off such piles 460 mm below the top of pile (except at single pile caps). Build up piles to details provided by Contract Administrator at no additional cost to the Contract.

.14 Drive piles to required final set in competent hard glacial till deposit.

.15 Drive piles continuously, without intermission until driven to required final set, at depth adequate to support the loads indicated on the drawings.

.16 Observe and check pile upheaval. Re-drive pile to refusal and final set any piles showing uplift after driving adjacent piles.

3.2 REPAIR/RESTORATION

.1 One or more of the following remedial measures may require:

.1 Remove rejected pile and replace with a new, and if necessary, longer pile.

.2 Remove rejected pile and fill holes as directed.

.3 Leave rejected pile in place and cut off as directed by Contract Administrator.

.4 Leave rejected pile in place, place adjacent pile(s), and modify pile cap as directed.

3.3 FIELD QUALITY CONTROL

.1 Inspection of pile driving operations shall be supplied by an independent inspection and testing agency retained and paid for by the Contractor. The independent inspection and Testing Agency shall be approved by the Contract Administrator.

.2 An accurate driving record of penetration per blow shall be kept by the inspector or in his absence by the piling subtrade. These records shall include final penetration resistance, pile heave and amount of downward movement on redrive.

.3 Notify the Contract Administrator or his representative sufficiently in advance of pile installation to allow necessary inspections to be carried out.

3.4 CLEAN-UP

.1 After installation of foundation units, remove all excess concrete and other debris and leave site in clean condition.

END OF SECTION