

1. GENERAL
  - 1.01 RELATED REQUIREMENTS
    - .1 Other Sections which specify earthwork or backfill
  - 1.02 REFERENCE DOCUMENTS
    - .1 Applicable test methods for earthwork testing specified in this Section:
      - .1 Particle Size Analysis of Fill Materials: Testing for conformance with specified gradation limits will utilize testing sieves complying with CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
      - .2 Compaction Testing: to ASTM D698-91, Laboratory Compaction Characteristics Of Soil Using Standard Effort.
  - 1.03 GEOTECHNICAL TESTING AGENCY SERVICES
    - .1 The Owner will appoint and pay for services of geotechnical testing agency to perform quality control testing associated with the site grading and roadway construction. The cost of retests due to original test failures, shall be the responsibility of the Contractor.
    - .2 Cooperate with testing agency in site sampling for testing.
  - 1.02 FILL MATERIAL TESTING
    - .3 Provide onsite, for testing purposes, 1 m<sup>3</sup> of each type of borrow fill material.
    - .4 Borrow fill materials will be tested by the geotechnical testing agency, before placement, for conformance with requirements and to confirm suitability for intended uses.
    - .5 Native excavated material to be used as fill material will, before placement, be inspected for compliance with requirements and tested to confirm suitability for intended uses.
  - 1.04 COMPACTION TESTING
    - .1 Fills for embankments, berms and beneath landscaped areas shall be compacted to 96% of Standard Proctor Density (ASTM D698 Method A).
    - .2 Where concrete slabs or pavement structures are to be placed next upon completion of filling, fill shall be compacted to 98% of a Standard Proctor Density (ASTM D698 Method A) within 2% of optimum moisture content.
  - 1.05 OTHER TESTING
    - .1 Testing associated with subgrade, aggregates and other Sitework components shall be undertaken as described in the Other Sections which specify field quality control.
2. PRODUCTS
  - .1 NOT USED
3. EXECUTION
  - .1 NOT USED

END OF SECTION



1. GENERAL
  - 1.1 SECTION INCLUDES
    - .1 Designated classes, gradation and physical requirements of aggregate.
    - .2 Production and supply of aggregate and quality assurance.
  - 1.2 QUALITY ASSURANCE
    - .1 The Geotechnical Engineer will conduct sieve analyses to ASTM C136 and other tests to ensure that aggregate being produced and supplied meets the requirements outlined in the Geotechnical Report. The contractor shall provide a daily estimate of production tonnage to the Geotechnical Engineer.
    - .2 A minimum of one sieve analysis per 500 tonnes of aggregate supplied to a jobsite is required. The aggregate may be sampled from a stockpile at the jobsite or at the gravel pit / crusher site.
    - .3 If the aggregate fails to meet the specified gradation, the contractor shall suspend gravel placement until proof of compliance with the specification is provided to the Geotechnical Engineer. Alternatively, the contractor may elect to remove the suspect gravel from the jobsite and provide aggregate from a different source.
  - 1.3 SUBMITTALS
    - .1 Provide copies of scale certificates to the Consultant prior to use.
    - .2 Each truckload of aggregate weighed in shall have a ticket filled out and submitted to the Consultant.
    - .3 Quality Control Plan:
      - .1 Submit a minimum of one sieve analysis per 500 tonnes of aggregate for stockpile or 300 tonnes of aggregate shipped directly from the crusher to the jobsite to the Consultant. Do not stockpile or ship aggregate to the jobsite until the Consultant has accepted the applicable test results.
      - .2 Evaluation of Tests: The average grading of the first 8 consecutive sieve tests shall conform to the specified grading band. If it does not, adjust the production process so that the average grading of material already produced and that produced in the next 8 consecutive tests will conform to specifications. Failing this, do not supply aggregate represented by the nonconforming average of 16 tests. The preceding evaluation will be repeated for subsequent series of 8 consecutive tests.
  - 1.4 STORAGE AND PROTECTION
    - .1 Place aggregate into stockpile in horizontal lifts of 750 mm maximum thickness. Avoid segregation of particle sizes. Do not dump aggregate over the edges or down the faces of the stockpile. On completion, peak the stockpile at a minimum 3% grade.
2. PRODUCTS
  - 2.1 MATERIALS
    - .1 Aggregates shall conform to the requirements in the Geotechnical Report, which specifies Alberta Transportation - Designation 2, Class 25 base course and Alberta Transportation – Designation 6, Class 80 sub-base course.

2.2 EQUIPMENT

- .1 Crushers: capable of producing aggregate as specified.
- .2 Scale Tickets: Supply truckers with scale ticket forms approved by the City.
- .3 Metric Sieves: CAN/CGSB-8.2-M sieve sizes shall replace ASTM E11 sieves as follows:

CAN/CGSB-8.2-M Sieves (µM)	ASTM E11 Sieves (mm)
125 000	125.0
80 000	75.0
63 000	63.0
50 000	50.0
40 000	37.5
25 000	25.0
20 000	19.0
16 000	16.0
12 500	12.5
10 000	9.5
5 000	4.75
2 500	2.36
2 000	2.00
1 600	1.70
1 250	1.18
800	0.850
630	0.600
400	0.425
315	0.300
160	0.150
80	0.075
45	0.045

3. EXECUTION

3.1 EXAMINATION

- .1 Crushed aggregate shall consist of sound, hard and durable particles of sand, gravel and rock, free of elongated particles, injurious amounts of flaky particles, soft shale, coal, ironstone, clay lumps and organic and other deleterious material.

3.2 PREPARATION

Adjust and modify aggregate as required to meet gradation requirements by aggregate splitting, elimination of fines, or blending with sand.

END OF SECTION

1. GENERAL

1.1 INTENT

- .1 This Section specifies general requirements common to all earthwork. Read this Section in conjunction with related Sections which specify requirements for specific types of earthwork.

1.2 RELATED REQUIREMENTS

.1 General Conditions of Contract – Changes in Sub-Surface Conditions

.2 Division 00 – Subsurface Soils Information

.3 Section 31 00 10 – Geotechnical Sitework Testing

1.3 DEFINITIONS

- .1 Earthwork: Earthwork means excavating of all types, backfilling, filling, compacting, grading and related work.

1.4 BASIS OF EXCAVATION

- .1 For bidding purposes, assume that all excavation work will be "Earth Excavation".
- .2 Rock encountered within areas requiring excavation and classified by Owner as "Rock Excavation in Trenches or Pits" or "Rock Excavation in Open Excavations", will be considered a change in the Work and valued in accordance with the General Conditions of Contract.
- .3 Classifications of excavation encountered which are contrary to the foregoing, and are classified as such by Owner, will be considered a change in the Work and valued in accordance with the General Conditions of Contract.

1.5 UNAUTHORIZED EXCAVATION

- .1 Unauthorized excavation shall be any excavation beyond elevations and dimensions indicated, without specific direction by Owner.
- .2 Fill unauthorized excavation to elevations and dimensions indicated.
- .3 Unauthorized excavation and remedial work shall be at Contractor's expense.
- .4 The Contractor is not permitted to excavate beyond the south property line of the site on Canadian National Railway property, without written permission.

1.6 EXCAVATION LEVELS

- .1 For bidding purposes, assume that excavation levels will be as indicated on Drawings.
- .2 Notify Owner if unsuitable bearing materials are encountered at indicated elevations. Carry excavation deeper and replace excavated material with suitable materials if and as directed by Owner.
- .3 Notify Owner if bearing conditions are fulfilled at elevations above those indicated. Adjust excavation elevations if and as directed by Owner.
- .4 Adjustments in levels, if directed by the Owner, will be considered a change in the Work and will be valued in accordance with the General Conditions of Contract.

2. PRODUCTS

2.1 FILL MATERIALS

- .1 Borrow materials proposed to be used as fill will be tested by the geotechnical testing agency, before placement, for conformance with requirements and to confirm suitability for intended uses.

3. EXECUTION

3.1 PREPARATION

- .1 Notify Owner minimum 2 days prior to beginning excavating operations.
- .2 Prior to commencing excavation:
  - .1 Contact all affected utility companies regarding exact location and current status of all utilities, voltage of underground and overhead power lines and pressure of natural gas lines.
  - .2 Notify Owner if any utility lines have been omitted from or incorrectly indicated on Drawings.
  - .3 Identify known underground utilities. Stake and flag locations. Identify and flag surface and aerial utilities.
  - .4 Notify utility company about removal and relocation of utility lines.
- .3 Expose building connections, service connections, utilities to be crossed to confirm horizontal and vertical alignment of existing utilities.
- .4 Expose existing utility lines by hand excavation to confirm location before machine digging within 600 mm of lines.
- .5 Maintain and protect existing above and below grade utilities which pass through work area. Protect active utility lines exposed by excavation, from damage. Hand excavate to final elevations and dimensions.
- .6 Where existing pipes, ducts or other underground services intersect a trench, support trench in a manner approved by Utility.
- .7 Where existing overhead line poles are adjacent to excavations, temporarily support poles in a manner approved by Utility.
- .8 The Contractor may encounter abandoned utility lines from previous uses on the site. All watermains and sewers, including their connections have been abandoned. The Contractor shall verify that existing power and gas services have been abandoned at the property line.

3.2 SHORING AND BRACING

- .1 If required to provide safe working conditions and to prevent cave-ins and loose soil from falling into excavations, protect excavations by shoring, bracing, sheet piling, underpinning, or other suitable methods.
- .2 Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases or cuts.

3.3 DEWATERING

- .1 Maintain excavations free of water. Provide pumps, piping, temporary drains, trenches, sumps, and related equipment to remove water.
- .2 Do not use private property for discharge of water.

- .3 The Contractor is responsible for all dewatering costs and should reference the Geotechnical Report for further details on groundwater.

3.4 EXCAVATING

- .1 Remove topsoil and unsuitable materials to the satisfaction of the Consultant prior to beginning of excavation and embankment/engineered fill. Dispose any remaining topsoil and unsuitable materials on-site.
- .2 Do not excavate under wet conditions or when such conditions are anticipated.
- .3 When excavating is necessary through roots of plant materials, which are to remain, perform work by hand and cut roots with a sharp axe.

3.5 MATERIAL STORAGE

- .1 Native excavated material, other than topsoil, acceptable and required for use as fill material under this Contract: Stockpile on site until required.
- .2 Topsoil and organic material: Stockpile on site and spread upon completion of earthwork. Ensure positive drainage is maintained from all disturbed areas.
- .3 Stockpile locations shall be subject to Owner's approval.

3.6 DISPOSAL OF EXCESS AND WASTE MATERIAL

- .1 Waste material, trash and debris: Remove from site and ensure proper disposal.
- .2 Contractor shall be responsible for all permits and fees associated with all disposal required by this section.

3.7 BACKFILLING

- .1 Ensure areas to be backfilled are free of debris, snow, ice, water and that surfaces are not frozen. Do not backfill over porous, wet, or spongy subgrade surfaces.
- .2 Backfill systematically, as early as possible, to allow maximum time for natural settlement.

3.8 COMPACTION

- .1 Compact fill materials using only mechanical methods. Do not use hydraulic methods.
- .2 Do not perform compaction using vehicles and other equipment not designed for compacting.
- .3 Maintain optimum moisture content of materials being compacted, as required to attain specified compaction density.

END OF SECTION





**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 13 – Subgrade Preparation

**1.2 SECTION INCLUDES**

- .1 Excavation of soil for construction of roadway and associated structures.
- .2 Construction of fill.
- .3 Disposal of surplus and unsuitable materials.

**1.3 DEFINITIONS**

- .1 Common Excavation: includes topsoil, clay, silt, sand, gravel and peat within a jobsite.
- .2 Borrow Excavation: includes select topsoil, clay, sand and gravel from a designated borrow site on the jobsite for use as fill within a jobsite.
- .3 Garbage Excavation: includes household, commercial and industrial refuse or any other deleterious material.
- .4 Fill: any earth structure built up by successive lifts of a specified material compacted to specified densities.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Suitable Materials: The Geotechnical Engineer will determine the suitability of excavated materials for use in embankments, subgrade, backfill, berms and any other purpose.
- .2 Salvageable Materials: When directed by the Geotechnical Engineer, reserve and stockpile at designated locations topsoil, sand, gravel, surplus fill and other materials deemed salvageable by the Geotechnical Engineer.
- .3 Unsuitable Materials: Remove and dispose off-site of peat, roots, stumps, topsoil, frozen soil, garbage and any other material deemed unsuitable by the Geotechnical Engineer.

**2.2 EQUIPMENT**

- .1 Only vehicles licensed for highway use shall be used for hauling on developed roadways.
- .2 Off-highway earthmoving equipment shall not travel along or across developed roadways, unless authorized in writing by the City before work starts.
- .3 Equipment shall be adequately muffled to conform to local noise bylaws, as applicable.

**3. EXECUTION**

**3.1 EXCAVATION**

- .1 Excavate to designated cross-sections. Complete initial excavation and exercise caution to preserve bank stability where necessary. Stage excavation to allow related work.
- .2 Use of Excavated Soil: Use Geotechnical Engineer-approved excavated soil to construct embankments, subgrade, berms, boulevard fill, trench backfill and for other purposes as directed.

- .3 Borrow Excavation: Where excavated suitable material is not sufficient for jobsite use, obtain additional material from a designated borrow site. If necessary, clear and grub the borrow site. Strip the site of topsoil and unsuitable materials. Excavate, load, haul and place where required.
- .4 Undercut: When excavation exposes unsuitable materials below the subgrade elevation and the Geotechnical Engineer directs removal, excavate such materials using transition slopes no steeper than 10% along the road profile. Make the bottom of the cut level, with no loose material.
- .5 Over-Excavation: Where over-excavation occurs, restore grades by backfilling, compacting and regrading as directed by the Geotechnical Engineer. If over-excavation is the result of the Contractor's error, no claim shall be made for the excess excavation and grade restoration.

### 3.2 FILL

- .1 Preparation: Where necessary, clear and grub the base of fill, remove topsoil and other unsuitable materials and scarify the base to ensure bond with fill material.
- .2 Soil Moisture Alteration: The required compaction can best be achieved if the soil is dried or moistened to within  $\pm 2\%$  of optimum moisture content.
- .3 Fill Placement and Compaction: Place and spread fill material in successive horizontal lifts, each lift not exceeding 150 mm thickness when compacted. Compact each lift to the required density using suitable equipment.

### 3.3 SIDE SLOPES

- .1 Trim slopes of cuts, fills and berms from top to bottom. Leave the base of the slope neatly trimmed by removing lumps or loose material, or by blending loose material into the base. Finish slopes true to designated alignment, grade and shape.

### 3.4 FIELD QUALITY CONTROL

- .1 Grade Tolerances: Check graded surfaces to ensure they meet a grade tolerance of  $\pm 25$  mm maximum variation from designated grade elevations and that crossfall and bottoms of ditches are graded to create positive flow:
  - .1 When tolerance is exceeded: Trim high areas to within tolerance and scarify low areas, backfill with approved material, compact to required density and regrade to within tolerance.
- .2 Density Requirements:
  - .1 Maximum density: as used in this section, is the dry unit mass of sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.
  - .2 The required densities for fill are:
    - .1 Fills for embankments, berms and beneath landscaped areas shall be compacted to 96% of Standard Proctor Density (ASTM D698 Method A).
    - .2 Where concrete slabs or pavement structures are to be placed next upon completion of filling, fill shall be compacted to 98% of a Standard Proctor Density (ASTM D698 Method A) within 2% of optimum moisture content.
  - .3 Testing Frequency: The quality assurance laboratory will take a minimum of one field density test for each 2 000 m<sup>2</sup> of compacted lift, or approved alternate frequency, according to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A.
  - .4 Noncompliance: If a density test result is less than the required density, that test result is to be recorded as "failed" and a retest shall be performed on the area represented by the failed test. If the retest is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompacted to the required density.

- .5 If the lift is covered before the Geotechnical Engineer has accepted the test results then the Contractor assumes the risk of uncovering and reworking the compacted lift.

**3.5 PROTECTION**

- .1 Drainage: If the work area floods, drain immediately by natural flow or by pumping into catch basins, manholes or ditches.
- .2 Protect finished grades from damage, and repair and retest as required by the Geotechnical Engineer, if damaged.

**END OF SECTION**



**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 10 – Site Excavation, Filling and Grading

**1.2 SECTION INCLUDES**

- .2 Working and compacting subgrade soil.

**1.3 DEFINITION**

- .3 Prepared subgrade: soil immediately below a pavement structure or slab, compacted to a depth of 150 mm, or as specified.

**1.4 QUALITY ASSURANCE**

- .1 Maximum Density: the dry unit mass of a soil sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.
- .2 Required Density: a minimum of 98.0% of the maximum density for each 150 mm lift of subgrade under all structures.
- .3 Testing Frequency: the quality assurance laboratory will take a minimum of one field density test for each 1 000 m<sup>2</sup> of compacted subgrade lift according to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A or as directed by the Consultant.
- .4 Proof Rolling: a proof roll of the finished subgrade will be required to confirm adequate bearing capacity of the subgrade soils. The proof roll shall be supervised by the Consultant, and must be performed to the satisfaction of the Geotechnical Engineer.

**2. PRODUCTS**

**2.1 MATERIALS**

- .1 Use only compacted clay subgrade soil with no deleterious material reviewed by the Consultant.

**2.2 EQUIPMENT**

- .2 Equipment: various pieces of equipment designed for and capable of disking, scarifying, spreading, spraying water, compacting and trimming soil to specified depth.

**3. EXECUTION**

**3.1 EXCAVATION**

- .1 Loosen soil to required depth. Work soil with cultivating and mixing equipment until soil is pulverized into pieces no larger than 25 mm maximum dimension, exclusive of stones, to the full depth of subgrade preparation.
- .2 The required compaction can generally best be achieved if the soil is dried or moistened to within  $\pm 2\%$  of the optimum moisture content before compacting.
- .3 If the Consultant determines that it is not practical to dry an otherwise suitable soil after sufficient effort has been expended by the Contractor, the Consultant, with input from the Owner and Geotechnical Engineer, may order cement soil stabilization. Spread soil in lifts not exceeding 150 mm when compacted. Compact each lift to the required density in 1.04.2.

- .4 Leave the surface of the compacted subgrade slightly higher than required elevation; then trim to design crown and grade. Leave finished surface even and free of depressions, humps and loose material.

3.2 FIELD QUALITY CONTROL

- .1 Check finished surface of subgrade to ensure it meets the following tolerances:
  - .1 Grade: 6 mm maximum variation above designated elevation. 25 mm maximum variation below designated elevation.
  - .2 When Tolerance Exceeded:
    - .1 Trim high spots and refinish surface to within tolerance.
    - .2 Add approved material to low areas, scarify and blend to full subgrade depth, recompact to required density and refinish surface at the contractor's expense. Alternatively, fill low areas with extra thickness of subsequent granular sub-base or base course at the contractor's expense.
- .5 If a density test result is less than the required density, that test result is to be recorded as "failed" and a retest shall be performed on the area represented by the failed test. If the retest is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompact to the required density.
  - .1 The Contractor shall assume the risk of uncovering and reworking the subgrade if it is covered before the Consultant has accepted test results thereof.

3.3 PROTECTION OF FINISHED WORK

- .1 Do not permit vehicular traffic over the prepared subgrade.
- .2 If folding of the subgrade occurs, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches. This shall be done at the expense of the Contractor.
- .3 Maintain protection of prepared subgrade until subsequent granular sub-base or base course is placed. Repair and retest as required by the Consultant if damaged.

END OF SECTION

1. General
- 1.1 RELATED REQUIREMENTS
  - .1 Aggregate Materials Section 31 05 16
  - .2 Site Excavation, Filling and Grading Section 31 23 10
  - .3 Culverts Section 34 42 15
- 1.2 SECTION INCLUDES
  - .1 Excavating and backfilling trenches and cuts for sewer and water pipe, manholes, valve chambers, catch basins, area drains, subdrains, culverts and other underground utilities and structures.
- 1.3 REGULATORY REQUIREMENTS
  - .1 The following legislation and related regulations shall be observed at all times:
    - .1 Alberta Occupational Health and Safety Act
    - .2 Local County Bylaws
- 1.4 QUALITY ASSURANCE
  - .1 Testing Standards: The quality assurance laboratory will take density and other tests on compacted soil to the following standards as directed by the Geotechnical Engineer: ASTM D698 Method A., ASTM D1556, ASTM D2167, ASTM D2922 and ASTM D3017.
2. Products
- 2.1 MATERIALS
  - .1 Native Fill Material: Material excavated from trench or from grading as described in Section 31 05 16 - Aggregate Materials and approved by the Geotechnical Engineer.
  - .2 Section 31 23 10 – Site Excavation, Filling and Grading: Fill material shall be free of stones larger than 200 mm, organic matter and other deleterious material.
  - .3 Borrow Fill Material: Geotechnical Engineer approved material from on-site borrow sources to supplement or replace insufficient or unacceptable material on-site. Fill material shall be free of stones larger than 50 mm, organic matter and other deleterious material.
  - .4 Granular Fill: to Section 31 05 16 - Aggregate Materials as specified.
  - .5 Pipe Bedding Material: Consult individual pipe installation sections for material specifications.
3. Execution
- 3.1 TRENCHING
  - .1 Trench Excavation:
    - .1 Excavate trench to indicated alignment and to width and depth required to achieve indicated elevations and to accommodate required bedding. Hand trim bottom of trench where required.
    - .2 The Consultant or the utility owner may require that a professional engineer design the method of support to existing or proposed utilities within the trench limits. Submit any required design drawings for the Consultant's or utility owner's review beginning trench excavation.
    - .3 The Consultant may limit the amount of trench to be opened or left open at any one time.

- .4 Stockpile excavated material or imported fill at a safe distance from edge of trench.
- .5 Dispose of surplus or otherwise non-useable excavated material offsite or as directed by the Consultant.
- .2 Trench Dimensions:
  - .1 The depth of trench shall be as shown on the drawings.
  - .2 Cut back the walls of trench in strict compliance with the Occupational Health and Safety Regulations.
  - .3 For a vertical cut trench with sheeting, the width of trench shall be:
    - At the pipe springline: a minimum width equal to the outside diameter of pipe plus 450 mm and a maximum width equal to the outside diameter of pipe plus 600 mm.
    - At ground level: a maximum width of outside diameter of pipe plus 600 mm.
  - .4 Do not over-excavate beyond the specified limits. If the trench must be excavated deeper or wider than specified, obtain approval from the Consultant. No additional payment for over-excavation will be made unless authorised by the Consultant.
- .3 Trenching in Poor Ground:
  - .1 If the bottom of the trench is in soil which, in an undisturbed state, has adequate bearing capacity, but becomes "quick" due to soil water pressure or becomes unstable due to the construction activity in the trench, the contractor shall over-excavate to a depth specified by the Consultant, place geotextile fabric and cover with foundation granular material, all as specified by the Consultant.
  - .2 If the bottom of the trench is in peat or other unsuitable foundation material, apply one of the following corrective measures as appropriate:
    - Over-excavate to suitable material and backfill with compacted gravel or washed rock to the underside of bedding if the amount of over-excavation is less than 0.5 m.
    - Do not over-excavate, but provide structural support for the pipe as specified by the Consultant, if the depth to suitable foundation soil from the bottom of the pipe bedding is greater than 1.0 m.
- 3.2 DEWATERING
  - .1 Keep the excavation free of water.
  - .2 Protect open excavations against flooding and damage due to surface runoff.
  - .3 Do not allow ground water to drain into water pipes.
  - .4 Water from the excavation shall be disposed of in accordance with the General Requirements or in a manner approved by the Consultant.
  - .5 Dispose of water in a manner not detrimental to public and/or private property or any portion of the work completed or under construction.
- 3.3 BEDDING
  - .1 Place pipe bedding for sewers in accordance with the individual pipe installation sections.
- 3.4 BACKFILLING AND COMPACTION
  - .1 Backfill the trench with approved fill material from the top of bedding to the designated subgrade elevation or existing ground level, whichever is lower.
  - .2 Place backfill in uniform horizontal lifts and compact each lift according to trench and backfill types in 3.5 below.
  - .3 Remove any free water from a lift before placing the next lift of backfill.



- .4 Backfilling Alternatives: The Consultant may consider alternative proposals from the Geotechnical Engineer to use special materials or methods that will achieve long term stability of trench backfill. Use only alternatives accepted by the Consultant, at no additional cost to the Client.
- .5 Backfilling in Cold Weather:
  - .1 The reference for shutdown temperatures shall be the temperature reported by Environment Canada.
  - .2 Do not start daily excavation, backfilling or compaction for open cut trenches under pavement when the average air temperature is expected to be -10°C or lower or when the minimum air temperature is expected to be -20°C or lower.
  - .3 For open cut trenches the shutdown temperature is -15°C. If an approved trench covering system is used the shutdown temperature is -25°C.
  - .4 Frozen ground shall be thawed by an approved ground burning method before commencing excavation. Remove all frozen materials from the trench including snow and ice.
  - .5 Do not backfill with frozen soil or with material containing ice, snow, straw, organic or other deleterious material.
  - .6 Limit the length of open trench ahead of the backfilled portion to 10 m.

### 3.5 TRENCH AND BACKFILL TYPES

- .1 Backfill with native or imported fill material over bedding up to the designated subgrade or existing ground elevation, whichever is lower, in lifts not exceeding 300 mm when compacted. Compact each lift to 98% of a the Standard Proctor Density within 2% of the Optimum Moisture Content.

### 3.6 DENSITY REQUIREMENTS

- .1 Reference Density:
  - .1 Standard Proctor: the maximum dry density obtained from a plot of the dry densities of multiple specimens at various moisture contents, moulded and compacted in the laboratory according to ASTM D698 Method A.
- .2 Testing Frequency:
  - .1 A minimum of 3 density tests evenly spaced through the depth and length of the trench or as directed by the Consultant.
  - .2 Non-compliance: If a density test result is less than the required density, that test result is discarded and a retest shall be performed on the area represented by the failed test. If the retest is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompacted to the required density.

### 3.7 RESTORATION AND CLEANUP

- .1 Restore or replace in an approved manner all fences, poles, shrubs, grass and other structures damaged or removed during trenching and backfilling, unless directed otherwise by the Consultant.
- .2 Remove and dispose of all debris, surplus fill and unused material excavated from the trench.
- .3 Leave work site clean and as nearly as possible in original condition.

END OF SECTION



---

**1. GENERAL**

**1.1 RELATED SECTIONS**

- .1 The Contract Documents apply to and govern the Work of this section.

**1.2 REFERENCES**

- .1 ASTM A36/A36M-08 - Carbon Structural Steel.
- .2 ASTM A252-98 (2007) - Welded and Seamless Steel Pipe Piles.
- .3 ASTM D1143/D1143M-07e1 - Test Methods for Deep Foundations Under Static Axial Compressive Load.
- .4 CAN/CSA-G40.20-04/G40.21-04 - Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .5 CSA W47.1-03 - Certification of Companies for Fusion Welding of Steel Structures.
- .6 CSA W48-06 - Filler Metals and Allied Materials for Metal Arc Welding.
- .7 CSA W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding).
- .8 Workers' Compensation Board.

**1.3 DESIGN REQUIREMENTS**

- .1 Design piles for the loading shown on drawings.
- .2 Design components and connections necessary to resist all loads indicated on drawings.

**1.4 SUBMITTALS**

- .1 Provide submittals accordance with Section 01 33 00.
- .2 Shop Drawings:
  - .1 Submit a minimum of 10 working days in advance of start of pile operations.
  - .2 Review of Shop Drawings is intended as an assistance to the Contractor and does not relieve him of his responsibility for the accuracy and completeness of his work.
  - .3 Include the following information:
    - .1 Pile layout.
    - .2 Type of pile.
    - .3 Pile loads.
    - .4 Grade and details of steel.
    - .5 Elevation of pile bases.
    - .6 Elevation of top of pile caps.

- .4 Shop Drawings shall be signed and sealed by a Professional Engineer registered in the Province of Alberta.

## 1.5 FIELD RECORDS/DRAWINGS

- .1 Maintain accurate records of all piles installed. Records are to include the following:
- .1 Locations of the piles.
  - .2 Sequence of placing.
  - .3 Final base and head elevations.
  - .4 Date and time of drilling.
  - .5 Inspector's name and condition of base material.
- .2 Submit three (3) copies of all field records and drawings to the Engineer.

## 1.6 QUALITY ASSURANCE

- .1 Perform work in accordance with requirements of CSA G40.21, unless indicated otherwise herein.
- .2 Supervision: Pilings are to be installed under the direct supervision of a Geotechnical Engineer.

## 2. PRODUCTS

### 2.1 MATERIALS

- .1 Plates. Grade  
300W
- .2 Pipe.
- | <u>ASTM 252</u> | <u>Yield Strength</u> | <u>Tensile Strength</u> |
|-----------------|-----------------------|-------------------------|
| (Grade 2)       | 250 MPa               | 414 MPa                 |
| (Grade 3)       | 310 MPa               | 455 MPa                 |
- .3 Plate (Helix) and pile caps.
- | <u>CSA G40.21</u> | <u>Yield Strength</u> | <u>Tensile Strength</u> |
|-------------------|-----------------------|-------------------------|
| ASTM A36          | 245 MPa               | 414 MPa                 |
| ASTM 44W          | 310 MPa               | 414 MPa                 |
- .4 Helix(s) shall have a minimum thickness of 12.7 mm and shall be ASTM A36/A36M or G40.21, Grade 300W material.
- .5 Pipe splicing shall be full strength complete penetration groove welds or the combination of a collar and continuous fillet weld on each end of the collar to ensure continuity of pipe.
- .6 Helix(s) shall be welded to the pipe section using a continuous fillet weld on both sides of the helix to pipe connection.

- .7 Welding Procedures and Welder Qualification: To CSA W59 and CSA 47.1.
- .8 Welding Electrodes: To CSA W48.1, E7018 classification for stick welding and E4802-6-CH classification for wire feed welding.

### 3. EXECUTION

#### 3.1 GENERAL

- .1 Verify dimension prior to commencing work.
- .2 Install piles to reviewed shop drawings.
- .3 Weld to CSA W59.

#### 3.2 SCREW PILE NOTES

- .1 Screw piles used for piling shall be in accordance with ASTM A252 Grade 2 or 3 or A106 Grade B or C.
- .2 Piles shall have 300x300x12 plate welded to top of pile..
- .3 Piles shall be installed to minimum depth as shown in the shop drawings and to a torque value necessary to achieve the design loads specified in the pile schedule.
- .4 Minimum requirements for steel pipe screw piles are as follows unless noted otherwise.

<u>Pile Diameter (mm)</u>	<u>Min. Wall Thick (mm)</u>
114.3	6.02
139.7	6.99
168.3	7.11
219.1	6.71
273.1	9.27

- .5 Supply the Engineer with the installation torque of each pile. The torque value shall be average over 600 mm during installation of each pile within 1500 mm of the final pile installation depth.
- .6 Position of piles should be considered satisfactory providing the following conditions are met:
  - .1 Piles tops are located within 75 mm of the position specified on the drawings.
  - .2 Piles are within 2% inclination from the vertical or specified inclination.
  - .3 The piles, as placed, are not structurally damaged.
- .7 Changes or repairs of structural damage due to improper placement of piles shall be made as directed by the Engineer and at the Contractors expense.
- .8 Screw pile installation records for all piles shall be provided to the owner.

**3.3 FIELD QUALITY CONTROL**

- .1 Coordination and placement of piles to be by a full-time qualified superintendent representing the Contractor, and required to be in attendance during all phases of the Work.
- .2 Full-time pile inspection of pile drilling shall be carried out by an experienced qualified personnel retained by this Contractor.
- .3 Notify Engineer seven (7) working days in advance of starting work on site.

**END OF SECTION**