

**SECTION 312000 - EARTH MOVING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY****A. Section Includes:**

1. Preparing subgrades for slabs-on-grade, walks and pavements.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
8. Excavating well hole to accommodate elevator-cylinder assembly.

**B. Related Sections:**

1. Division 01 Section "Construction Progress Documentation" for recording preexcavation and earth moving progress.
2. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
3. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Divisions 21, 22, 23, 26, 27, 28, and 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
5. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
6. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
7. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
8. Division 31 Section "Drilled Concrete Piers and Shafts" for excavation of shafts and disposal of surplus excavated material.
9. Division 32 Section "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
10. Division 32 Section "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.
11. Division 33 Section "Subdrainage" for drainage of foundations, slabs-on-grade, walls and landscaped areas.

### 1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices."
- B. Quantity allowances for earth moving are included in Division 01 Section "Allowances."
- C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
  - 1. **24 inches (600 mm)** outside of concrete forms other than at footings.
  - 2. **12 inches (300 mm)** outside of concrete forms at footings.
  - 3. **6 inches (150 mm)** outside of minimum required dimensions of concrete cast against grade.
  - 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
  - 5. **6 inches (150 mm)** beneath bottom of concrete slabs-on-grade.
  - 6. **6 inches (150 mm)** beneath pipe in trenches, and the greater of **24 inches (600 mm)** wider than pipe or **42 inches (1065 mm)** wide.

### 1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
  - 2. Bulk Excavation: Excavation more than **10 feet (3 m)** in width and more than **30 feet (9 m)** in length.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed **1 cu. yd. (0.76 cu. M)** for bulk excavation or **3/4 cu. yd. (0.57 cu. M)** for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a **42-inch- (1065-mm-)** wide, maximum, short-tip-radius rock bucket; rated at not less than **138-hp (103-kW)** flywheel power with bucket-curling force of not less than **28,700 lbf (128 kN)** and stick-crowd force of not less than **18,400 lbf (82 kN)** with extra-long reach boom; measured according to SAE J-1179.
  2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than **230-hp (172-kW)** flywheel power and developing a minimum of **47,992-lbf (213.3-kN)** breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material **3/4 cu. yd. (0.57 cu. m)** or more in volume that exceed a standard penetration resistance of **100 blows/2 inches (97 blows/50 mm)** when tested by a geotechnical testing agency, according to ASTM D 1586.
- J. 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.
- K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- 1.5 SUBMITTALS
- A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D 2487.
  2. Laboratory compaction curve according to ASTM D 698.
- B. Blasting plan approved by the City of Lake Geneva.

- C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

## 1.6 QUALITY ASSURANCE

- A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
  - 1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  - 2. Seismographic monitoring during blasting operations.
- B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
  - 1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  - 2. Seismographic monitoring during blasting operations.
- C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- D. Preexcavation Conference: Conduct conference at the field office of the general contractor or the project manager.

## 1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
  - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

- D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 01 Section "Temporary Facilities and Controls," and Division 31 Section "Site Clearing," are in place.
- E. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree and Plant Protection" are in place.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification **Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 and Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145**], or a combination of these groups; free of rock or gravel larger than **3 inches (75 mm)** in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification **Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 and Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145**, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a **1-1/2-inch (37.5-mm)** sieve and not more than 12 percent passing a **No. 200 (0.075-mm)** sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a **1-1/2-inch (37.5-mm)** sieve and not more than 8 percent passing a **No. 200 (0.075-mm)** sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a **1-1/2-inch (37.5-mm)** sieve and not more than 12 percent passing a **No. 200 (0.075-mm)** sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a **1-inch (25-mm)** sieve and not more than 8 percent passing a **No. 200 (0.075-mm)** sieve.
- H. Drainage Course: Narrowly graded mixture of **washed**, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a **1-1/2-inch (37.5-mm)** sieve and 0 to 5 percent passing a **No. 8 (2.36-mm)** sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a **1-inch (25-mm)** sieve and 0 to 5 percent passing a **No. 4 (4.75-mm)** sieve.

- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, **6 inches (150 mm)** wide and **4 mils (0.1 mm)** thick, continuously inscribed with a description of the utility; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.
  - 3. Orange: Telephone and other communications.
  - 4. Blue: Water systems.
  - 5. Green: Sewer systems.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of **6 inches (150 mm)** wide and **4 mils (0.1 mm)** thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to **30 inches (750 mm)** deep; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.
  - 3. Orange: Telephone and other communications.
  - 4. Blue: Water systems.
  - 5. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

### 3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.
- B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
  - 1. Perform blasting without damaging adjacent structures, property, or site improvements.
  - 2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

### 3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. **24 inches (600 mm)** outside of concrete forms other than at footings.
    - b. **12 inches (300 mm)** outside of concrete forms at footings.
    - c. **6 inches (150 mm)** outside of minimum required dimensions of concrete cast against grade.
    - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    - e. **6 inches (150 mm)** beneath bottom of concrete slabs-on-grade.
    - f. **6 inches (150 mm)** beneath pipe in trenches, and the greater of **24 inches (600 mm)** wider than pipe or **42 inches (1065 mm)** wide.
- B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
  - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

- a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
  - a. **24 inches (600 mm)** outside of concrete forms other than at footings.
  - b. **12 inches (300 mm)** outside of concrete forms at footings.
  - c. **6 inches (150 mm)** outside of minimum required dimensions of concrete cast against grade.
  - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
  - e. **6 inches (150 mm)** beneath bottom of concrete slabs-on-grade.
  - f. **6 inches (150 mm)** beneath pipe in trenches, and the greater of **24 inches (600 mm)** wider than pipe or **42 inches (1065 mm)** wide.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus **1 inch (25 mm)**. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  1. 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.
  2. Pile Foundations: Stop excavations **6 to 12 inches (150 to 300 mm)** above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
  3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus **1 inch (25 mm)**. Do not disturb bottom of excavations intended as bearing surfaces.

### 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to **12 inches (300 mm)** higher than top of pipe or conduit unless otherwise indicated.
  - 1. Clearance: **12 inches (300 mm)** each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  - 1. For pipes and conduit less than **6 inches (150 mm)** in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
  - 2. For pipes and conduit **6 inches (150 mm)** or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
  - 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
  - 4. Excavate trenches **6 inches (150 mm)** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches **6 inches (150 mm)** deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
  - 1. Excavate trenches **6 inches (150 mm)** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

### 3.8 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than **15 tons (13.6 tonnes)** to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to **3 mph (5 km/h)**.
  - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### 3.9 UNAUTHORIZED EXCAVATION

- A. 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, with 28-day compressive strength of **2500 psi (17.2 MPa)**, may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

### 3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting 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.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within **18 inches (450 mm)** of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide **4-inch- (100-mm-)** thick, concrete-base slab support for piping or conduit less than **30 inches (750 mm)** below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of **4 inches (100 mm)** of

concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Place and compact initial backfill of subbase material, free of particles larger than **1 inch (25 mm)** in any dimension, to a height of **12 inches (300 mm)** over the pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of **12 inches (300 mm)** over the pipe or conduit. Coordinate backfilling with utilities testing.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- J. Install warning tape directly above utilities, **12 inches (300 mm)** below finished grade, except **6 inches (150 mm)** below subgrade under pavements and slabs.

### 3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

### 3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than **8 inches (200 mm)** in loose depth for material compacted by heavy compaction equipment, and not more than **4 inches (100 mm)** in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top **12 inches (300 mm)** of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under walkways, scarify and recompact top **6 inches (150 mm)** below subgrade and compact each layer of backfill or fill soil material at 92 percent.
  - 3. Under turf or unpaved areas, scarify and recompact top **6 inches (150 mm)** below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

### 3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of 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.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus **1 inch (25 mm)**.
  - 2. Walks: Plus or minus **1 inch (25 mm)**.
  - 3. Pavements: Plus or minus **1/2 inch (13 mm)**.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of **1/2 inch (13 mm)** when tested with a **10-foot (3-m)** straightedge.

### 3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course **6 inches (150 mm)** or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds **6 inches (150 mm)** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches (150 mm)** thick or less than **3 inches (75 mm)** thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least **12 inches (300 mm)** wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

### 3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  2. Place drainage course **6 inches (150 mm)** or less in compacted thickness in a single layer.
  3. Place drainage course that exceeds **6 inches (150 mm)** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches (150 mm)** thick or less than **3 inches (75 mm)** thick.
  4. Compact each layer of drainage course to required cross sections and thicknesses to not less than **95** percent of maximum dry unit weight according to ASTM D 698.

### 3.19 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  2. Determine that fill material and maximum lift thickness comply with requirements.
  3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every **2000 sq. ft. (186 sq. m)** or less of paved area or building slab, but in no case fewer than three tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every **100 feet (30 m)** or less of wall length, but no fewer than two tests.
  - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every **150 feet (46 m)** or less of trench length, but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### 3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
  - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

**SECTION 312319 - DEWATERING**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes construction dewatering.
- B. Related Sections:
  - 1. Division 01 Section "Photographic Documentation" for recording preexisting conditions and dewatering system progress.
  - 2. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
  - 3. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
  - 4. Division 33 Section "Subdrainage" for permanent foundation wall, underfloor, and footing drainage.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
  - 1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
  - 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
  - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
  - 5. Remove dewatering system when no longer required for construction.

#### 1.4 SUBMITTALS

- A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
  - 1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
  - 2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
- B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Qualification Data: For qualified Installer and professional engineer.
- D. Field quality-control reports.
- E. Other Informational Submittals:
- F. Usually retain subparagraph below for determining effect of dewatering system on permanent construction.
  - 1. Photographs: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Preinstallation Conference: Conduct conference at the field office of the general contractor or project manager.
  - 1. Review methods and procedures related to dewatering including, but not limited to, the following:
    - a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
    - b. Geotechnical report.
    - c. Proposed site clearing and excavations.
    - d. Existing utilities and subsurface conditions.
    - e. Coordination for interruption, shutoff, capping, and continuation of utility services.

- f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- g. Testing and monitoring of dewatering system.

## 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  - 1. Notify the Owner no fewer than two days in advance of proposed interruption of utility.
  - 2. Do not proceed with interruption of utility without Owner's permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
  - 1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
  - 2. The geotechnical report is referenced elsewhere in the Project Manual.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
  - 1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
  - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
  - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damages to adjacent facilities caused by dewatering.
- F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing" during dewatering operations.

### 3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
  - 1. Space well points or wells at intervals required to provide sufficient dewatering.
  - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
  - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
  - 1. Maintain piezometric water level a minimum of **24 inches (600 mm)** below surface of excavation.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

- F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
  - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of **36 inches (900 mm)** below overlying construction.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

### 3.3 FIELD QUALITY CONTROL

- A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.
  - 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
  - 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
  - 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION 312319