

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

- A. Work included under this Section includes, but is not limited to, providing all labor, materials, equipment, and incidentals to conduct and complete the Work related to the planned building, parking, structures, landscaped areas, utilities and site improvements as specified herein and shown on the Drawings.
1. Thoroughly read, fully understand, and abide by all data, evaluations, and recommendations of the S.W. Cole Engineering, Inc. Explorations and Geotechnical Engineering Services Report, dated February 25, 2016. If any conflict exists between the requirements of the Geotechnical Engineering Report, these specifications, and/or the plan, request clarification from the ENGINEER prior to performing the work.
 2. Thoroughly read, fully understand, and abide by all data, evaluations, and recommendations of the Soil Management Plan, prepared by Woodard & Curran, dated October 11, 2016. If any conflict exists between the requirements of the Soil Management Plan, these specifications, and/or the plan, request clarification from the ENGINEER prior to performing the work.
 3. Excavate all materials, including soil, boulders, abandoned utilities, pavements, curbs, granite blocks, and all other materials as necessary to construct the improvements shown on the Drawings.
 4. The CONTRACTOR shall be solely responsible for impacts and damage to structures due to his/her work, and for corrective action or repairs needed to restore the structure(s) to its original condition at no additional cost to the OWNER. Where structures are adversely affected by construction operations, they shall be repaired, restored and replaced in accordance with the requirements outlined herein.
 5. The CONTRACTOR shall note that some over-excavation and replacement of fill may be required as noted on the plans.
 6. Handle, process, re-handle, segregate, and stockpile materials during the course of the Work. Existing on-site materials may require processing prior to reuse. Processing may include crushing, blending, screening, and other measures to meet the requirements herein and as directed by the ENGINEER. Only those soils and other materials approved by the ENGINEER shall be reused on-site.
 7. Prepare, grade, shape, compact and protect all subgrades, backfills, and ground surfaces shown on the Drawings.
 8. Dewater as necessary to enable construction of site improvements, including backfilling, in-the-dry. The CONTRACTOR shall be responsible for control, pumping, and legal disposal of groundwater, precipitation, or other water which enters or accumulates in excavations to maintain stable subgrades and allow all below-grade construction to be conducted in-the-dry.
 9. Provide, place, moisture condition, compact, and grade fill, backfill and other materials to the horizontal and vertical limits to construct the proposed site improvements and achieve the lines and grades as shown on the Drawings.
 10. Place plastic separators, vapor barriers, mudmats, and geotextiles as necessary and required.
 11. Install foundation drainage system elements at the locations and elevations shown on the Drawings.
 12. Preserve and protect existing structures and utilities and new site improvements during the course of the Work.

13. Manage and legally dispose off-site all excess excavated materials, including, but not limited to, soil, rock, boulders, water, demolition waste, and debris that cannot be reused on-site.
14. Obtain, maintain and pay for all required permits, licenses, and approvals prior to commencing the Work of this and other related Sections.
15. Off-site disposal of Contaminated Material, if required, shall not be conducted without approval of the OWNER and ENGINEER, in accordance with the referenced soil management plan.
16. Provide and install erosion control during the Work as indicated on the Drawings, as required in the Specifications, and in accordance with applicable regulations and permits.
17. The CONTRACTOR shall be solely responsible for impacts and damage to any existing structures due to their Work, and for corrective action or repairs needed to restore the structure(s) to original condition at no additional cost to the OWNER.
18. Furnish and place all fill and gravel as required to complete work for contract at the compactions specified herein.
19. Removal of all unsuitable material from site.
20. Removal of all abandoned utility lines incidental to work.

1.02 RELATED REFERENCES:

- A. S.W. Cole Engineering, Inc. Explorations and Geotechnical Engineering Services Report, dated February 25, 2016.
- B. Soil Management Plan, prepared by Woodard & Curran, dated October 11, 2016.
- C. Specification Sections:
 1. Erosion and Sedimentation Control: Section 31 25 13
- D. State of Maine Department of Transportation "Standard Specifications", most recent revision
- E. State of Maine Department of Transportation "Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Latest Edition"
- F. Manual of Accident Prevention in Construction - Associated General Contractors of America, Inc.
- G. 29 CFR 1926/1910 - OSHA Safety and Health Standards for Construction Industry
- H. City of Portland Technical and Design Standards, latest edition (available online <http://me-portland.civicplus.com/757/Technical-Design-Standards>)

1.03 PROTECTION:

- A. Paved Surfaces: Do not operate equipment that will cause damage on paved surfaces to remain. Any damage to existing roads or other paved surfaces caused by construction equipment shall be repaired at no additional cost to OWNER.
- B. Maintain excavations with approved barricades, lights, and signs to protect life and property until excavation is filled and graded to a condition acceptable to the ENGINEER.
- C. Protect structures, utilities, monitoring wells, property monuments, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created

by earthwork operations. The CONTRACTOR shall be responsible for actual cost of repair or replacement of any items damaged as a result of construction activities, including any professional services required for inspection of repairs and replacement.

1.04 QUALITY ASSURANCE:

- A. Testing and Inspection: OWNER shall be responsible for all testing, unless otherwise noted. The cost for retesting due to failed tests shall be the responsibility of the CONTRACTOR.

The CONTRACTOR shall be responsible for coordinating with ENGINEER to allow for testing to be performed at the frequencies specified. A minimum of 48 hours notice for in-place testing shall be given to allow proper scheduling by ENGINEER.

- B. The ENGINEER may observe the CONTRACTOR'S earthwork activities, including excavation, dewatering, subgrade preparation, backfilling and on-site reuse of excavated materials. The Contractor shall provide sufficient notice to the ENGINEER to allow the ENGINEER to be present to observe the Work.
- C. The ENGINEER or OWNER's Representative will conduct field and laboratory density testing of placed and compacted soils to confirm compliance with the requirements of this Section. Field and laboratory density testing will be conducted in general conformance with ASTM or other applicable reference standards. The CONTRACTOR shall cooperate with the ENGINEER in all respects to facilitate any testing or observations.
- D. The CONTRACTOR shall not place or compact any fill, prepare subgrades or place concrete on bearing surfaces unless the ENGINEER or OWNER's Representative is present to observe the Work. Materials placed and/or compacted which do not conform to project specifications for the area, shall be removed and replaced with appropriate, suitable material when directed by the OWNER or the ENGINEER at no additional cost to the OWNER. Costs related to testing or replacement of nonconforming Work or materials, and/or delays caused by nonconforming Work or materials, shall be paid for by the CONTRACTOR at no additional cost to the OWNER.
- E. The presence of the ENGINEER shall not relieve the CONTRACTOR of its responsibility to perform the Work in accordance with the Contract Documents, nor shall it be construed to relieve the CONTRACTOR from full responsibility for the means and methods of construction, protection of site improvements against damage, and for safety on the construction site. The CONTRACTOR shall comply with all applicable laws, rules, ordinances and regulations of the Federal Government, the State of Maine, and the City of Portland relative to the work performed on the site and any CONTRACTOR activities on or adjacent to the site.
- F. The CONTRACTOR shall adhere to the applicable requirements of the specifications, OSHA Standards and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section.
- G. The CONTRACTOR may conduct additional field and laboratory testing or screening tests for its own information at no additional cost to the OWNER.
- H. In case of conflict between regulations or between regulations and Specifications, the CONTRACTOR shall comply with the strictest applicable codes, regulations, or Specifications.
- I. CONTRACTOR shall coordinate pre-excavation meetings with OWNER and ENGINEER.

1.05 JOB AND SUBSURFACE CONDITIONS:

- A. Site Information: A geotechnical investigation was completed for this project. A copy of the report and associated borings can be provided upon request.

The CONTRACTOR may make his own borings, hand probes, explorations, and observations to determine soil, water levels, and other subsurface conditions at no additional cost to OWNER. Coordinate with OWNER prior to start of additional investigative work.

- B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations. Coordinate with utility companies for actual locations and shut-off services. If utilities are encountered that are not shown or that are shown incorrectly on the Drawings, notify ENGINEER immediately. Repair damaged utilities to satisfaction of ENGINEER and utility.

1.06 LINES, GRADES AND TOLERANCES:

- A. The CONTRACTOR shall be responsible for establishing all lines, grades and other survey control to complete the Work as shown on the Drawings.
- B. Maintain the moisture content of backfill materials as necessary to allow for the material to be readily placed to the degree of compaction specified herein.
- C. Construct finished soil and backfill surfaces to the elevations indicated on the Drawings.
- D. Compact backfill materials to the specified degree of compaction.

PART 2 - MATERIALS

2.01 MATERIALS:

- A. General: All materials utilized for this Project shall be obtained from a source that has been licensed or permitted for such use by local and state authorities. The CONTRACTOR shall be required to submit evidence of such if so requested.
 1. Suitable materials: Suitable soil materials are defined as those complying with ASTM D2487 soil classification groups GW, SM, SW, and SP.
 2. Unsuitable materials: Materials containing excessive amounts of water, clay, vegetation, organic matter, debris, pavement, stones or boulders over 6-inches in greatest dimension, frozen material, and material which, in the opinion of the ENGINEER, will not provide a suitable foundation or subgrade.
 3. On-Site Material: Any suitable material from on-site excavation.
 4. Material for embankments and general site fills outside of the building envelope may contain pieces of excavated ledge having a greatest dimension of up to 6-inches, unless otherwise approved by ENGINEER.

5. Inspection: The ENGINEER may inspect off-site sources of materials and order tests of these materials to verify compliance with these Specifications.
6. Sieve Analysis: Submit sieve analysis in accordance with ASTM D422 for all materials prior to start of construction.
- B. Gravel/Aggregate Base: Hard, durable gravel equal to MDOT 703.06 Type B material as specified on the drawings. Sieve analyses by weight:

Sieve Size	% Passing by Weight
4"	100
1/2"	35 - 75
1/4"	25 - 60
No. 40	0 - 25
No. 200	0 - 5

- C. Aggregate Subbase: Sand or gravel of hard, durable particles; equal to MDOT 703.06 Type D material. Aggregate subbase shall not contain particles that will not pass the 6-inch sieve. The part that passes the 3-inch sieve shall meet the following gradation requirements:

Sieve Size	% Passing by Weight
3"	100
1/2"	35 - 80
1/4"	25 - 65
No. 40	0 - 30
No. 200	0 - 7

- D. Structural Fill: Well-graded sand and gravel mixture meeting the following gradation requirements:

Sieve Size	% Passing by Weight
4"	100
3"	90 - 100
1/4"	25 - 90
No. 40	0 - 30
No. 200	0 - 5

Structural fill is recommended for use as backfill for over-excavations, backfill to repair soft areas, backfill for foundations, slab and paver base material and material below exterior entrances and sidewalks, as recommended in the S.W. Cole report.

- E. Granular Borrow: Imported materials consisting of a mixture of sand, gravel and silt or reclaimed asphalt, concrete, brick, crushed rock that is crushed and blended with sand to create a compactable fill meeting the following gradation:

Sieve Size	% Passing by Weight
6 inch	100
1/4 inch	25 to 90
No. 40	0 to 50
No. 200	0 to 20

Granular borrow shall be used to raise exterior parking areas to bottom of subbase materials; backfill after removal of relic foundation elements and other deleterious materials outside of the building footprints; and in other locations as identified in the Construction Documents.

- F. $\frac{3}{4}$ " Crushed Stone: Durable, clean angular rock fragments obtained by breaking and crushing rock material. Gradation shall be:

Sieve Size	% Passing by Weight
1"	100
$\frac{3}{4}$ "	90 – 100
$\frac{3}{8}$ "	20 – 55
No. 4	0 – 10
No. 200	0 – 1.5

Crushed stone shall be used beneath walkways and exterior slabs and in all other areas as indicated on the plans.

- G. Sand: Sand shall be well-graded coarse sand without excessive fines and free from loam, clay, and organic matter. Beach sand shall not be used. The grading requirements are as follows:

Sieve Size	% Passing by Weight
$\frac{3}{8}$ "	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	10 – 30
No. 100	2 – 10

Sand shall be used beneath interior building slabs and in all other areas as indicated on the plans.

- H. Underdrain backfill: In accordance with MDOT 703.22 underdrain backfill, Type C:

Sieve Size	% Passing by Weight
1"	100
$\frac{3}{4}$ "	90 – 100
$\frac{3}{8}$ "	0 – 75
No. 4	0 – 25
No. 10	0 – 5

- I. Riprap: In accordance with MDOT 703.26 – Plain and Hand Laid Riprap, or as otherwise noted.
- J. Refill Material: Use $\frac{3}{4}$ " crushed stone for refilling excavation below normal grade, rock excavation or refilling excavations of unsuitable material, unless otherwise directed by ENGINEER.
- K. Fabric Protection Layer: As specified on the Contract Plans.

PART 3 - EXECUTION

3.01 EXCAVATION:

- A. General: Excavation shall include the removal of all encountered materials, including but not limited to, soil, boulders, asphalt pavement, concrete (reinforced and unreinforced), miscellaneous debris, buried and abandoned foundations and utilities, site improvements, incidental structures and all other materials encountered to the limits shown on the Drawings, or designated in the Specifications.
- B. All topsoil, peat, organic material, debris, rubbish, frozen soils, muck, loose, or disturbed soils and other unsuitable materials should be removed from the area of new construction. Topsoil may be stockpiled outside the construction area for reuse in landscaped areas. Topsoil may not be used as common fill below pavements or as fill below proposed building.
- C. Call Dig Safe prior to beginning any excavation.
- D. Rock Excavation includes removal and disposal of materials and obstructions encountered that cannot be excavated with modern, track-mounted, heavy-duty excavating equipment without drilling or ripping; includes boulders larger than 2 cubic yards each.

Do not perform rock excavation or excavation of unsuitable materials until material to be excavated has been cross-sectioned and classified by ENGINEER.

- E. Earth Excavation: Remove and dispose of obstructions visible on ground surface, underground structures, utilities, and items indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation.
- F. Excavation in Paved Areas: Cut pavement prior to excavation to provide a clean, uniform edge. Minimize disturbance of remaining pavement. Cut and remove the minimum amount of pavement required to do the Work. Use shoring and bracing where sides of excavation will not stand without undermining pavement.
- G. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

In excavating for foundations, take care not to disturb bottom of excavation. Excavate the final 1.0 feet to foundation subgrade level using methods and equipment designed to prevent disturbance to the bearing soils (by hand or by smooth bucket excavator). Trim bottoms to required lines and grades to leave solid base to receive other Work. When excavating in clay material, use a smooth-edged bucket to avoid disturbance of the bottom of the excavation. Use shoring and bracing as required by OSHA standards.

- H. Excavation for Utility Trenches: Excavate to widths shown on the Drawings and depths indicated or required to establish indicated slope and invert elevations. Produce an evenly graded, flat trench bottom at the subgrade elevation required for installation of pipe and bedding material. Place backfill material directly into trench or excavation. Do not stockpile material to be used as backfill along edges of trenches. Load excavated material directly into trucks, unless otherwise permitted by the ENGINEER.

- I. Unauthorized Excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of ENGINEER. Unauthorized excavation, as well as remedial work directed by ENGINEER, including refilling, shall be at CONTRACTOR's expense.
- J. Refilling Unauthorized Excavation: For trenches, use 3/4-inch crushed stone. A geotextile barrier may be required at the discretion of the ENGINEER. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by ENGINEER.
- K. Excavation of Unsuitable Materials: When excavation has reached required subgrade elevations, notify ENGINEER who will make an inspection of conditions. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper only at the direction of the ENGINEER and replace excavated material with 3/4" crushed stone on a non-woven geotextile fabric (Mirafi 140N or approved equal).
- L. Material Storage: Stockpile and maintain suitable surplus excavated materials for re-use as backfill within the Project limits, as directed by ENGINEER. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations.

3.02 STABILITY OF EXCAVATIONS:

- A. General: Side slopes of excavations shall comply with OSHA Regulations and Local Codes. Shore and brace where sloping is not possible due to space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.03 DEWATERING:

- A. General: Perform all Work in the dry. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

Do not allow water to accumulate in excavations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Dewatering should be continuous until the permanent foundation drainage system is installed and foundations are built and backfilled.

A layer of crushed stone underlain with geotextile might be needed to protect subgrades from disturbance during construction.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey water removed from excavations and rainwater to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

Utilize discharge filter systems to remove sediment prior to discharge to receiving waters.

3.04 SUBGRADE PREPARATION:

- A. General

1. Care shall be taken to avoid disturbance to subgrades.
 2. Provide a firm, smooth, stable, undisturbed subgrade as judged by the ENGINEER. Loose, disturbed soil shall be removed by hand shovel.
 3. Subgrades consisting of cohesive soils shall not be “backbladed” or compacted to prepare a smooth surface.
 4. Subgrades shall be prepared as recommended in the geotechnical report.
 5. Stripped subgrades beneath planned building and paved area and composed of granular soil should be proof-rolled with a minimum of two passes of a 10-ton roller in each of two perpendicular directions to improve the density of suitable soils. Silty clay to sandy silt subgrades should not be proof-rolled. Rolling of subgrades should be observed for areas of soil rutting or weaving, indicative of unsuitable underlying materials. Unsuitable fill and/or soft, loose, and/or disturbed native soil materials should be excavated and replaced with structural fill. If high groundwater is present during subgrade preparation, the vibratory roller should be operated in the “static” mode to avoid liquefying the soil.
 6. Movement of construction equipment directly over exposed final subgrades, except for compaction equipment, shall not be permitted.
 7. The exposed subgrade will be examined in the field by the ENGINEER to observe the strength and bearing capacity of the soils. Disturbed or soft or unstable soils, as judged by the ENGINEER, shall be excavated and replaced with lean concrete, granular fill, or other acceptable materials at no additional cost to the Owner.
 8. Prevent soil subgrades from freezing and frost. Soil subgrades that freeze prior to concrete or backfill placement shall be thawed and recompacted, or removed and replaced with non-frozen backfill, lean concrete or other acceptable material as directed by the ENGINEER.
 9. Excavations shall not undermine existing foundations, streets, sidewalks, or structures.
- B. Plaza Paver Area
1. The subgrade in the plaza paver area is anticipated to consist of uncontrolled fill. The uncontrolled fill should be proof-rolled and densified with 3 to 5 passes of a vibratory roller having a static weight of at least 5 tons. Areas of subgrade that yield or become soft after proof-rolling or are observed to have voided rubble should be overexcavated and replaced with compacted Structural Fill.

3.05 BACKFILL AND FILL:

- A. General: Place suitable soil material in layers to required elevations as shown on the Drawings. Fill, backfill, and compact to produce minimum subsequent settlement of the material and provide adequate support for the surface treatment or structure to be placed on the material. Place material in approximately horizontal layers of beginning at lowest area to be filled. Do not impair drainage.
- B. Placement: Place backfill and fill materials in layers not more than 9-inches in loose depth in uncompacted thickness. In confined areas, within 4 feet of foundation walls, and in areas where self-propelled compaction equipment should not be used based on vibration considerations, fill shall be placed in lifts not exceeding 6-inches in uncompacted thickness and be compacted with hand-operated compaction equipment. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

Do not allow heavy machinery within 5 feet of structure during backfilling and compacting.

C. Backfill excavations as promptly as work permits, but not until completion of the following:

Acceptance of construction below finish grade including dampproofing, and/or waterproofing.

Inspection, approval and recording locations of underground utilities.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids with suitable materials.

Removal of trash and debris from excavation.

Permanent or temporary horizontal bracing is in place on horizontally supported walls.

Backfill cast-in-place concrete structures when the concrete has developed adequate strength.

Use care in backfilling to avoid damage or displacement of underground structures and pipe.

D. Backfilling Trenches: See Trench Detail on the Drawings.

Bed pipe in 3/4-inch crushed stone, unless otherwise indicated. Limits of bedding and requirements for remaining trench backfill shown on Drawings. Backfill under all existing utility pipes crossed by new utility pipes or work with 3/4" crushed stone. The crushed stone backfill shall extend continuously from the bedding of the new pipe to the utility pipe crossed, including a 6" thick envelope of crushed stone all around the existing utility pipe(s). The 3/4" crushed stone backfill shall stand at its own angle of repose. No "haunching" or "forming" with common fill will be allowed.

E. Replacement of Unsuitable Materials:

Below normal grade: See paragraph 3.01J.

Above normal grade: Replace unsuitable material with suitable material from on-site. All excess suitable material must be used before additional material from off-site is used.

3.06 COMPACTION:

- A. Methods: Use methods which produce the required degree of compaction throughout the entire depth of material placed without damage to new or existing facilities and which are approved by the ENGINEER. In the parking lot and other open areas, compact with self-propelled compaction equipment. Within the building, utility trenches, and other confined areas, compact with hand-operated compaction equipment. Adjust moisture content of soil as required. Remove and replace material that is too wet to compact to required density. Compact each horizontal layer of fill and slope as Work progresses.

B. Degree of Compaction: Compact to the following minimum densities:

FILL AND BACKFILL LOCATION	DENSITY	TESTING FREQUENCY ONE TEST PER LIFT PER:
Building and pavement subgrade (top 18")	100% of max.	1,000 SF
Pavement below 18" of subgrade	95%	5,000 SF
Structures and walkways	95%	2,000 SF
Trenches	95%	150 LF
Lawn or Unimproved Areas	92%	20,000 SF

Maximum density: ASTM D1557.

Field density tests: ASTM D1556 (sand cone) or ASTM D6938 (nuclear methods).

C. Testing: In-place densities using field tests will be determined by the ENGINEER or the OWNER's Representative. Perform additional work to obtain proper compaction if in-place densities do not meet specified densities at no additional cost to the OWNER.

D. Protection of Fill

1. The CONTRACTOR shall take the necessary steps to avoid disturbance of subgrade and underlying soils during excavation and backfilling operations. Procedures for excavating and backfilling shall be revised as necessary to avoid disturbance of subgrade and underlying soils, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering, and other acceptable control measures. Disturbance shall include the deterioration of backfill (after placement and satisfactory compaction) due to the Contractor's operations, such as moving equipment, hauling trucks, etc. All excavated or backfilled areas or subgrades that become disturbed during construction shall be removed and replaced with acceptable materials.
2. Prevent materials below constructed foundations from freezing. Materials that become frozen shall be removed and replaced, including foundations, at no additional cost to the OWNER.
3. At the completion of Work, all ground surfaces shall be left in a firm, stable, unyielding, reasonably uniform condition, free of ruts and surface irregularities, in accordance with grading requirements shown on the Drawings.

3.07 GRADING:

- A. Grading: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish surface within specified tolerances and compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grading Outside Structure Lines: Grade areas adjacent to structure to drain away from structures and to prevent ponding.
- C. Finish surfaces free from irregular surface changes and as follows:

Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.

Pavements: Shape areas under pavement to line, grade and cross-section, with finish surface not more than 1/2 inch above or below required top of base gravel elevation.

Fill Under Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.

- D. Compaction: After grading, compact subgrade surfaces as required.
- 3.08 EROSION CONTROL: Provide erosion control measures as specified in Section 31 25 13 and as shown on Drawings.
- 3.09 MAINTENANCE:
- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
 - B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.
 - C. Settling: Where settling is measurable or observable at excavated areas during warranty period; remove surface, base gravel, fill material, and add required backfill material, compact, and replace surface. Restore appearance, quality, and condition of surface to match adjacent work, and eliminate evidence of restoration work to greatest extent possible.
- 3.12 DISPOSAL OF EXCESS MATERIALS: Remove excess excavated material and dispose of it off-site in a lawful manner, unless otherwise directed by ENGINEER.

END OF SECTION 312000

SECTION 33 40 00 - STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK: Furnish and install storm sewer system as shown on the Drawings. This includes:

- A. Underdrain pipe/foundation drain and associated cleanouts
- B. Storm drain culvert piping
- C. Reinforced concrete drainage structures
- D. PVC drain basins
- E. Trench Drains

1.02 REFERENCES:

- A. Specification Sections:
 - 1. Earth Moving: Refer to Section 31 20 00
 - 2. Erosion and Sedimentation Controls: Refer to Section 31 25 13
- B. State of Maine Department of Transportation "Standard Specifications – Revision of December 2002"
- C. State of Maine Department of Transportation "Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Latest Edition"

1.03 SUBMITTALS:

- A. Manufacturer's product data and installation instructions.
- B. Certified copies of tests on pipe units.
- C. Construction Records: Record depth and location of the following:
 - 1. Structure locations and elevations
 - 2. Repairs to existing pipes.
 - 3. Underdrain pipe locations and connection points to storm drainage system, and elevations.

Record neatly in a permanently bound notebook and submit at Substantial Completion. Provide access to records for ENGINEER at all times. Submit copies to ENGINEER on a weekly basis.

- D. Buoyancy calculations stamped by a professional engineer for all buried drainage structures, including catch basins, manholes, and drain basins.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS:

- A. General: Provide fittings of same type and class of materials as pipe. Fitting must have single piece gasket.
- B. Underdrain Pipe shall be perforated SDR 35 PVC pipe. Coiled pipes shall not be used.
- D. Storm drain pipe shall be SDR 35 PVC. PVC pipe used for storm drainage shall conform to all aspects of ASTM specification D3034-73A and/or ASTM Specification F789.

2.02 PRECAST CONCRETE STRUCTURES

- A. Base Sections: Precast monolithic construction with steps.
- B. Barrel Sections: Precast with steps.
- C. Top Sections: Precast eccentric cone with steps.
- D. Steps: Polypropylene reinforced with steel rod. Meet OSHA requirements, minimum width 16-inches. Cast into concrete.
- E. Pipe to Structure Connections: Connections shall be watertight, expandable pipe sleeve with adjustable expansion ring equal to Press-Boot by Press-Seal Gasket Corp., Fort Wayne, Indiana.
- F. Joints Between Precast Sections: Watertight, shiplap-type seal with two rings of one-inch diameter butyl rubber sealant.
- G. Inverts: Provide inverts as shown on the Drawings. Configuration to be as required by connecting pipes and as shown on Drawings.
- H. Outlet Control Structure: Provide precast concrete structure with perforations as shown in the Construction Drawings.

2.03 FRAMES, COVERS, AND GRATES

- A. Material: Cast iron, ASTM A48 Class 30, or Bronze as shown on the Drawings
- B. Provide frames, covers and grates as identified on the Drawings

2.04 MISCELLANEOUS:

- A. Area Drain: Area drains shall be as detailed on the Construction Drawings and shall be Nyloplast drain basins, or equal. Area drains shall have ductile iron integrated frame and grate or solid cover or Bronze drop-in grate as identified on the Construction Drawings. Provide anti-floatation as identified on the Construction Drawings
- B. Paver Trench Drain: Paver slot drains shall be located as identified on the Construction Drawings. Pave slot drains shall be by ACO Technologies, or approved equal. See Landscaping Drawings for additional model information for drain and grate.
- B. Marking Tape: Lineguard III by Tri-Sales, Inc., 2-inch wide, green; detectable with magnetic locators, or approved equal.

- C. Rigid Insulation: Extruded closed-cell rigid foamed polystyrene, 2-inch thickness, width of trench, Styrofoam HI-60, by Dow Chemical, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF GRAVITY PIPE AND FITTINGS:

- A. Methods: Install in accordance with manufacturer's recommendations. Use a laser beam for line and grade unless otherwise permitted by the ENGINEER. Secure each length of pipe with bedding before placing next length. Plug open ends when work is suspended. Bed pipe as shown on Drawings. A 30-inch minimum cover over the top of PVC pipe and DI pipe should be provided before the trench is wheel-loaded.
- B. Grade and Line:
 - 1. Lay pipe to line and grade shown on the Drawings. If grade is not shown, determine elevations of start and finish points for each run of pipe. Lay pipe to a uniform grade between these points.
 - 2. Line and grade may be adjusted by the ENGINEER as required by field conditions.
- C. Conditions: Lay pipe in the dry. Do not use installed pipe to remove water from work area.
- D. Flush and clean all pipe and remove all debris and materials. Flushing and cleaning methods approved by ENGINEER. Gravity flushing is not acceptable.
- E. Underdrain: All work shall conform to the Drawings and MDOT SECTION 605 – UNDERDRAINS
- F. Foundation Drain: Provide 4-inch diameter, perforated PVC pipe around perimeter of proposed building. Wrap drain in minimum of 6 inches of crushed stone bedding and nonwoven filter fabric as detailed.

3.02 INSTALLATION OF MANHOLES/CATCH BASINS:

- A. Placement: Place precast bases and structures on compacted bedding material so bottom of structure is plumb and pipe inverts are at proper elevations. Place manhole barrel and top sections in the appropriate height combinations. Plug all lifting holes inside and out with non-shrink grout. Construct manhole inverts in accordance with Drawings.
- B. Joints: Follow manufacturer's instructions for sealing joints between precast sections. Provide two rings of 1 inch diameter butyl rubber sealant. Point joints inside and out with butyl caulk.
- C. Frame and Covers:
 - 1. Set to final grade as shown on the Drawings and as specified. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
 - 2. Use two rings of 1 inch diameter butyl rubber sealant between frame and rubber riser. Provide downward force to frame so as to compress the joint, provide a watertight seal, and prevent future settlement. Point compressed joint with butyl rubber caulk sealant.

3. Set manhole frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.
- D. Inverts: As specified in paragraph 2.02G of this section.
- E. Steps: Replace any steps that are out of plumb and proper horizontal placement.
- F. Frost Barriers: Wrap each manhole to the maximum excavation depth or not less than 6 feet below grade, with a minimum of four layers of 6 mils each of the polyethylene.
1. Clean manhole exterior of all dirt and remove any protrusions.
 2. Apply a 6-inch wide vertical strip of bituminous waterproofing adhesive from the top of manhole to the greatest excavation depth, but not in excess of 6 feet.
 3. Start poly wrap at adhesive strip and proceed around manhole continuously, overlapping adhesive strip a minimum of 24 inches on the final layer.
 4. Tuck and pleat poly at top in a continuous manner, minimizing size of folds. Extend poly past top of manhole frame and temporarily tuck remainder inside frame, until final backfill and paving.
 5. Paved areas: Cut poly flush with manhole rim after pavement is in place.
 6. Unpaved areas: Pull loose ends of poly together, remove excess air and tie off end with galvanized wire. Bury with manhole below grade.

3.03 MISCELLANEOUS:

- A. All other drainage systems shall be installed per manufacturer's instructions and per the Construction Drawings.

3.04 INSULATION:

- A. Install as shown on Drawings.

END OF SECTION 334000

SECTION 33 40 00 - STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK: Furnish and install storm sewer system as shown on the Drawings. This includes:

- A. Underdrain pipe/foundation drain and associated cleanouts
- B. Storm drain culvert piping
- C. Reinforced concrete drainage structures
- D. PVC drain basins
- E. Trench Drains

1.02 REFERENCES:

- A. Specification Sections:
 - 1. Earth Moving: Refer to Section 31 20 00
 - 2. Erosion and Sedimentation Controls: Refer to Section 31 25 13
- B. State of Maine Department of Transportation "Standard Specifications – Revision of December 2002"
- C. State of Maine Department of Transportation "Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Latest Edition"

1.03 SUBMITTALS:

- A. Manufacturer's product data and installation instructions.
- B. Certified copies of tests on pipe units.
- C. Construction Records: Record depth and location of the following:
 - 1. Structure locations and elevations
 - 2. Repairs to existing pipes.
 - 3. Underdrain pipe locations and connection points to storm drainage system, and elevations.

Record neatly in a permanently bound notebook and submit at Substantial Completion. Provide access to records for ENGINEER at all times. Submit copies to ENGINEER on a weekly basis.

- D. Buoyancy calculations stamped by a professional engineer for all buried drainage structures, including catch basins, manholes, and drain basins.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS:

- A. General: Provide fittings of same type and class of materials as pipe. Fitting must have single piece gasket.
- B. Underdrain Pipe shall be perforated SDR 35 PVC pipe. Coiled pipes shall not be used.
- D. Storm drain pipe shall be SDR 35 PVC. PVC pipe used for storm drainage shall conform to all aspects of ASTM specification D3034-73A and/or ASTM Specification F789.

2.02 PRECAST CONCRETE STRUCTURES

- A. Base Sections: Precast monolithic construction with steps.
- B. Barrel Sections: Precast with steps.
- C. Top Sections: Precast eccentric cone with steps.
- D. Steps: Polypropylene reinforced with steel rod. Meet OSHA requirements, minimum width 16-inches. Cast into concrete.
- E. Pipe to Structure Connections: Connections shall be watertight, expandable pipe sleeve with adjustable expansion ring equal to Press-Boot by Press-Seal Gasket Corp., Fort Wayne, Indiana.
- F. Joints Between Precast Sections: Watertight, shiplap-type seal with two rings of one-inch diameter butyl rubber sealant.
- G. Inverts: Provide inverts as shown on the Drawings. Configuration to be as required by connecting pipes and as shown on Drawings.
- H. Outlet Control Structure: Provide precast concrete structure with perforations as shown in the Construction Drawings.

2.03 FRAMES, COVERS, AND GRATES

- A. Material: Cast iron, ASTM A48 Class 30, or Bronze as shown on the Drawings
- B. Provide frames, covers and grates as identified on the Drawings

2.04 MISCELLANEOUS:

- A. Area Drain: Area drains shall be as detailed on the Construction Drawings and shall be Nyloplast drain basins, or equal. Area drains shall have ductile iron integrated frame and grate or solid cover or Bronze drop-in grate as identified on the Construction Drawings. Provide anti-floatation as identified on the Construction Drawings
- B. Paver Trench Drain: Paver slot drains shall be located as identified on the Construction Drawings. Paver slot drains shall be by ACO Technologies, or approved equal. See Landscaping Drawings for additional model information for drain and grate.
- B. Marking Tape: Lineguard III by Tri-Sales, Inc., 2-inch wide, green; detectable with magnetic locators, or approved equal.

- C. Rigid Insulation: Extruded closed-cell rigid foamed polystyrene, 2-inch thickness, width of trench, Styrofoam HI-60, by Dow Chemical, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF GRAVITY PIPE AND FITTINGS:

- A. Methods: Install in accordance with manufacturer's recommendations. Use a laser beam for line and grade unless otherwise permitted by the ENGINEER. Secure each length of pipe with bedding before placing next length. Plug open ends when work is suspended. Bed pipe as shown on Drawings. A 30-inch minimum cover over the top of PVC pipe and DI pipe should be provided before the trench is wheel-loaded.
- B. Grade and Line:
 - 1. Lay pipe to line and grade shown on the Drawings. If grade is not shown, determine elevations of start and finish points for each run of pipe. Lay pipe to a uniform grade between these points.
 - 2. Line and grade may be adjusted by the ENGINEER as required by field conditions.
- C. Conditions: Lay pipe in the dry. Do not use installed pipe to remove water from work area.
- D. Flush and clean all pipe and remove all debris and materials. Flushing and cleaning methods approved by ENGINEER. Gravity flushing is not acceptable.
- E. Underdrain: All work shall conform to the Drawings and MDOT SECTION 605 – UNDERDRAINS
- F. Foundation Drain: Provide 4-inch diameter, perforated PVC pipe around perimeter of proposed building. Wrap drain in minimum of 6 inches of crushed stone bedding and nonwoven filter fabric as detailed.

3.02 INSTALLATION OF MANHOLES/CATCH BASINS:

- A. Placement: Place precast bases and structures on compacted bedding material so bottom of structure is plumb and pipe inverts are at proper elevations. Place manhole barrel and top sections in the appropriate height combinations. Plug all lifting holes inside and out with non-shrink grout. Construct manhole inverts in accordance with Drawings.
- B. Joints: Follow manufacturer's instructions for sealing joints between precast sections. Provide two rings of 1 inch diameter butyl rubber sealant. Point joints inside and out with butyl caulk.
- C. Frame and Covers:
 - 1. Set to final grade as shown on the Drawings and as specified. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
 - 2. Use two rings of 1 inch diameter butyl rubber sealant between frame and rubber riser. Provide downward force to frame so as to compress the joint, provide a watertight seal, and prevent future settlement. Point compressed joint with butyl rubber caulk sealant.

3. Set manhole frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.
- D. Inverts: As specified in paragraph 2.02G of this section.
 - E. Steps: Replace any steps that are out of plumb and proper horizontal placement.
 - F. Frost Barriers: Wrap each manhole to the maximum excavation depth or not less than 6 feet below grade, with a minimum of four layers of 6 mils each of the polyethylene.
 1. Clean manhole exterior of all dirt and remove any protrusions.
 2. Apply a 6-inch wide vertical strip of bituminous waterproofing adhesive from the top of manhole to the greatest excavation depth, but not in excess of 6 feet.
 3. Start poly wrap at adhesive strip and proceed around manhole continuously, overlapping adhesive strip a minimum of 24 inches on the final layer.
 4. Tuck and pleat poly at top in a continuous manner, minimizing size of folds. Extend poly past top of manhole frame and temporarily tuck remainder inside frame, until final backfill and paving.
 5. Paved areas: Cut poly flush with manhole rim after pavement is in place.
 6. Unpaved areas: Pull loose ends of poly together, remove excess air and tie off end with galvanized wire. Bury with manhole below grade.

3.03 MISCELLANEOUS:

- A. All other drainage systems shall be installed per manufacturer's instructions and per the Construction Drawings.

3.04 INSULATION:

- A. Install as shown on Drawings.

END OF SECTION 334000